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Contents

1.1 libxml2 2.9.10

1.1.1 Available under license

1.2 json-c 0.15

1.2.1 Available under license

1.3 curl 7.74.0

1.3.1 Available under license

1.4 protobuf 2.6.1

1.4.1 Available under license

1.5 sqlite 3.33.0

1.5.1 Available under license

1.6 libusb 1.0.17-1ubuntu2

1.6.1 Available under license

1.7 libx11 1.7.0

1.7.1 Available under license

1.8 sipcc 12.8.0

1.8.1 Available under license

1.9 libsrt 2.2.0

1.9.1 Available under license

1.10 boost 1.65.1

1.10.1 Available under license

1.11 libxv 1.0.11

1.11.1 Available under license

1.12 json-cpp 1.9.4

1.12.1 Available under license

1.13 jansson 2.12

1.13.1 Available under license

1.14 gstreamer 0.10.30

1.14.1 Available under license

1.15 pcre 8.44

1.15.1 Available under license

1.16 pcre 8.38-3.1

1.16.1 Available under license

1.17 libjpeg 9d

1.17.1 Available under license

1.18 icu 56

1.18.1 Available under license

1.19 pcre 10.36

1.19.1 Available under license

1.20 harfbuzz 1.7.4

1.20.1 Available under license

1.21 libdouble-conversion 3.1.5

1.21.1 Available under license

1.22 libxkbcommon 0.5.0-1ubuntu2.1

1.22.1 Available under license

1.23 gstreamer 1.16.2

1.23.1 Available under license

1.24 udt 1.0.3

1.24.1 Available under license

1.25 libtiff 4.1.0

1.25.1 Available under license

1.26 sql-cipher 4.4.2

1.26.1 Available under license

1.27 expat 2.2.10

1.27.1 Available under license

1.28 glib 2.66.4

1.28.1 Available under license

1.29 libwebp 1.2.0

1.29.1 Available under license

1.30 openssl 1.1.1i

1.30.1 Available under license

1.31 glib 2.64.2

1.31.1 Available under license

1.32 speexdsp 1.2.0

1.32.1 Available under license

1.33 opus 1.0

- 1.33.1 Available under license
- 1.34 libpng 1.6.37**
 - 1.34.1 Available under license
- 1.35 libxcb 1.11.1 1ubuntu1**
 - 1.35.1 Available under license
- 1.36 effective-tld-names 1.0**
 - 1.36.1 Available under license
- 1.37 qt 5.15.1**
 - 1.37.1 Available under license
- 1.38 protobuf 3.7.1**
- 1.39 libjpeg-turbo 2.0.6**
 - 1.39.1 Available under license

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1.4 protobuf 2.6.1

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- * Small optimizations to Python serialization.

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- * Fix compiler to not make output executable.

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- * Heuristic detection of sub-messages when printing unknown fields in text format.

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- * Added @Override annotation to generated Java code where appropriate.

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- * MS Visual Studio error format option.
- * Detect unordered_map in stl_hash.m4.

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- * gzip/zlib I/O support.

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- * Fixed warnings about generated constructors not explicitly initializing

all fields (only present with certain compiler settings).

- * Added generation of field number constants.

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- * Small patch improving performance of in Python serialization.

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- * Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

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- * Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

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- * Detect whether zlib is new enough in configure script.
- * Fixes for Solaris 10 32/64-bit confusion.

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- * Optimize Java serialization code when writing a small message to a stream.
- * Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
- * Clean up some Java warnings.
- * Fix bug with permanent callbacks that delete themselves when run.

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- * Added CodedInputStream.getTotalBytesRead().

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- * Fixed m4/acx_pthread.m4 problem for some Linux distributions.

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- * Fixed detection of sched_yield on Solaris.
- * Added atomicops for Solaris

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1.5 sqlite 3.33.0

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1.7 libx11 1.7.0

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1.8 sipcc 12.8.0

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1.10 boost 1.65.1

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1.14 gstreamer 0.10.30

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1.15 pcre 8.44

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Written by: Philip Hazel
Email local part: Philip.Hazel
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1.16 pcre 8.38-3.1

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The basic library functions are written in C and are freestanding. Also

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THE BASIC LIBRARY FUNCTIONS

Written by: Philip Hazel
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PCRE JUST-IN-TIME COMPILATION SUPPORT

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STACK-LESS JUST-IN-TIME COMPILER

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THE C++ WRAPPER FUNCTIONS

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1.17 libjpeg 9d

1.17.1 Available under license :

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```
/*
 * jchuff.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2006-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains Huffman entropy encoding routines.
 * Both sequential and progressive modes are supported in this single module.
 *
 * Much of the complexity here has to do with supporting output suspension.
 * If the data destination module demands suspension, we want to be able to
 * back up to the start of the current MCU. To do this, we copy state
 * variables into local working storage, and update them back to the
 * permanent JPEG objects only upon successful completion of an MCU.
 *
 * We do not support output suspension for the progressive JPEG mode, since
 * the library currently does not allow multiple-scan files to be written
 * with output suspension.
 */
```

Found in path(s):

```
* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jchuff.c
```

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IJG JPEG LIBRARY: CODING RULES

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Since numerous people will be contributing code and bug fixes, it's important

to establish a common coding style. The goal of using similar coding styles is much more important than the details of just what that style is.

In general we follow the recommendations of "Recommended C Style and Coding Standards" revision 6.1 (Cannon et al. as modified by Spencer, Keppel and Brader). This document is available in the IJG FTP archive (see jpeg/doc/cstyle.ms.tbl.Z, or [cstyle.txt.Z](http://jpeg/doc/cstyle.txt.Z) for those without nroff/tbl).

Block comments should be laid out thusly:

```
/*
 * Block comments in this style.
 */
```

We indent statements in K&R style, e.g.,

```
if (test) {
    then-part;
} else {
    else-part;
}
```

with two spaces per indentation level. (This indentation convention is handled automatically by GNU Emacs and many other text editors.)

Multi-word names should be written in lower case with underscores, e.g., `multi_word_name` (not `multiWordName`). Preprocessor symbols and enum constants are similar but upper case (`MULTI_WORD_NAME`). Names should be unique within the first fifteen characters. (On some older systems, global names must be unique within six characters. We accommodate this without cluttering the source code by using macros to substitute shorter names.)

We use function prototypes everywhere; we rely on automatic source code transformation to feed prototype-less C compilers. Transformation is done by the simple and portable tool 'ansi2knr.c' (courtesy of Ghostscript). `ansi2knr` is not very bright, so it imposes a format requirement on function declarations: the function name MUST BEGIN IN COLUMN 1. Thus all functions should be written in the following style:

```
LOCAL(int *)
function_name (int a, char *b)
{
    code...
}
```

Note that each function definition must begin with `GLOBAL(type)`, `LOCAL(type)`, or `METHODDEF(type)`. These macros expand to "static type" or just "type" as appropriate. They provide a readable indication of the routine's usage and can readily be changed for special needs. (For instance, special linkage keywords can be inserted for use in Windows DLLs.)

ansi2knr does not transform method declarations (function pointers in structs). We handle these with a macro JMETHOD, defined as

```
#ifdef HAVE_PROTOTYPES
#define JMETHOD(type,methodname,arglist) type (*methodname) arglist
#else
#define JMETHOD(type,methodname,arglist) type (*methodname) ()
#endif
```

which is used like this:

```
struct function_pointers {
    JMETHOD(void, init_entropy_encoder, (int somearg, jparms *jp));
    JMETHOD(void, term_entropy_encoder, (void));
};
```

Note the set of parentheses surrounding the parameter list.

A similar solution is used for forward and external function declarations (see the EXTERN and JPP macros).

If the code is to work on non-ANSI compilers, we cannot rely on a prototype declaration to coerce actual parameters into the right types. Therefore, use explicit casts on actual parameters whenever the actual parameter type is not identical to the formal parameter. Beware of implicit conversions to "int".

It seems there are some non-ANSI compilers in which the sizeof() operator is defined to return int, yet size_t is defined as long. Needless to say, this is brain-damaged. Always use the SIZEOF() macro in place of sizeof(), so that the result is guaranteed to be of type size_t.

The JPEG library is intended to be used within larger programs. Furthermore, we want it to be reentrant so that it can be used by applications that process multiple images concurrently. The following rules support these requirements:

1. Avoid direct use of file I/O, "malloc", error report printouts, etc; pass these through the common routines provided.
2. Minimize global namespace pollution. Functions should be declared static wherever possible. (Note that our method-based calling conventions help this a lot: in many modules only the initialization function will ever need to be called directly, so only that function need be externally visible.) All global function names should begin with "jpeg_", and should have an abbreviated name (unique in the first six characters) substituted by macro when NEED_SHORT_EXTERNAL_NAMES is set.
3. Don't use global variables; anything that must be used in another module should be in the common data structures.
4. Don't use static variables except for read-only constant tables. Variables

that should be private to a module can be placed into private structures (see the system architecture document, structure.txt).

5. Source file names should begin with "j" for files that are part of the library proper; source files that are not part of the library, such as cjpeg.c and djpeg.c, do not begin with "j". Keep source file names to eight characters (plus ".c" or ".h", etc) to make life easy for MS-DOSers. Keep compression and decompression code in separate source files --- some applications may want only one half of the library.

Note: these rules (particularly #4) are not followed religiously in the modules that are used in cjpeg/djpeg but are not part of the JPEG library proper. Those modules are not really intended to be used in other applications.

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/coderules.txt

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```
/*
 * jerror.h
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 1997-2018 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file defines the error and message codes for the JPEG library.
 * Edit this file to add new codes, or to translate the message strings to
 * some other language.
 * A set of error-reporting macros are defined too. Some applications using
 * the JPEG library may wish to include this file to get the error codes
 * and/or the macros.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jerror.h

No license file was found, but licenses were detected in source scan.

```
/*
 * jfdctfst.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2003-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a fast, not so accurate integer implementation of the
```


- * forward DCT (Discrete Cosine Transform).
- *
- * A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
- * on each column. Direct algorithms are also available, but they are
- * much more complex and seem not to be any faster when reduced to code.
- *
- * This implementation is based on Arai, Agui, and Nakajima's algorithm for
- * scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
- * Japanese, but the algorithm is described in the Pennebaker & Mitchell
- * JPEG textbook (see REFERENCES section in file README). The following code
- * is based directly on figure 4-8 in P&M.
- * While an 8-point DCT cannot be done in less than 11 multiplies, it is
- * possible to arrange the computation so that many of the multiplies are
- * simple scalings of the final outputs. These multiplies can then be
- * folded into the multiplications or divisions by the JPEG quantization
- * table entries. The AA&N method leaves only 5 multiplies and 29 adds
- * to be done in the DCT itself.
- * The primary disadvantage of this method is that with fixed-point math,
- * accuracy is lost due to imprecise representation of the scaled
- * quantization values. The smaller the quantization table entry, the less
- * precise the scaled value, so this implementation does worse with high-
- * quality-setting files than with low-quality ones.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jfdctfst.c
 No license file was found, but licenses were detected in source scan.

```
/*
 * wrjpgcom.c
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 2015-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a very simple stand-alone application that inserts
 * user-supplied text as a COM (comment) marker in a JFIF file.
 * This may be useful as an example of the minimum logic needed to parse
 * JPEG markers.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/wrjpgcom.c
 No license file was found, but licenses were detected in source scan.

INSTALLATION INSTRUCTIONS for the Independent JPEG Group's JPEG software

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This file is part of the Independent JPEG Group's software.
For conditions of distribution and use, see the accompanying README file.

This file explains how to configure and install the IJG software. We have tried to make this software extremely portable and flexible, so that it can be adapted to almost any environment. The downside of this decision is that the installation process is complicated. We have provided shortcuts to simplify the task on common systems. But in any case, you will need at least a little familiarity with C programming and program build procedures for your system.

If you are only using this software as part of a larger program, the larger program's installation procedure may take care of configuring the IJG code. For example, Ghostscript's installation script will configure the IJG code. You don't need to read this file if you just want to compile Ghostscript.

If you are on a Unix machine, you may not need to read this file at all.

Try doing

```
./configure
```

```
make
```

```
make test
```

If that doesn't complain, do

```
make install
```

(better do "make -n install" first to see if the makefile will put the files where you want them). Read further if you run into snags or want to customize the code for your system.

TABLE OF CONTENTS

Before you start

Configuring the software:

- using the automatic "configure" script

- using one of the supplied jconfig and makefile files

- by hand

Building the software

Testing the software

Installing the software

Optional stuff

Optimization

Hints for specific systems

BEFORE YOU START

=====

Before installing the software you must unpack the distributed source code. Since you are reading this file, you have probably already succeeded in this task. However, there is a potential for error if you needed to convert the files to the local standard text file format (for example, if you are on MS-DOS you may have converted LF end-of-line to CR/LF). You must apply such conversion to all the files EXCEPT those whose names begin with "test". The test files contain binary data; if you change them in any way then the self-test will give bad results.

Please check the last section of this file to see if there are hints for the specific machine or compiler you are using.

CONFIGURING THE SOFTWARE

=====

To configure the IJG code for your system, you need to create two files:

- * jconfig.h: contains values for system-dependent #define symbols.
- * Makefile: controls the compilation process.

(On a non-Unix machine, you may create "project files" or some other substitute for a Makefile. jconfig.h is needed in any environment.)

We provide three different ways to generate these files:

- * On a Unix system, you can just run the "configure" script.
- * We provide sample jconfig files and makefiles for popular machines; if your machine matches one of the samples, just copy the right sample files to jconfig.h and Makefile.
- * If all else fails, read the instructions below and make your own files.

Configuring the software using the automatic "configure" script

If you are on a Unix machine, you can just type

```
./configure
```

and let the configure script construct appropriate configuration files.

If you're using "csh" on an old version of System V, you might need to type

```
sh configure
```

instead to prevent csh from trying to execute configure itself.

Expect configure to run for a few minutes, particularly on slower machines; it works by compiling a series of test programs.

Configure was created with GNU Autoconf and it follows the usual conventions for GNU configure scripts. It makes a few assumptions that you may want to override. You can do this by providing optional switches to configure:

- * Configure will build both static and shared libraries, if possible.

If you want to build libjpeg only as a static library, say

`./configure --disable-shared`

If you want to build libjpeg only as a shared library, say

`./configure --disable-static`

Configure uses GNU libtool to take care of system-dependent shared library building methods.

* Configure will use gcc (GNU C compiler) if it's available, otherwise cc.

To force a particular compiler to be selected, use the CC option, for example

`./configure CC='cc'`

The same method can be used to include any unusual compiler switches.

For example, on HP-UX you probably want to say

`./configure CC='cc -Aa'`

to get HP's compiler to run in ANSI mode.

* The default CFLAGS setting is "-g" for non-gcc compilers, "-g -O2" for gcc.

You can override this by saying, for example,

`./configure CFLAGS='-O2'`

if you want to compile without debugging support.

* Configure will set up the makefile so that "make install" will install files into /usr/local/bin, /usr/local/man, etc. You can specify an installation prefix other than "/usr/local" by giving configure the option "--prefix=PATH".

* If you don't have a lot of swap space, you may need to enable the IJG software's internal virtual memory mechanism. To do this, give the option "--enable-maxmem=N" where N is the default maxmemory limit in megabytes. This is discussed in more detail under "Selecting a memory manager", below. You probably don't need to worry about this on reasonably-sized Unix machines, unless you plan to process very large images.

Configure has some other features that are useful if you are cross-compiling or working in a network of multiple machine types; but if you need those features, you probably already know how to use them.

Configuring the software using one of the supplied jconfig and makefile files

If you have one of these systems, you can just use the provided configuration files:

Makefile jconfig file System and/or compiler

makefile.manx jconfig.manx Amiga, Manx Aztec C

makefile.sas jconfig.sas Amiga, SAS C

makeproj.mac jconfig.mac Apple Macintosh, Metrowerks CodeWarrior

mak*jpeg.st jconfig.st Atari ST/STE/TT, Pure C or Turbo C

makefile.bcc jconfig.bcc MS-DOS or OS/2, Borland C

makefile.dj jconfig.dj MS-DOS, DJGPP (Delorie's port of GNU C)
makefile.mc6 jconfig.mc6 MS-DOS, Microsoft C (16-bit only)
makefile.wat jconfig.wat MS-DOS, OS/2, or Windows NT, Watcom C
makefile.vc jconfig.vc Windows, MS Visual C++
makefile.vs jconfig.vc Windows, MS Visual C++ 6 Developer Studio
make*.vc6
makefile.vs jconfig.vc Windows, Visual Studio 2019 (v16)
make*.v16
makefile.b32 jconfig.vc Windows, Borland C++ 32-bit (bcc32)
makefile.mms jconfig.vms Digital VMS, with MMS software
makefile.vms jconfig.vms Digital VMS, without MMS software

Copy the proper jconfig file to jconfig.h and the makefile to Makefile (or whatever your system uses as the standard makefile name). For more info see the appropriate system-specific hints section near the end of this file.

Configuring the software by hand

First, generate a jconfig.h file. If you are moderately familiar with C, the comments in jconfig.txt should be enough information to do this; just copy jconfig.txt to jconfig.h and edit it appropriately. Otherwise, you may prefer to use the ckconfig.c program. You will need to compile and execute ckconfig.c by hand --- we hope you know at least enough to do that. ckconfig.c may not compile the first try (in fact, the whole idea is for it to fail if anything is going to). If you get compile errors, fix them by editing ckconfig.c according to the directions given in ckconfig.c. Once you get it to run, it will write a suitable jconfig.h file, and will also print out some advice about which makefile to use.

You may also want to look at the canned jconfig files, if there is one for a system similar to yours.

Second, select a makefile and copy it to Makefile (or whatever your system uses as the standard makefile name). The most generic makefiles we provide are

makefile.ansi: if your C compiler supports function prototypes
makefile.unix: if not.

(You have function prototypes if ckconfig.c put "#define HAVE_PROTOTYPES" in jconfig.h.) You may want to start from one of the other makefiles if there is one for a system similar to yours.

Look over the selected Makefile and adjust options as needed. In particular you may want to change the CC and CFLAGS definitions. For instance, if you are using GCC, set CC=gcc. If you had to use any compiler switches to get ckconfig.c to work, make sure the same switches are in CFLAGS.

If you are on a system that doesn't use makefiles, you'll need to set up project files (or whatever you do use) to compile all the source files and link them into executable files `cjpeg`, `djpeg`, `jpegtran`, `rdjpgcom`, and `wrjpgcom`. See the file lists in any of the makefiles to find out which files go into each program. Note that the provided makefiles all make a "library" file `libjpeg` first, but you don't have to do that if you don't want to; the file lists identify which source files are actually needed for compression, decompression, or both. As a last resort, you can make a batch script that just compiles everything and links it all together; `makefile.vms` is an example of this (it's for VMS systems that have no make-like utility).

Here are comments about some specific configuration decisions you'll need to make:

Command line style

These programs can use a Unix-like command line style which supports redirection and piping, like this:

```
cjpeg inputfile >outputfile
cjpeg <inputfile >outputfile
source program | cjpeg >outputfile
```

The simpler "two file" command line style is just

```
cjpeg inputfile outputfile
```

You may prefer the two-file style, particularly if you don't have pipes.

You **MUST** use two-file style on any system that doesn't cope well with binary data fed through `stdin/stdout`; this is true for some MS-DOS compilers, for example. If you're not on a Unix system, it's safest to assume you need two-file style. (But if your compiler provides either the Posix-standard `fdopen()` library routine or a Microsoft-compatible `setmode()` routine, you can safely use the Unix command line style, by defining `USE_FDOPEN` or `USE_SETMODE` respectively.)

To use the two-file style, make `jconfig.h` say `#define TWO_FILE_COMMANDLINE`.

Selecting a memory manager

The IJG code is capable of working on images that are too big to fit in main memory; data is swapped out to temporary files as necessary. However, the code to do this is rather system-dependent. We provide five different memory managers:

- * `jmemansi.c` This version uses the ANSI-standard library routine `tmpfile()`, which not all non-ANSI systems have. On some systems `tmpfile()` may put the temporary file in a non-optimal location; if you don't like what it does, use `jmemname.c`.

* `jmemname.c` This version creates named temporary files. For anything except a Unix machine, you'll need to configure the `select_file_name()` routine appropriately; see the comments near the head of `jmemname.c`. If you use this version, define `NEED_SIGNAL_CATCHER` in `jconfig.h` to make sure the temp files are removed if the program is aborted.

* `jmemnobs.c` (That stands for No Backing Store :-).) This will compile on almost any system, but it assumes you have enough main memory or virtual memory to hold the biggest images you work with.

* `jmemdos.c` This should be used with most 16-bit MS-DOS compilers. See the system-specific notes about MS-DOS for more info. IMPORTANT: if you use this, define `USE_MSDOS_MEMMGR` in `jconfig.h`, and include the assembly file `jmemdosa.asm` in the programs. The supplied makefiles and `jconfig` files for 16-bit MS-DOS compilers already do both.

* `jmemmac.c` Custom version for Apple Macintosh; see the system-specific notes for Macintosh for more info.

To use a particular memory manager, change the `SYSDEPMEM` variable in your makefile to equal the corresponding object file name (for example, `jmemansi.o` or `jmemansi.obj` for `jmemansi.c`).

If you have plenty of (real or virtual) main memory, just use `jmemnobs.c`.

"Plenty" means about ten bytes for every pixel in the largest images you plan to process, so a lot of systems don't meet this criterion.

If yours doesn't, try `jmemansi.c` first. If that doesn't compile, you'll have to use `jmemname.c`; be sure to adjust `select_file_name()` for local conditions. You may also need to change `unlink()` to `remove()` in `close_backing_store()`.

Except with `jmemnobs.c` or `jmemmac.c`, you need to adjust the `DEFAULT_MAX_MEM` setting to a reasonable value for your system (either by adding a `#define` for `DEFAULT_MAX_MEM` to `jconfig.h`, or by adding a `-D` switch to the Makefile).

This value limits the amount of data space the program will attempt to allocate. Code and static data space isn't counted, so the actual memory needs for `cjpeg` or `djpeg` are typically 100 to 150Kb more than the max-memory setting. Larger max-memory settings reduce the amount of I/O needed to process a large image, but too large a value can result in "insufficient memory" failures. On most Unix machines (and other systems with virtual memory), just set `DEFAULT_MAX_MEM` to several million and forget it. At the other end of the spectrum, for MS-DOS machines you probably can't go much above 300K to 400K. (On MS-DOS the value refers to conventional memory only. Extended/expanded memory is handled separately by `jmemdos.c`.)

BUILDING THE SOFTWARE

=====

Now you should be able to compile the software. Just say "make" (or whatever's necessary to start the compilation). Have a cup of coffee.

Here are some things that could go wrong:

If your compiler complains about undefined structures, you should be able to shut it up by putting "#define INCOMPLETE_TYPES_BROKEN" in jconfig.h.

If you have trouble with missing system include files or inclusion of the wrong ones, read jinclude.h. This shouldn't happen if you used configure or ckconfig.c to set up jconfig.h.

There are a fair number of routines that do not use all of their parameters; some compilers will issue warnings about this, which you can ignore. There are also a few configuration checks that may give "unreachable code" warnings. Any other warning deserves investigation.

If you don't have a getenv() library routine, define NO_GETENV.

Also see the system-specific hints, below.

TESTING THE SOFTWARE

=====

As a quick test of functionality we've included a small sample image in several forms:

testorig.jpg Starting point for the djpeg tests.

testing.ppm The output of djpeg testorig.jpg

testing.bmp The output of djpeg -bmp -colors 256 testorig.jpg

testing.jpg The output of cjpeg testing.ppm

testprog.jpg Progressive-mode equivalent of testorig.jpg.

testingp.jpg The output of cjpeg -progressive -optimize testing.ppm

(The first- and second-generation .jpg files aren't identical since the default compression parameters are lossy.) If you can generate duplicates of the testing* files then you probably have working programs.

With most of the makefiles, "make test" will perform the necessary comparisons.

If you're using a makefile that doesn't provide the test option, run djpeg and cjpeg by hand and compare the output files to testing* with whatever binary file comparison tool you have. The files should be bit-for-bit identical.

If the programs complain "MAX_ALLOC_CHUNK is wrong, please fix", then you need to reduce MAX_ALLOC_CHUNK to a value that fits in type size_t. Try adding "#define MAX_ALLOC_CHUNK 65520L" to jconfig.h. A less likely configuration error is "ALIGN_TYPE is wrong, please fix": defining ALIGN_TYPE as long should take care of that one.

If the cjpeg test run fails with "Missing Huffman code table entry", it's a good bet that you needed to define RIGHT_SHIFT_IS_UNSIGNED. Go back to the configuration step and run ckconfig.c. (This is a good plan for any other test failure, too.)

If you are using Unix (one-file) command line style on a non-Unix system, it's a good idea to check that binary I/O through stdin/stdout actually works. You should get the same results from "djpeg <testorig.jpg >out.ppm" as from "djpeg -outfile out.ppm testorig.jpg". Note that the makefiles all use the latter style and therefore do not exercise stdin/stdout! If this check fails, try recompiling with USE_SETMODE or USE_FDOPEN defined. If it still doesn't work, better use two-file style.

If you chose a memory manager other than jmemnobs.c, you should test that temporary-file usage works. Try "djpeg -bmp -colors 256 -max 0 testorig.jpg" and make sure its output matches testing.bmp. If you have any really large images handy, try compressing them with -optimize and/or decompressing with -colors 256 to make sure your DEFAULT_MAX_MEM setting is not too large.

NOTE: this is far from an exhaustive test of the JPEG software; some modules, such as 1-pass color quantization, are not exercised at all. It's just a quick test to give you some confidence that you haven't missed something major.

INSTALLING THE SOFTWARE

=====

Once you're done with the above steps, you can install the software by copying the executable files (cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom) to wherever you normally install programs. On Unix systems, you'll also want to put the man pages (cjpeg.1, djpeg.1, jpegtran.1, rdjpgcom.1, wrjpgcom.1) in the man-page directory. The pre-fab makefiles don't support this step since there's such a wide variety of installation procedures on different systems.

If you generated a Makefile with the "configure" script, you can just say
make install
to install the programs and their man pages into the standard places.
(You'll probably need to be root to do this.) We recommend first saying
make -n install
to see where configure thought the files should go. You may need to edit

the Makefile, particularly if your system's conventions for man page filenames don't match what configure expects.

If you want to install the IJG library itself, for use in compiling other programs besides ours, then you need to put the four include files `jpeglib.h` `jerror.h` `jconfig.h` `jmorecfg.h` into your include-file directory, and put the library file `libjpeg.a` (extension may vary depending on system) wherever library files go. If you generated a Makefile with "configure", it will do what it thinks is the right thing if you say

```
make install-lib
```

OPTIONAL STUFF

=====

Progress monitor:

If you like, you can `#define PROGRESS_REPORT` (in `jconfig.h`) to enable display of percent-done progress reports. The routine provided in `cdjpeg.c` merely prints percentages to `stderr`, but you can customize it to do something fancier.

Utah RLE file format support:

We distribute the software with support for RLE image files (Utah Raster Toolkit format) disabled, because the RLE support won't compile without the Utah library. If you have URT version 3.1 or later, you can enable RLE support as follows:

1. `#define RLE_SUPPORTED` in `jconfig.h`.
2. Add a `-I` option to `CFLAGS` in the Makefile for the directory containing the URT `.h` files (typically the "include" subdirectory of the URT distribution).
3. Add `-L... -lrle` to `LDLIBS` in the Makefile, where ... specifies the directory containing the URT "librle.a" file (typically the "lib" subdirectory of the URT distribution).

Support for 9-bit to 12-bit deep pixel data:

The IJG code currently allows 8, 9, 10, 11, or 12 bits sample data precision. (For color, this means 8 to 12 bits per channel, of course.) If you need to work with deeper than 8-bit data, you can compile the IJG code for 9-bit to 12-bit operation.

To do so:

1. In `jmorecfg.h`, define `BITS_IN_JSAMPLE` as 9, 10, 11, or 12 rather than 8.
2. In `jconfig.h`, undefine `BMP_SUPPORTED`, `RLE_SUPPORTED`, and `TARGA_SUPPORTED`, because the code for those formats doesn't handle deeper than 8-bit data and won't even compile. (The PPM code does work, as explained below.

The GIF code works too; it scales 8-bit GIF data to and from 12-bit depth automatically.)

3. Compile. Don't expect "make test" to pass, since the supplied test files are for 8-bit data.

Currently, 9-bit to 12-bit support does not work on 16-bit-int machines.

Run-time selection and conversion of data precision are currently not supported and may be added later.

Exception: The transcoding part (jpegtran) supports all settings in a single instance, since it operates on the level of DCT coefficients and not sample values.

The PPM reader (rdppm.c) can read deeper than 8-bit data from either text-format or binary-format PPM and PGM files. Binary-format PPM/PGM files which have a maxval greater than 255 are assumed to use 2 bytes per sample, MSB first (big-endian order). As of early 1995, 2-byte binary format is not officially supported by the PBMPLUS library, but it is expected that a future release of PBMPLUS will support it. Note that the PPM reader will read files of any maxval regardless of the BITS_IN_JSAMPLE setting; incoming data is automatically rescaled to maxval=MAXJSAMPLE as appropriate for the cjpeg bit depth.

The PPM writer (wrppm.c) will normally write 2-byte binary PPM or PGM format, maxval=MAXJSAMPLE, when compiled with BITS_IN_JSAMPLE>8. Since this format is not yet widely supported, you can disable it by compiling wrppm.c with PPM_NORAWWORD defined; then the data is scaled down to 8 bits to make a standard 1-byte/sample PPM or PGM file. (Yes, this means still another copy of djpeg to keep around. But hopefully you won't need it for very long. Poskanzer's supposed to get that new PBMPLUS release out Real Soon Now.)

Of course, if you are working with 9-bit to 12-bit data, you probably have it stored in some other, nonstandard format. In that case you'll probably want to write your own I/O modules to read and write your format.

Note:

The standard Huffman tables are only valid for 8-bit data precision. If you selected more than 8-bit data precision, cjpeg uses arithmetic coding by default. The Huffman encoder normally uses entropy optimization to compute usable tables for higher precision. Otherwise, you'll have to supply different default Huffman tables.

Removing code:

If you need to make a smaller version of the JPEG software, some optional functions can be removed at compile time. See the xxx_SUPPORTED #defines in jconfig.h and jmorecfg.h. If at all possible, we recommend that you leave in decoder support for all valid JPEG files, to ensure that you can read anyone's

output. Taking out support for image file formats that you don't use is the most painless way to make the programs smaller. Another possibility is to remove some of the DCT methods: in particular, the "IFAST" method may not be enough faster than the others to be worth keeping on your machine. (If you do remove ISLOW or IFAST, be sure to redefine JDCT_DEFAULT or JDCT_FASTEST to a supported method, by adding a #define in jconfig.h.)

OPTIMIZATION

=====

Unless you own a Cray, you'll probably be interested in making the JPEG software go as fast as possible. This section covers some machine-dependent optimizations you may want to try. We suggest that before trying any of this, you first get the basic installation to pass the self-test step. Repeat the self-test after any optimization to make sure that you haven't broken anything.

The integer DCT routines perform a lot of multiplications. These multiplications must yield 32-bit results, but none of their input values are more than 16 bits wide. On many machines, notably the 680x0 and 80x86 CPUs, a 16x16=>32 bit multiply instruction is faster than a full 32x32=>32 bit multiply. Unfortunately there is no portable way to specify such a multiplication in C, but some compilers can generate one when you use the right combination of casts. See the MULTIPLYxxx macro definitions in jdct.h. If your compiler makes "int" be 32 bits and "short" be 16 bits, defining SHORTxSHORT_32 is fairly likely to work. When experimenting with alternate definitions, be sure to test not only whether the code still works (use the self-test), but also whether it is actually faster --- on some compilers, alternate definitions may compute the right answer, yet be slower than the default. Timing cjpeg on a large PGM (grayscale) input file is the best way to check this, as the DCT will be the largest fraction of the runtime in that mode. (Note: some of the distributed compiler-specific jconfig files already contain #define switches to select appropriate MULTIPLYxxx definitions.)

If your machine has sufficiently fast floating point hardware, you may find that the float DCT method is faster than the integer DCT methods, even after tweaking the integer multiply macros. In that case you may want to make the float DCT be the default method. (The only objection to this is that float DCT results may vary slightly across machines.) To do that, add "#define JDCT_DEFAULT JDCT_FLOAT" to jconfig.h. Even if you don't change the default, you should redefine JDCT_FASTEST, which is the method selected by djpeg's -fast switch. Don't forget to update the documentation files (usage.txt and/or cjpeg.1, djpeg.1) to agree with what you've done.

If access to "short" arrays is slow on your machine, it may be a win to define type JCOEF as int rather than short. This will cost a good deal of

memory though, particularly in some multi-pass modes, so don't do it unless you have memory to burn and short is REALLY slow.

If your compiler can compile function calls in-line, make sure the `INLINE` macro in `jmorcfcfg.h` is defined as the keyword that marks a function inline-able. Some compilers have a switch that tells the compiler to inline any function it thinks is profitable (e.g., `-finline-functions` for gcc). Enabling such a switch is likely to make the compiled code bigger but faster.

In general, it's worth trying the maximum optimization level of your compiler, and experimenting with any optional optimizations such as loop unrolling. (Unfortunately, far too many compilers have optimizer bugs ... be prepared to back off if the code fails self-test.) If you do any experimentation along these lines, please report the optimal settings to jpeg-info@jpegclub.org so we can mention them in future releases. Be sure to specify your machine and compiler version.

HINTS FOR SPECIFIC SYSTEMS

=====

We welcome reports on changes needed for systems not mentioned here. Submit 'em to jpeg-info@jpegclub.org. Also, if `configure` or `ckconfig.c` is wrong about how to configure the JPEG software for your system, please let us know.

Acorn RISC OS:

(Thanks to Simon Middleton for these hints on compiling with Desktop C.)
After renaming the files according to Acorn conventions, take a copy of `makefile.ansi`, change all occurrences of `'libjpeg.a'` to `'libjpeg.o'` and change these definitions as indicated:

```
CFLAGS= -throwback -IC: -Wn
LDLIBS=C:o.Stubs
SYSDEPMEM=jmemansi.o
LN=Link
AR=LibFile -c -o
```

Also add a new line `'c.o: $(cc) $< $(cflags) -c -o $@'`. Remove the lines `'$(RM) libjpeg.o'` and `'$(AR2) libjpeg.o'` and the `'jconfig.h'` dependency section.

Copy `jconfig.txt` to `jconfig.h`. Edit `jconfig.h` to define `TWO_FILE_COMMANDLINE` and `CHAR_IS_UNSIGNED`.

Run the makefile using `!AMU` not `!Make`. If you want to use the `'clean'` and `'test'` makefile entries then you will have to fiddle with the syntax a bit

and rename the test files.

Amiga:

SAS C 6.50 reportedly is too buggy to compile the IJG code properly. A patch to update to 6.51 is available from SAS or AmiNet FTP sites.

The supplied config files are set up to use jmemname.c as the memory manager, with temporary files being created on the device named by "JPEGTMP:".

Atari ST/STE/TT:

Copy the project files makcjpeg.st, makdjpeg.st, maktjpeg.st, and makljpeg.st to cjpeg.prj, djpeg.prj, jpegtran.prj, and libjpeg.prj respectively. The project files should work as-is with Pure C. For Turbo C, change library filenames "pc..." to "tc..." in each project file. Note that libjpeg.prj selects jmemansi.c as the recommended memory manager. You'll probably want to adjust the DEFAULT_MAX_MEM setting --- you want it to be a couple hundred K less than your normal free memory. Put "#define DEFAULT_MAX_MEM nnnn" into jconfig.h to do this.

To use the 68881/68882 coprocessor for the floating point DCT, add the compiler option "-8" to the project files and replace pcftlib.lib with pc881lib.lib in cjpeg.prj and djpeg.prj. Or if you don't have a coprocessor, you may prefer to remove the float DCT code by undefining DCT_FLOAT_SUPPORTED in jmorecfg.h (since without a coprocessor, the float code will be too slow to be useful). In that case, you can delete pcftlib.lib from the project files.

Note that you must make libjpeg.lib before making cjpeg.ttp, djpeg.ttp, or jpegtran.ttp. You'll have to perform the self-test by hand.

We haven't bothered to include project files for rdjpgcom and wrjpgcom. Those source files should just be compiled by themselves; they don't depend on the JPEG library. You can use the default.prj project file of the Pure C distribution to make the programs.

There is a bug in some older versions of the Turbo C library which causes the space used by temporary files created with "tmpfile()" not to be freed after an abnormal program exit. If you check your disk afterwards, you will find cluster chains that are allocated but not used by a file. This should not happen in cjpeg/djpeg/jpegtran, since we enable a signal catcher to explicitly close temp files before exiting. But if you use the JPEG library with your own code, be sure to supply a signal catcher, or else use a different system-dependent memory manager.

Cray:

Should you be so fortunate as to be running JPEG on a Cray YMP, there is a compiler bug in old versions of Cray's Standard C (prior to 3.1). If you still have an old compiler, you'll need to insert a line reading `"#pragma novector"` just before the loop

```
for (i = 1; i <= (int) htbl->bits[l]; i++)
    huffsize[p++] = (char) l;
```

in `fix_huff_tbl` (in V5beta1, line 204 of `jchuff.c` and line 176 of `jdchuff.c`). [This bug may or may not still occur with the current IJG code, but it's probably a dead issue anyway...]

HP-UX:

If you have HP-UX 7.05 or later with the "software development" C compiler, you should run the compiler in ANSI mode. If using the configure script, say

```
./configure CC='cc -Aa'
```

(or `-Ae` if you prefer). If configuring by hand, use `makefile.ansi` and add `"-Aa"` to the `CFLAGS` line in the `makefile`.

If you have a pre-7.05 system, or if you are using the non-ANSI C compiler delivered with a minimum HP-UX system, then you must use `makefile.unix` (and do NOT add `-Aa`); or just run `configure` without the `CC` option.

On HP 9000 series 800 machines, the HP C compiler is buggy in revisions prior to A.08.07. If you get complaints about "not a typedef name", you'll have to use `makefile.unix`, or run `configure` without the `CC` option.

Macintosh, generic comments:

The supplied user-interface files (`cjpeg.c`, `djpeg.c`, etc) are set up to provide a Unix-style command line interface. You can use this interface on the Mac by means of the `ccommand()` library routine provided by Metrowerks CodeWarrior or Think C. This is only appropriate for testing the library, however; to make a user-friendly equivalent of `cjpeg/djpeg` you'd really want to develop a Mac-style user interface. There isn't a complete example available at the moment, but there are some helpful starting points:

1. Sam Bushell's free "To JPEG" applet provides drag-and-drop conversion to JPEG under System 7 and later. This only illustrates how to use the compression half of the library, but it does a very nice job of that part.

The CodeWarrior source code is available from <http://www.pobox.com/~jsam>.

2. Jim Brunner prepared a Mac-style user interface for both compression and decompression. Unfortunately, it hasn't been updated since IJG v4, and

the library's API has changed considerably since then. Still it may be of some help, particularly as a guide to compiling the IJG code under Think C. Jim's code is available from the Info-Mac archives, at sumex-aim.stanford.edu or mirrors thereof; see file `/info-mac/dev/src/jpeg-convert-c.hqx`.

`jmemmac.c` is the recommended memory manager back end for Macintosh. It uses `NewPtr/DisposePtr` instead of `malloc/free`, and has a Mac-specific implementation of `jpeg_mem_available()`. It also creates temporary files that follow Mac conventions. (That part of the code relies on System-7-or-later OS functions. See the comments in `jmemmac.c` if you need to run it on System 6.) NOTE that `USE_MAC_MEMMGR` must be defined in `jconfig.h` to use `jmemmac.c`.

You can also use `jmemnobs.c`, if you don't care about handling images larger than available memory. If you use any memory manager back end other than `jmemmac.c`, we recommend replacing "malloc" and "free" by "NewPtr" and "DisposePtr", because Mac C libraries often have peculiar implementations of `malloc/free`. (For instance, `free()` may not return the freed space to the Mac Memory Manager. This is undesirable for the IJG code because `jmemmgr.c` already clumps space requests.)

Macintosh, Metrowerks CodeWarrior:

The Unix-command-line-style interface can be used by defining `USE_CCOMMAND`. You'll also need to define `TWO_FILE_COMMANDLINE` to avoid `stdin/stdout`. This means that when using the `cjpeg/djpeg` programs, you'll have to type the input and output file names in the "Arguments" text-edit box, rather than using the file radio buttons. (Perhaps `USE_FDOPEN` or `USE_SETMODE` would eliminate the problem, but I haven't heard from anyone who's tried it.)

On 680x0 Macs, Metrowerks defines type "double" as a 10-byte IEEE extended float. `jmemmgr.c` won't like this: it wants `sizeof(ALIGN_TYPE)` to be a power of 2. Add `#define ALIGN_TYPE long` to `jconfig.h` to eliminate the complaint.

The supplied configuration file `jconfig.mac` can be used for your `jconfig.h`; it includes all the recommended symbol definitions. If you have AppleScript installed, you can run the supplied script `makeproj.mac` to create CodeWarrior project files for the library and the testbed applications, then build the library and applications. (Thanks to Dan Sears and Don Agro for this nifty hack, which saves us from trying to maintain CodeWarrior project files as part of the IJG distribution...)

Macintosh, Think C:

The documentation in Jim Brunner's "JPEG Convert" source code (see above) includes detailed build instructions for Think C; it's probably somewhat out of date for the current release, but may be helpful.

If you want to build the minimal command line version, proceed as follows. You'll have to prepare project files for the programs; we don't include any in the distribution since they are not text files. Use the file lists in any of the supplied makefiles as a guide. Also add the ANSI and Unix C libraries in a separate segment. You may need to divide the JPEG files into more than one segment; we recommend dividing compression and decompression modules. Define `USE_CCOMMAND` in `jconfig.h` so that the `ccommand()` routine is called. You must also define `TWO_FILE_COMMANDLINE` because `stdin/stdout` don't handle binary data correctly.

On 680x0 Macs, Think C defines type "double" as a 12-byte IEEE extended float. `jmemmgr.c` won't like this: it wants `sizeof(ALIGN_TYPE)` to be a power of 2. Add `#define ALIGN_TYPE long` to `jconfig.h` to eliminate the complaint.

`jconfig.mac` should work as a `jconfig.h` configuration file for Think C, but the `makeproj.mac` AppleScript script is specific to CodeWarrior. Sorry.

MIPS R3000:

MIPS's `cc` version 1.31 has a rather nasty optimization bug. Don't use `-O` if you have that compiler version. (Use `"cc -V"` to check the version.) Note that the R3000 chip is found in workstations from DEC and others.

MS-DOS, generic comments for 16-bit compilers:

The IJG code is designed to work well in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile `cjpeg` or `djpeg` by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model, and you should avoid "huge" model if at all possible. Be sure that `NEED_FAR_POINTERS` is defined in `jconfig.h` if you use a small-data memory model; be sure it is NOT defined if you use a large-data model. (The supplied makefiles and `jconfig` files for Borland and Microsoft C compile in medium model and define `NEED_FAR_POINTERS`.)

The DOS-specific memory manager, `jmemdos.c`, should be used if possible. It needs some assembly-code routines which are in `jmemdosa.asm`; make sure your makefile assembles that file and includes it in the library. If you don't have a suitable assembler, you can get pre-assembled object files for `jmemdosa` by FTP from `ftp.uu.net:/graphics/jpeg/jdosaobj.zip`. (DOS-oriented distributions of the IJG source code often include these object files.)

When using `jmemdos.c`, `jconfig.h` must define `USE_MSDOS_MEMMGR` and must set

MAX_ALLOC_CHUNK to less than 64K (65520L is a typical value). If your C library's far-heap malloc() can't allocate blocks that large, reduce MAX_ALLOC_CHUNK to whatever it can handle.

If you can't use jmemdos.c for some reason --- for example, because you don't have an assembler to assemble jmemdosa.asm --- you'll have to fall back to jmemansi.c or jmemname.c. You'll probably still need to set MAX_ALLOC_CHUNK in jconfig.h, because most DOS C libraries won't malloc() more than 64K at a time. IMPORTANT: if you use jmemansi.c or jmemname.c, you will have to compile in a large-data memory model in order to get the right stdio library. Too bad.

wrjpgcom needs to be compiled in large model, because it malloc()s a 64KB work area to hold the comment text. If your C library's malloc can't handle that, reduce MAX_COM_LENGTH as necessary in wrjpgcom.c.

Most MS-DOS compilers treat stdin/stdout as text files, so you must use two-file command line style. But if your compiler has either fdopen() or setmode(), you can use one-file style if you like. To do this, define USE_SETMODE or USE_FDOPEN so that stdin/stdout will be set to binary mode. (USE_SETMODE seems to work with more DOS compilers than USE_FDOPEN.) You should test that I/O through stdin/stdout produces the same results as I/O to explicitly named files... the "make test" procedures in the supplied makefiles do NOT use stdin/stdout.

MS-DOS, generic comments for 32-bit compilers:

None of the above comments about memory models apply if you are using a 32-bit flat-memory-space environment, such as DJGPP or Watcom C. (And you should use one if you have it, as performance will be much better than 8086-compatible code!) For flat-memory-space compilers, do NOT define NEED_FAR_POINTERS, and do NOT use jmemdos.c. Use jmemnobs.c if the environment supplies adequate virtual memory, otherwise use jmemansi.c or jmemname.c.

You'll still need to be careful about binary I/O through stdin/stdout. See the last paragraph of the previous section.

MS-DOS, Borland C:

Be sure to convert all the source files to DOS text format (CR/LF newlines). Although Borland C will often work OK with unmodified Unix (LF newlines) source files, sometimes it will give bogus compile errors. "Illegal character '#'" is the most common such error. (This is true with Borland C 3.1, but perhaps is fixed in newer releases.)

If you want one-file command line style, just undefine TWO_FILE_COMMANDLINE.
jconfig.bcc already includes #define USE_SETMODE to make this work.
(fdopen does not work correctly.)

MS-DOS, Microsoft C:

makefile.mc6 works with Microsoft C, DOS Visual C++, etc. It should only
be used if you want to build a 16-bit (small or medium memory model) program.

If you want one-file command line style, just undefine TWO_FILE_COMMANDLINE.
jconfig.mc6 already includes #define USE_SETMODE to make this work.
(fdopen does not work correctly.)

Note that this makefile assumes that the working copy of itself is called
"makefile". If you want to call it something else, say "makefile.mak",
be sure to adjust the dependency line that reads "\$(RFILE) : makefile".
Otherwise the make will fail because it doesn't know how to create "makefile".
Worse, some releases of Microsoft's make utilities give an incorrect error
message in this situation.

Old versions of MS C fail with an "out of macro expansion space" error
because they can't cope with the macro TRACEMS8 (defined in jerror.h).
If this happens to you, the easiest solution is to change TRACEMS8 to
expand to nothing. You'll lose the ability to dump out JPEG coefficient
tables with djpeg -debug -debug, but at least you can compile.

Original MS C 6.0 is very buggy; it compiles incorrect code unless you turn
off optimization entirely (remove -O from CFLAGS). 6.00A is better, but it
still generates bad code if you enable loop optimizations (-Ol or -Ox).

MS C 8.0 crashes when compiling jquant1.c with optimization switch /Oo ...
which is on by default. To work around this bug, compile that one file
with /Oo-.

Microsoft Windows (all versions), generic comments:

Some Windows system include files define typedef boolean as "unsigned char".
The IJG code also defines typedef boolean, but we make it an "enum" by default.
This doesn't affect the IJG programs because we don't import those Windows
include files. But if you use the JPEG library in your own program, and some
of your program's files import one definition of boolean while some import the
other, you can get all sorts of mysterious problems. A good preventive step
is to make the IJG library use "unsigned char" for boolean. To do that,
add something like this to your jconfig.h file:

```
/* Define "boolean" as unsigned char, not enum, per Windows custom */  
#ifndef __RPCNDR_H__ /* don't conflict if rpcndr.h already read */
```



```

typedef unsigned char boolean;
#endif
#ifndef FALSE /* in case these macros already exist */
#define FALSE 0 /* values of boolean */
#endif
#ifndef TRUE
#define TRUE 1
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
(This is already in jconfig.vc, by the way.)

```

windef.h contains the declarations

```

#define far
#define FAR far

```

Since jmorecfg.h tries to define FAR as empty, you may get a compiler warning if you include both jpeglib.h and windef.h (which windows.h includes). To suppress the warning, you can put "#ifndef FAR"/"#endif" around the line "#define FAR" in jmorecfg.h.

(Something like this is already in jmorecfg.h, by the way.)

When using the library in a Windows application, you will almost certainly want to modify or replace the error handler module jerror.c, since our default error handler does a couple of inappropriate things:

1. it tries to write error and warning messages on stderr;
2. in event of a fatal error, it exits by calling exit().

A simple stopgap solution for problem 1 is to replace the line

```
fprintf(stderr, "%s\n", buffer);
```

(in output_message in jerror.c) with

```
MessageBox(GetActiveWindow(),buffer,"JPEG Error",MB_OK|MB_ICONERROR);
```

It's highly recommended that you at least do that much, since otherwise error messages will disappear into nowhere. (Beginning with IJG v6b, this code is already present in jerror.c; just define USE_WINDOWS_MESSAGEBOX in jconfig.h to enable it.)

The proper solution for problem 2 is to return control to your calling application after a library error. This can be done with the setjmp/longjmp technique discussed in libjpeg.txt and illustrated in example.c. (NOTE: some older Windows C compilers provide versions of setjmp/longjmp that don't actually work under Windows. You may need to use the Windows system functions Catch and Throw instead.)

The recommended memory manager under Windows is jmemnobs.c; in other words, let Windows do any virtual memory management needed. You should NOT use jmemdos.c nor jmemdosa.asm under Windows.

For Windows 3.1, we recommend compiling in medium or large memory model; for newer Windows versions, use a 32-bit flat memory model. (See the MS-DOS

sections above for more info about memory models.) In the 16-bit memory models only, you'll need to put

```
#define MAX_ALLOC_CHUNK 65520L /* Maximum request to malloc() */
```

into `jconfig.h` to limit allocation chunks to 64Kb. (Without that, you'd have to use huge memory model, which slows things down unnecessarily.) `jmemnobs.c` works without modification in large or flat memory models, but to use medium model, you need to modify its `jpeg_get_large` and `jpeg_free_large` routines to allocate far memory. In any case, you might like to replace its calls to `malloc` and `free` with direct calls on Windows memory allocation functions.

You may also want to modify `jdatasrc.c` and `jdatadst.c` to use Windows file operations rather than `fread/fwrite`. This is only necessary if your C compiler doesn't provide a competent implementation of C `stdio` functions.

You might want to tweak the `RGB_xxx` macros in `jmorecfg.h` so that the library will accept or deliver color pixels in BGR sample order, not RGB; BGR order is usually more convenient under Windows. Note that this change will break the sample applications `cjpeg/djpeg`, but the library itself works fine.

Many people want to convert the IJG library into a DLL. This is reasonably straightforward, but watch out for the following:

1. Don't try to compile as a DLL in small or medium memory model; use large model, or even better, 32-bit flat model. Many places in the IJG code assume the address of a local variable is an ordinary (not FAR) pointer; that isn't true in a medium-model DLL.
2. Microsoft C cannot pass file pointers between applications and DLLs. (See Microsoft Knowledge Base, PSS ID Number Q50336.) So `jdatasrc.c` and `jdatadst.c` don't work if you open a file in your application and then pass the pointer to the DLL. One workaround is to make `jdatasrc.c/jdatadst.c` part of your main application rather than part of the DLL.
3. You'll probably need to modify the macros `GLOBAL()` and `EXTERN()` to attach suitable linkage keywords to the exported routine names. Similarly, you'll want to modify `METHODDEF()` and `JMETHOD()` to ensure function pointers are declared in a way that lets application routines be called back through the function pointers. These macros are in `jmorecfg.h`. Typical definitions for a 16-bit DLL are:

```
#define GLOBAL(type) type _far _pascal _loadds _export
#define EXTERN(type) extern type _far _pascal _loadds
#define METHODDEF(type) static type _far _pascal
#define JMETHOD(type,methodname,arglist) \
    type (_far _pascal *methodname) arglist
```

For a 32-bit DLL you may want something like

```
#define GLOBAL(type) __declspec(dllexport) type
```



```
#define EXTERN(type) extern __declspec(dllexport) type
```

Although not all the GLOBAL routines are actually intended to be called by the application, the performance cost of making them all DLL entry points is negligible.

The unmodified IJG library presents a very C-specific application interface, so the resulting DLL is only usable from C or C++ applications. There has been some talk of writing wrapper code that would present a simpler interface usable from other languages, such as Visual Basic. This is on our to-do list but hasn't been very high priority --- any volunteers out there?

Microsoft Windows, Borland C:

The provided jconfig.bcc should work OK in a 32-bit Windows environment, but you'll need to tweak it in a 16-bit environment (you'd need to define NEED_FAR_POINTERS and MAX_ALLOC_CHUNK). Beware that makefile.bcc will need alteration if you want to use it for Windows --- in particular, you should use jmemnobs.c not jmemdos.c under Windows.

Borland C++ 4.5 fails with an internal compiler error when trying to compile jdmerge.c in 32-bit mode. If enough people complain, perhaps Borland will fix it. In the meantime, the simplest known workaround is to add a redundant definition of the variable range_limit in h2v1_merged_upsample(), at the head of the block that handles odd image width (about line 268 in v6 jdmerge.c):

```
/* If image width is odd, do the last output column separately */
if (cinfo->output_width & 1) {
    register JSAMPLE * range_limit = cinfo->sample_range_limit; /* ADD THIS */
    cb = GETJSAMPLE(*inptr1);
```

Pretty bizarre, especially since the very similar routine h2v2_merged_upsample doesn't trigger the bug.

Recent reports suggest that this bug does not occur with "bcc32a" (the Pentium-optimized version of the compiler).

Another report from a user of Borland C 4.5 was that incorrect code (leading to a color shift in processed images) was produced if any of the following optimization switch combinations were used:

```
-Ot -Og
-Ot -Op
-Ot -Om
```

So try backing off on optimization if you see such a problem. (Are there several different releases all numbered "4.5"??)

Microsoft Windows, Microsoft Visual C++:

jconfig.vc should work OK with any Microsoft compiler for a 32-bit memory model. makefile.vc is intended for command-line use. (If you are using

the Developer Studio environment, you may prefer the DevStudio project files; see below.)

IJG JPEG 7 adds extern "C" to jpeglib.h. This avoids the need to put extern "C" { ... } around #include "jpeglib.h" in your C++ application. You can also force VC++ to treat the library as C++ code by renaming all the *.c files to *.cpp (and adjusting the makefile to match). In this case you also need to define the symbol DONT_USE_EXTERN_C in the configuration to prevent jpeglib.h from using extern "C".

Microsoft Windows, Microsoft Visual C++ 6 Developer Studio:

We include makefiles that should work as project files in Developer Studio 6.0 or later. There is a library makefile that builds the IJG library as a static Win32 library, and application makefiles that build the sample applications as Win32 console applications. (Even if you only want the library, we recommend building the applications so that you can run the self-test.)

To use:

1. Open the command prompt, change to the source directory and execute the command line

```
NMAKE /f makefile.vs setup-vc6
```

If you get an error message saying that the "NMAKE" command could not be found, execute the command

```
"%ProgramFiles%\Microsoft Visual Studio\VC98\Bin\VCVARS32"
```

to set the environment for using Microsoft Visual C++ tools, and repeat the NMAKE call.

This will move jconfig.vc to jconfig.h and makefiles to project files.

(Note that the renaming is critical!)

Alternatively you can use

```
NMAKE /f makefile.vs setupcopy-vc6
```

This will create renamed copies of the files, which allows to repeat the setup later.

2. Open the workspace file jpeg.dsw, build the library project.
(If you are using Developer Studio more recent than 6.0, you'll probably get a message saying that the project files are being updated.)
3. Open the workspace file apps.dsw, build the application projects.
4. To perform the self-test, execute the command line

```
NMAKE /f makefile.vs test-build
```
5. Move the application .exe files from the Release folder to an appropriate location on your path.

Microsoft Windows, Visual Studio 2019 (v16):

We include makefiles that should work as project files in Visual Studio

2019 (v16) or later. There is a library makefile that builds the IJG library as a static Win32/x64 library, and application makefiles that build the sample applications as Win32/x64 console applications. (Even if you only want the library, we recommend building the applications so that you can run the self-test.)

To use:

1. Open the Developer Command Prompt for VS 2019, change to the source directory and execute the command line

```
NMAKE /f makefile.vs setup-v16
```

This will move jconfig.vc to jconfig.h and makefiles to project files.

(Note that the renaming is critical!)

Alternatively you can use

```
NMAKE /f makefile.vs setupcopy-v16
```

This will create renamed copies of the files, which allows to repeat the setup later.

2. Open the solution file jpeg.sln, build the library project.

- a) If you are using Visual Studio more recent than 2019 (v16), you'll probably get a message saying that the project files are being updated.

- b) If necessary, open the project properties and adapt the Windows Target Platform Version in the Configuration Properties, General section; we support the latest version at the time of release.

- c) If you want to build x64 code, change the platform setting from Win32 to x64. You can build Win32 and x64 versions side by side.

3. Open the solution file apps.sln, build the application projects.

4. To perform the self-test, execute the command line

```
NMAKE /f makefile.vs test-32
```

for the Win32 build, or on a 64-bit system

```
NMAKE /f makefile.vs test-64
```

for the x64 build.

5. Move the application .exe files from the Release folder to an appropriate location on your path.

OS/2, Borland C++:

Watch out for optimization bugs in older Borland compilers; you may need to back off the optimization switch settings. See the comments in makefile.bcc.

SGI:

On some SGI systems, you may need to set "AR2= ar -ts" in the Makefile.

If you are using configure, you can do this by saying

```
./configure RANLIB='ar -ts'
```


This change is not needed on all SGIs. Use it only if the make fails at the stage of linking the completed programs.

On the MIPS R4000 architecture (Indy, etc.), the compiler option "-mips2" reportedly speeds up the float DCT method substantially, enough to make it faster than the default int method (but still slower than the fast int method). If you use -mips2, you may want to alter the default DCT method to be float. To do this, put "#define JDCT_DEFAULT JDCT_FLOAT" in jconfig.h.

VMS:

On an Alpha/VMS system with MMS, be sure to use the "/Marco=Alpha=1" qualifier with MMS when building the JPEG package.

VAX/VMS v5.5-1 may have problems with the test step of the build procedure reporting differences when it compares the original and test images. If the error points to the last block of the files, it is most likely bogus and may be safely ignored. It seems to be because the files are Stream_LF and Backup/Compare has difficulty with the (presumably) null padded files. This problem was not observed on VAX/VMS v6.1 or AXP/VMS v6.1.

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/install.txt

No license file was found, but licenses were detected in source scan.

/*

* jconfig.txt

*

* Copyright (C) 1991-1994, Thomas G. Lane.

* Modified 2009-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file documents the configuration options that are required to

* customize the JPEG software for a particular system.

*

* The actual configuration options for a particular installation are stored

* in jconfig.h. On many machines, jconfig.h can be generated automatically

* or copied from one of the "canned" jconfig files that we supply. But if

* you need to generate a jconfig.h file by hand, this file tells you how.

*

* DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.

* EDIT A COPY NAMED JCONFIG.H.

*/

/*


```

* These symbols indicate the properties of your machine or compiler.
* #define the symbol if yes, #undef it if no.
*/

/* Does your compiler support function prototypes?
* (If not, you also need to use ansi2knr, see install.txt)
*/
#define HAVE_PROTOTYPES

/* Does your compiler support the declaration "unsigned char" ?
* How about "unsigned short" ?
*/
#define HAVE_UNSIGNED_CHAR
#define HAVE_UNSIGNED_SHORT

/* Define "void" as "char" if your compiler doesn't know about type void.
* NOTE: be sure to define void such that "void *" represents the most general
* pointer type, e.g., that returned by malloc().
*/
/* #define void char */

/* Define "const" as empty if your compiler doesn't know the "const" keyword.
*/
/* #define const */

/* Define this if an ordinary "char" type is unsigned.
* If you're not sure, leaving it undefined will work at some cost in speed.
* If you defined HAVE_UNSIGNED_CHAR then the speed difference is minimal.
*/
#undef CHAR_IS_UNSIGNED

/* Define this if your system has an ANSI-conforming <stddef.h> file.
*/
#define HAVE_STDDEF_H

/* Define this if your system has an ANSI-conforming <stdlib.h> file.
*/
#define HAVE_STDLIB_H

/* Define this if your system does not have an ANSI/SysV <string.h>,
* but does have a BSD-style <strings.h>.
*/
#undef NEED_BSD_STRINGS

/* Define this if your system does not provide typedef size_t in any of the
* ANSI-standard places (stddef.h, stdlib.h, or stdio.h), but places it in
* <sys/types.h> instead.
*/

```



```

#undef NEED_SYS_TYPES_H

/* For 80x86 machines, you need to define NEED_FAR_POINTERS,
 * unless you are using a large-data memory model or 80386 flat-memory mode.
 * On less brain-damaged CPUs this symbol must not be defined.
 * (Defining this symbol causes large data structures to be referenced through
 * "far" pointers and to be allocated with a special version of malloc.)
 */
#undef NEED_FAR_POINTERS

/* Define this if your linker needs global names to be unique in less
 * than the first 15 characters.
 */
#undef NEED_SHORT_EXTERNAL_NAMES

/* Although a real ANSI C compiler can deal perfectly well with pointers to
 * unspecified structures (see "incomplete types" in the spec), a few pre-ANSI
 * and pseudo-ANSI compilers get confused. To keep one of these bozos happy,
 * define INCOMPLETE_TYPES_BROKEN. This is not recommended unless you
 * actually get "missing structure definition" warnings or errors while
 * compiling the JPEG code.
 */
#undef INCOMPLETE_TYPES_BROKEN

/* Define "boolean" as unsigned char, not enum, on Windows systems.
 */
#ifdef _WIN32
#ifndef __RPCNDR_H__ /* don't conflict if rpcndr.h already read */
typedef unsigned char boolean;
#endif
#endif

#ifndef FALSE /* in case these macros already exist */
#define FALSE 0 /* values of boolean */
#endif

#ifndef TRUE
#define TRUE 1
#endif

#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
#endif

/*
 * The following options affect code selection within the JPEG library,
 * but they don't need to be visible to applications using the library.
 * To minimize application namespace pollution, the symbols won't be
 * defined unless JPEG_INTERNALS has been defined.
 */

#ifdef JPEG_INTERNALS

```



```

/* Define this if your compiler implements ">>" on signed values as a logical
* (unsigned) shift; leave it undefined if ">>" is a signed (arithmetic) shift,
* which is the normal and rational definition.
*/
#undef RIGHT_SHIFT_IS_UNSIGNED

#endif /* JPEG_INTERNALS */

/*
* The remaining options do not affect the JPEG library proper,
* but only the sample applications cjpeg/djpeg (see cjpeg.c, djpeg.c).
* Other applications can ignore these.
*/

#ifdef JPEG_CJPEG_DJPEG

/* These defines indicate which image (non-JPEG) file formats are allowed. */

#define BMP_SUPPORTED /* BMP image file format */
#define GIF_SUPPORTED /* GIF image file format */
#define PPM_SUPPORTED /* PBMPLUS PPM/PGM image file format */
#undef RLE_SUPPORTED /* Utah RLE image file format */
#define TARGA_SUPPORTED /* Targa image file format */

/* Define this if you want to name both input and output files on the command
* line, rather than using stdout and optionally stdin. You MUST do this if
* your system can't cope with binary I/O to stdin/stdout. See comments at
* head of cjpeg.c or djpeg.c.
*/
#undef TWO_FILE_COMMANDLINE

/* Define this if your system needs explicit cleanup of temporary files.
* This is crucial under MS-DOS, where the temporary "files" may be areas
* of extended memory; on most other systems it's not as important.
*/
#undef NEED_SIGNAL_CATCHER

/* By default, we open image files with fopen(...,"rb") or fopen(...,"wb").
* This is necessary on systems that distinguish text files from binary files,
* and is harmless on most systems that don't. If you have one of the rare
* systems that complains about the "b" spec, define this symbol.
*/
#undef DONT_USE_B_MODE

/* Define this if you want percent-done progress reports from cjpeg/djpeg.

```


*/

#undef PROGRESS_REPORT

#endif /* JPEG_CJPEG_DJPEG */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jconfig.txt

No license file was found, but licenses were detected in source scan.

/*

* jmaster.c

/*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2002-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

/*

* This file contains master control logic for the JPEG decompressor.

* These routines are concerned with selecting the modules to be executed

* and with determining the number of passes and the work to be done in each

* pass.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jmaster.c

No license file was found, but licenses were detected in source scan.

/*

* jdatadst.c

/*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2009-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

/*

* This file contains compression data destination routines for the case of

* emitting JPEG data to memory or to a file (or any stdio stream).

* While these routines are sufficient for most applications,

* some will want to use a different destination manager.

* IMPORTANT: we assume that fwrite() will correctly transcribe an array of

* JOCTETs into 8-bit-wide elements on external storage. If char is wider

* than 8 bits on your machine, you may need to do some tweaking.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdatadst.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jctrans.c
 *
 * Copyright (C) 1995-1998, Thomas G. Lane.
 * Modified 2000-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains library routines for transcoding compression,
 * that is, writing raw DCT coefficient arrays to an output JPEG file.
 * The routines in jcapimin.c will also be needed by a transcoder.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jctrans.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdmainct.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2002-2016 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the main buffer controller for decompression.
 * The main buffer lies between the JPEG decompressor proper and the
 * post-processor; it holds downsampled data in the JPEG colorspace.
 *
 * Note that this code is bypassed in raw-data mode, since the application
 * supplies the equivalent of the main buffer in that case.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdmainct.c

No license file was found, but licenses were detected in source scan.

; For conditions of distribution and use, see the accompanying README file.

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jmemdosa.asm

No license file was found, but licenses were detected in source scan.

```
/*
 * jpegint.h
 *
```


- * Copyright (C) 1991-1997, Thomas G. Lane.
- * Modified 1997-2019 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file provides common declarations for the various JPEG modules.
- * These declarations are considered internal to the JPEG library; most
- * applications using the library shouldn't need to include this file.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jpegint.h
 No license file was found, but licenses were detected in source scan.

```
/*
 * jmemsys.h
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This include file defines the interface between the system-independent
 * and system-dependent portions of the JPEG memory manager. No other
 * modules need include it. (The system-independent portion is jmemmgr.c;
 * there are several different versions of the system-dependent portion.)
 *
 * This file works as-is for the system-dependent memory managers supplied
 * in the IJG distribution. You may need to modify it if you write a
 * custom memory manager. If system-dependent changes are needed in
 * this file, the best method is to #ifdef them based on a configuration
 * symbol supplied in jconfig.h, as we have done with USE_MSDOS_MEMMGR
 * and USE_MAC_MEMMGR.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jmemsys.h
 No license file was found, but licenses were detected in source scan.

```
/*
 * jcomapi.c
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains application interface routines that are used for both
 * compression and decompression.
```


*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jcomapi.c

No license file was found, but licenses were detected in source scan.

/*

* wrtarga.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2015-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in Targa format.

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*

* Based on code contributed by Lee Daniel Crocker.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/wrtarga.c

No license file was found, but licenses were detected in source scan.

/*

* jdapimin.c

*

* Copyright (C) 1994-1998, Thomas G. Lane.

* Modified 2009-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains application interface code for the decompression half

* of the JPEG library. These are the "minimum" API routines that may be

* needed in either the normal full-decompression case or the

* transcoding-only case.

*

* Most of the routines intended to be called directly by an application

* are in this file or in jdapistd.c. But also see jcomapi.c for routines

* shared by compression and decompression, and jdtrans.c for the transcoding

* case.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdapimin.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jcmaster.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2003-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains master control logic for the JPEG compressor.
 * These routines are concerned with parameter validation, initial setup,
 * and inter-pass control (determining the number of passes and the work
 * to be done in each pass).
 */
```

Found in path(s):

`/opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jcmaster.c`

No license file was found, but licenses were detected in source scan.

```
/*
 * jdcolor.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2011-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains output colorspace conversion routines.
 */
```

Found in path(s):

`/opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdcolor.c`

No license file was found, but licenses were detected in source scan.

```
/*
 * jmorecfg.h
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 1997-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains additional configuration options that customize the
 * JPEG software for special applications or support machine-dependent
 * optimizations. Most users will not need to touch this file.
 */
```


Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jmorecfg.h

No license file was found, but licenses were detected in source scan.

/*

* jpeglib.h

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2002-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file defines the application interface for the JPEG library.

* Most applications using the library need only include this file,

* and perhaps jerror.h if they want to know the exact error codes.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jpeglib.h

No license file was found, but licenses were detected in source scan.

/*

* jutils.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2009-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains tables and miscellaneous utility routines needed

* for both compression and decompression.

* Note we prefix all global names with "j" to minimize conflicts with

* a surrounding application.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jutils.c

No license file was found, but licenses were detected in source scan.

/*

* wrtle.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2017-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in RLE format.

- * The Utah Raster Toolkit library is required (version 3.1 or later).
- *
- * These routines may need modification for non-Unix environments or
- * specialized applications. As they stand, they assume output to
- * an ordinary stdio stream.
- *
- * Based on code contributed by Mike Lijewski,
- * with updates from Robert Hutchinson.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/wrrle.c
 No license file was found, but licenses were detected in source scan.

```
/*
 * rdswitch.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2003-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to process some of cjpeg's more complicated
 * command-line switches. Switches processed here are:
 * -qtables file Read quantization tables from text file
 * -scans file Read scan script from text file
 * -quality N[,N,...] Set quality ratings
 * -qslots N[,N,...] Set component quantization table selectors
 * -sample HxV[,HxV,...] Set component sampling factors
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/rdswitch.c
 No license file was found, but licenses were detected in source scan.

```
/*
 * jfdctflt.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2003-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a floating-point implementation of the
 * forward DCT (Discrete Cosine Transform).
 *
 * This implementation should be more accurate than either of the integer
 * DCT implementations. However, it may not give the same results on all
```


- * machines because of differences in roundoff behavior. Speed will depend
- * on the hardware's floating point capacity.
- *
- * A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
- * on each column. Direct algorithms are also available, but they are
- * much more complex and seem not to be any faster when reduced to code.
- *
- * This implementation is based on Arai, Agui, and Nakajima's algorithm for
- * scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
- * Japanese, but the algorithm is described in the Pennebaker & Mitchell
- * JPEG textbook (see REFERENCES section in file README). The following code
- * is based directly on figure 4-8 in P&M.
- * While an 8-point DCT cannot be done in less than 11 multiplies, it is
- * possible to arrange the computation so that many of the multiplies are
- * simple scalings of the final outputs. These multiplies can then be
- * folded into the multiplications or divisions by the JPEG quantization
- * table entries. The AA&N method leaves only 5 multiplies and 29 adds
- * to be done in the DCT itself.
- * The primary disadvantage of this method is that with a fixed-point
- * implementation, accuracy is lost due to imprecise representation of the
- * scaled quantization values. However, that problem does not arise if
- * we use floating point arithmetic.
- */

Found in path(s):

- * /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jfdctflt.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdapistd.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2002-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains application interface code for the decompression half
 * of the JPEG library. These are the "standard" API routines that are
 * used in the normal full-decompression case. They are not used by a
 * transcoding-only application. Note that if an application links in
 * jpeg_start_decompress, it will end up linking in the entire decompressor.
 * We thus must separate this file from jdapimin.c to avoid linking the
 * whole decompression library into a transcoder.
 */
```

Found in path(s):

- * /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdapistd.c

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

Copyright (C) 1991-2013, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software; that is, the functions of the various modules in the system and the interfaces between modules. For more precise details about any data structure or calling convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard. The README file includes references for learning about JPEG. The file libjpeg.txt describes the library from the viewpoint of an application programmer using the library; it's best to read that file before this one. Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific terminology follows the JPEG standard:

A "component" means a color channel, e.g., Red or Luminance.

A "sample" is a single component value (i.e., one number in the image data).

A "coefficient" is a frequency coefficient (a DCT transform output number).

A "block" is an array of samples or coefficients.

An "MCU" (minimum coded unit) is an interleaved set of blocks of size determined by the sampling factors, or a single block in a noninterleaved scan.

We do not use the terms "pixel" and "sample" interchangeably. When we say pixel, we mean an element of the full-size image, while a sample is an element of the downsampled image. Thus the number of samples may vary across components while the number of pixels does not. (This terminology is not used rigorously throughout the code, but it is used in places where confusion would otherwise result.)

*** System features ***

The IJG distribution contains two parts:

- * A subroutine library for JPEG compression and decompression.
- * cjpeg/djpeg, two sample applications that use the library to transform JFIF JPEG files to and from several other image formats.

cjpeg/djpeg are of no great intellectual complexity: they merely add a simple command-line user interface and I/O routines for several uncompressed image formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended sequential, and progressive DCT processes. The library does not support the

hierarchical or lossless processes defined in the standard.

Within these limits, any set of compression parameters allowed by the JPEG spec should be readable for decompression. (We can be more restrictive about what formats we can generate.) Although the system design allows for all parameter values, some uncommon settings are not yet implemented and may never be; nonintegral sampling ratios are the prime example. Furthermore, we treat 8-bit vs. 12-bit data precision as a compile-time switch, not a run-time option, because most machines can store 8-bit pixels much more compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, libtiff uses this library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

*** Portability issues ***

Portability is an essential requirement for the library. The key portability issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run on PC-class machines with limited memory. Images should therefore be processed sequentially (in strips), to avoid holding the whole image in memory at once. Where a full-image buffer is necessary, we should be able to use either virtual memory or temporary files.
2. Near/far pointer distinction. To run efficiently on 80x86 machines, the code should distinguish "small" objects (kept in near data space) from "large" ones (kept in far data space). This is an annoying restriction, but fortunately it does not impact code quality for less brain-damaged machines,

and the source code clutter turns out to be minimal with sufficient use of pointer typedefs.

3. Data precision. We assume that "char" is at least 8 bits, "short" and "int" at least 16, "long" at least 32. The code will work fine with larger data sizes, although memory may be used inefficiently in some cases. However, the JPEG compressed datastream must ultimately appear on external storage as a sequence of 8-bit bytes if it is to conform to the standard. This may pose a problem on machines where char is wider than 8 bits. The library represents compressed data as an array of values of typedef JOCTET. If no data type exactly 8 bits wide is available, custom data source and data destination modules must be written to unpack and pack the chosen JOCTET datatype into 8-bit external representation.

*** System overview ***

The compressor and decompressor are each divided into two main sections: the JPEG compressor or decompressor proper, and the preprocessing or postprocessing functions. The interface between these two sections is the image data that the official JPEG spec regards as its input or output: this data is in the colorspace to be used for compression, and it is downsampled to the sampling factors to be used. The preprocessing and postprocessing steps are responsible for converting a normal image representation to or from this form. (Those few applications that want to deal with YCbCr downsampled data can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main elements:

Preprocessing:

- * Color space conversion (e.g., RGB to YCbCr).
- * Edge expansion and downsampling. Optionally, this step can do simple smoothing --- this is often helpful for low-quality source data.

JPEG proper:

- * MCU assembly, DCT, quantization.
- * Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation, and support code (memory management & error handling). There is also a module responsible for physically writing the output data --- typically this is just an interface to fwrite(), but some applications may need to do something else with the data.

The decompressor library contains the following main elements:

JPEG proper:

- * Entropy decoding (sequential or progressive, Huffman or arithmetic).

- * Dequantization, inverse DCT, MCU disassembly.

Postprocessing:

- * Upsampling. Optionally, this step may be able to do more general rescaling of the image.
- * Color space conversion (e.g., YCbCr to RGB). This step may also provide gamma adjustment [currently it does not].
- * Optional color quantization (e.g., reduction to 256 colors).
- * Optional color precision reduction (e.g., 24-bit to 15-bit color).

[This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module.

The support code (memory management & error handling) can be shared with the compression half of the library.

There may be several implementations of each of these elements, particularly in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries) as a preprocessing/postprocessing function, even though the JPEG spec includes it in compression/decompression. We do this because downsampling/upsampling can be simplified a little if they work on padded data: it's not necessary to have special cases at the right and bottom edges. Therefore the interface buffer is always an integral number of blocks wide and high, and we expect compression preprocessing to pad the source data properly. Padding will occur only to the next block (block_size-sample) boundary. In an interleaved-scan situation, additional dummy blocks may be used to fill out MCUs, but the MCU assembly and disassembly logic will create or discard these blocks internally. (This is advantageous for speed reasons, since we avoid DCTing the dummy blocks. It also permits a small reduction in file size, because the compressor can choose dummy block contents so as to minimize their size in compressed form. Finally, it makes the interface buffer specification independent of whether the file is actually interleaved or not.) Applications that wish to deal directly with the downsampled data must provide similar buffering and padding for odd-sized images.

*** Poor man's object-oriented programming ***

It should be clear by now that we have a lot of quasi-independent processing steps, many of which have several possible behaviors. To avoid cluttering the code with lots of switch statements, we use a simple form of object-style programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented as two separate modules that present the same external interface; at runtime, the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while staying within portable C. The basic tool is a function pointer. An "object" is just a struct containing one or more function pointer fields, each of which corresponds to a method name in real object-oriented languages. During initialization we fill in the function pointers with references to whichever module we have determined we need to use in this run. Then invocation of the module is done by indirecting through a function pointer; on most machines this is no more expensive than a switch statement, which would be the only other way of making the required run-time choice. The really significant benefit, of course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different implementations of the same kind of object. We do this by making all the module-specific object structs be separately allocated entities, which will be accessed via pointers in the master compression or decompression struct. The "public" fields or methods for a given kind of object are specified by a commonly known struct. But a module's initialization code can allocate a larger struct that contains the common struct as its first member, plus additional private fields. With appropriate pointer casting, the module's internal functions can access these private fields. (For a simple example, see `jdatadst.c`, which implements the external interface specified by struct `jpeg_destination_mgr`, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple versions of any method, each tuned to a particular case. While a lot of precalculation might be done to select an optimal implementation of a method, the cost per invocation is constant. For example, the upsampling step might have a "generic" method, plus one or more "hardwired" methods for the most popular sampling factors; the hardwired methods would be faster because they'd use straight-line code instead of for-loops. The cost to determine which method to use is paid only once, at startup, and the selection criteria are hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures, in that only one instance of each object class will exist during execution. The reason for having the class structure is that on different runs we may create different instances (choose to execute different modules). You can think of the term "method" as denoting the common interface presented by a particular set of interchangeable functions, and "object" as denoting a group of related methods, or the total shared interface behavior of a group of modules.

*** Overall control structure ***

We previously mentioned the need for overall control logic in the compression and decompression libraries. In IJG implementations prior to v5, overall control was mostly provided by "pipeline control" modules, which proved to be large, unwieldy, and hard to understand. To improve the situation, the control logic has been subdivided into multiple modules. The control modules consist of:

1. Master control for module selection and initialization. This has two responsibilities:

1A. Startup initialization at the beginning of image processing.

The individual processing modules to be used in this run are selected and given initialization calls.

1B. Per-pass control. This determines how many passes will be performed and calls each active processing module to configure itself

appropriately at the beginning of each pass. End-of-pass processing, where necessary, is also invoked from the master control module.

Method selection is partially distributed, in that a particular processing module may contain several possible implementations of a particular method, which it will select among when given its initialization call. The master control code need only be concerned with decisions that affect more than one module.

2. Data buffering control. A separate control module exists for each inter-processing-step data buffer. This module is responsible for invoking the processing steps that write or read that data buffer.

Each buffer controller sees the world as follows:

```
input data => processing step A => buffer => processing step B => output data
      |           |           |
      ----- controller -----
```

The controller knows the dataflow requirements of steps A and B: how much data they want to accept in one chunk and how much they output in one chunk. Its function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a higher-level control module; thus the control modules form a binary tree with elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can

be had by replacing implementations of a control module. For example:

- * Merging of adjacent steps in the pipeline is done by replacing a control module and its pair of processing-step modules with a single processing-step module. (Hence the possible merges are determined by the tree of control modules.)
- * In some processing modes, a given interstep buffer need only be a "strip" buffer large enough to accommodate the desired data chunk sizes. In other modes, a full-image buffer is needed and several passes are required. The control module determines which kind of buffer is used and manipulates virtual array buffers as needed. One or both processing steps may be unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers interchangeable and provide just one set of implementations for all. In practice, each one contains considerable special-case processing for its particular job. The buffer controller concept should be regarded as an overall system structuring principle, not as a complete description of the task performed by any one controller.

*** Compression object structure ***

Here is a sketch of the logical structure of the JPEG compression library:

```

                                |-- Colospace conversion
    |-- Preprocessing controller --|
    |                                |-- Downsampling
Main controller --|
    |                                |-- Forward DCT, quantize
    |-- Coefficient controller --|
                                |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during typical image data processing. Each of the components shown in the diagram is an "object" which may have several different implementations available. One or more source code files contain the actual implementation(s) of each object.

The objects shown above are:

- * Main controller: buffer controller for the subsampled-data buffer, which holds the preprocessed input data. This controller invokes preprocessing to fill the subsampled-data buffer, and JPEG compression to empty it. There is usually no need for a full-image buffer here; a strip buffer is adequate.
- * Preprocessing controller: buffer controller for the downsampling input data buffer, which lies between colospace conversion and downsampling. Note that a unified conversion/downsampling module would probably replace this controller entirely.

- * Colorspace conversion: converts application image data into the desired JPEG color space; also changes the data from pixel-interleaved layout to separate component planes. Processes one pixel row at a time.
- * Downsampling: performs reduction of chroma components as required. Optionally may perform pixel-level smoothing as well. Processes a "row group" at a time, where a row group is defined as V_{max} pixel rows of each component before downsampling, and V_k sample rows afterwards (remember V_k differs across components). Some downsampling or smoothing algorithms may require context rows above and below the current row group; the preprocessing controller is responsible for supplying these rows via proper buffering. The downsampler is responsible for edge expansion at the right edge (i.e., extending each sample row to a multiple of `block_size` samples); but the preprocessing controller is responsible for vertical edge expansion (i.e., duplicating the bottom sample row as needed to make a multiple of `block_size` rows).
- * Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU assembly, including insertion of dummy DCT blocks when needed at the right or bottom edge. When performing Huffman-code optimization or emitting a multiscan JPEG file, this controller is responsible for buffering the full image. The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the JPEG file is noninterleaved.
- * Forward DCT and quantization: Perform DCT, quantize, and emit coefficients. Works on one or more DCT blocks at a time. (Note: the coefficients are now emitted in normal array order, which the entropy encoder is expected to convert to zigzag order as necessary. Prior versions of the IJG code did the conversion to zigzag order within the quantization step.)
- * Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the coded data to the data destination module. Works on one MCU per call. For progressive JPEG, the same DCT blocks are fed to the entropy coder during each pass, and the coder must emit the appropriate subset of coefficients.

In addition to the above objects, the compression library includes these objects:

- * Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules.
- * Marker writing: generates JPEG markers (except for `RSTn`, which is emitted by the entropy encoder when needed).
- * Data destination manager: writes the output JPEG datastream to its final

destination (e.g., a file). The destination manager supplied with the library knows how to write to a stdio stream or to a memory buffer; for other behaviors, the surrounding application may provide its own destination manager.

- * Memory manager: allocates and releases memory, controls virtual arrays (with backing store management, where required).
- * Error handler: performs formatting and output of error and trace messages; determines handling of nonfatal errors. The surrounding application may override some or all of this object's methods to change error handling.
- * Progress monitor: supports output of "percent-done" progress reports. This object represents an optional callback to the surrounding application: if wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are defined as separate objects in order to simplify application-specific customization of the JPEG library. A surrounding application may override individual methods or supply its own all-new implementation of one of these objects. The object interfaces for these objects are therefore treated as part of the application interface of the library, whereas the other objects are internal to the library.

The error handler and memory manager are shared by JPEG compression and decompression; the progress monitor, if used, may be shared as well.

*** Decompression object structure ***

Here is a sketch of the logical structure of the JPEG decompression library:

```

                                |-- Entropy decoding
|-- Coefficient controller --|
|                               |-- Dequantize, Inverse DCT
Main controller --|
|                               |-- Upsampling
|-- Postprocessing controller --| |-- Colorspace conversion
                                |-- Color quantization
                                |-- Color precision reduction
```

As before, this diagram also represents typical control flow. The objects shown are:

- * Main controller: buffer controller for the subsampled-data buffer, which holds the output of JPEG decompression proper. This controller's primary task is to feed the postprocessing procedure. Some upsampling algorithms may require context rows above and below the current row group; when this

is true, the main controller is responsible for managing its buffer so as to make context rows available. In the current design, the main buffer is always a strip buffer; a full-image buffer is never required.

* Coefficient controller: buffer controller for the DCT-coefficient data.

This controller handles MCU disassembly, including deletion of any dummy DCT blocks at the right or bottom edge. When reading a multiscan JPEG file, this controller is responsible for buffering the full image.

(Buffering DCT coefficients, rather than samples, is necessary to support progressive JPEG.) The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the source JPEG file is noninterleaved.

* Entropy decoding: Read coded data from the data source module and perform Huffman or arithmetic entropy decoding. Works on one MCU per call.

For progressive JPEG decoding, the coefficient controller supplies the prior coefficients of each MCU (initially all zeroes), which the entropy decoder modifies in each scan.

* Dequantization and inverse DCT: like it says. Note that the coefficients buffered by the coefficient controller have NOT been dequantized; we merge dequantization and inverse DCT into a single step for speed reasons. When scaled-down output is asked for, simplified DCT algorithms may be used that need fewer coefficients and emit fewer samples per DCT block, not the full 8x8. Works on one DCT block at a time.

* Postprocessing controller: buffer controller for the color quantization input buffer, when quantization is in use. (Without quantization, this controller just calls the upsampler.) For two-pass quantization, this controller is responsible for buffering the full-image data.

* Upsampling: restores chroma components to full size. (May support more general output rescaling, too. Note that if undersized DCT outputs have been emitted by the DCT module, this module must adjust so that properly sized outputs are created.) Works on one row group at a time. This module also calls the color conversion module, so its top level is effectively a buffer controller for the upsampling->color conversion buffer. However, in all but the highest-quality operating modes, upsampling and color conversion are likely to be merged into a single step.

* Colorspace conversion: convert from JPEG color space to output color space, and change data layout from separate component planes to pixel-interleaved. Works on one pixel row at a time.

* Color quantization: reduce the data to colormapped form, using either an externally specified colormap or an internally generated one. This module is not used for full-color output. Works on one pixel row at a time; may require two passes to generate a color map. Note that the output will

always be a single component representing colormap indexes. In the current design, the output values are JSAMPLEs, so an 8-bit compilation cannot quantize to more than 256 colors. This is unlikely to be a problem in practice.

* Color reduction: this module handles color precision reduction, e.g., generating 15-bit color (5 bits/primary) from JPEG's 24-bit output. Not quite clear yet how this should be handled... should we merge it with colorspace conversion???

Note that some high-speed operating modes might condense the entire postprocessing sequence to a single module (upsample, color convert, and quantize in one step).

In addition to the above objects, the decompression library includes these objects:

* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules. This is subdivided into input and output control: `jdinput.c` controls only input-side processing, while `jdmaster.c` handles overall initialization and output-side control.

* Marker reading: decodes JPEG markers (except for RSTn).

* Data source manager: supplies the input JPEG datastream. The source manager supplied with the library knows how to read from a stdio stream or from a memory buffer; for other behaviors, the surrounding application may provide its own source manager.

* Memory manager: same as for compression library.

* Error handler: same as for compression library.

* Progress monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress monitor are candidates for replacement by a surrounding application.

*** Decompression input and output separation ***

To support efficient incremental display of progressive JPEG files, the decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the coefficient controller's DCT coefficient buffer. Note that this processing is relatively cheap and fast.

2. Data output reads from the DCT coefficient buffer and performs the IDCT and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get arbitrarily far ahead of the data output processing. (This occurs only if the application calls `jpeg_consume_input()`; otherwise input and output run in lockstep, since the input section is called only when the output section needs more data.) In this way the application can avoid making extra display passes when data is arriving faster than the display pass can run. Furthermore, it is possible to abort an output pass without losing anything, since the coefficient buffer is read-only as far as the output section is concerned. See `libjpeg.txt` for more detail.

A full-image coefficient array is only created if the JPEG file has multiple scans (or if the application specifies buffered-image mode anyway). When reading a single-scan file, the coefficient controller normally creates only a one-MCU buffer, so input and output processing must run in lockstep in this case. `jpeg_consume_input()` is effectively a no-op in this situation.

The main impact of dividing the decompressor in this fashion is that we must be very careful with shared variables in the `cinfo` data structure. Each variable that can change during the course of decompression must be classified as belonging to data input or data output, and each section must look only at its own variables. For example, the data output section may not depend on any of the variables that describe the current scan in the JPEG file, because these may change as the data input section advances into a new scan.

The progress monitor is (somewhat arbitrarily) defined to treat input of the file as one pass when buffered-image mode is not used, and to ignore data input work completely when buffered-image mode is used. Note that the library has no reliable way to predict the number of passes when dealing with a progressive JPEG file, nor can it predict the number of output passes in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because there isn't any real need for it.

*** Data formats ***

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE; a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW; ptr to a row of samples
typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```


The basic element type JSAMPLE will typically be one of unsigned char, (signed) char, or short. Short will be used if samples wider than 8 bits are to be supported (this is a compile-time option). Otherwise, unsigned char is used if possible. If the compiler only supports signed chars, then it is necessary to mask off the value when reading. Thus, all reads of JSAMPLE values must be coded as "GETJSAMPLE(value)", where the macro will be defined as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be ≥ 0 . This helps simplify correct rounding during downsampling, etc. The JPEG standard's specification that sample values run from -128..127 is accommodated by subtracting 128 from the sample value in the DCT step. Similarly, during decompression the output of the IDCT step will be immediately shifted back to 0..255. (NB: different values are required when 12-bit samples are in use. The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be defined as 255 and 128 respectively in an 8-bit implementation, and as 4095 and 2048 in a 12-bit implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This choice costs only a small amount of memory and has several benefits:

- * Code using the data structure doesn't need to know the allocated width of the rows. This simplifies edge expansion/compression, since we can work in an array that's wider than the logical picture width.
- * Indexing doesn't require multiplication; this is a performance win on many machines.
- * Arrays with more than 64K total elements can be supported even on machines where malloc() cannot allocate chunks larger than 64K.
- * The rows forming a component array may be allocated at different times without extra copying. This trick allows some speedups in smoothing steps that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the traditional layout in which the components of a pixel are stored together. This simplifies coding of modules that work on each component independently, because they don't need to know how many components there are. Furthermore, we can read or write each component to a temporary file independently, which is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as

```
GETJSAMPLE(image[colorcomponent][row][col])
```

where col is measured from the image left edge, but row is measured from the first sample row currently in memory. Either of the first two indexings can be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which the components of a pixel are stored together, the data passed to or from the surrounding application uses the traditional convention: a single pixel is

represented by N consecutive JSAMPLE values, and an image row is an array of (# of color components)*(image width) JSAMPLEs. One or more rows of data can be represented by a pointer of type JSAMPARRAY in this scheme. This scheme is converted to component-wise storage inside the JPEG library. (Applications that want to skip JPEG preprocessing or postprocessing will have to contend with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

```
typedef short JCOEF; a 16-bit signed integer
typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
typedef JBLOCK *JBLOCKROW; ptr to one horizontal row of 8x8 blocks
typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays
```

The underlying type is at least a 16-bit signed integer; while "short" is big enough on all machines of interest, on some machines it is preferable to use "int" for speed reasons, despite the storage cost. Coefficients are grouped into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than "8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged order, and may be true values or divided by the quantization coefficients, depending on where the block is in the processing pipeline. In the current library, coefficient blocks are kept in natural order everywhere; the entropy codecs zigzag or dezigzag the data as it is written or read. The blocks contain quantized coefficients everywhere outside the DCT/IDCT subsystems. (This latter decision may need to be revisited to support variable quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 coefficient blocks, corresponding to block_size rows of samples. Otherwise the structure is much the same as for samples, and for the same reasons.

On machines where malloc() can't handle a request bigger than 64Kb, this data structure limits us to rows of less than 512 JBLOCKS, or a picture width of 4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW) must be declared as "far" pointers, but the upper levels can be "near" (implying that the pointer lists are allocated in the DS segment). We use a #define symbol FAR, which expands to the "far" keyword when compiling on 80x86 machines and to nothing elsewhere.

*** Suspendable processing ***

In some applications it is desirable to use the JPEG library as an incremental, memory-to-memory filter. In this situation the data source or destination may be a limited-size buffer, and we can't rely on being able to empty or refill the buffer at arbitrary times. Instead the application would like to have control return from the library at buffer overflow/underrun, and then resume compression or decompression at a later time.

This scenario is supported for simple cases. (For anything more complex, we recommend that the application "bite the bullet" and develop real multitasking capability.) The `libjpeg.txt` file goes into more detail about the usage and limitations of this capability; here we address the implications for library structure.

The essence of the problem is that the entropy codec (coder or decoder) must be prepared to stop at arbitrary times. In turn, the controllers that call the entropy codec must be able to stop before having produced or consumed all the data that they normally would handle in one call. That part is reasonably straightforward: we make the controller call interfaces include "progress counters" which indicate the number of data chunks successfully processed, and we require callers to test the counter rather than just assume all of the data was processed.

Rather than trying to restart at an arbitrary point, the current Huffman codecs are designed to restart at the beginning of the current MCU after a suspension due to buffer overflow/underrun. At the start of each call, the codec's internal state is loaded from permanent storage (in the JPEG object structures) into local variables. On successful completion of the MCU, the permanent state is updated. (This copying is not very expensive, and may even lead to **improved** performance if the local variables can be registerized.) If a suspension occurs, the codec simply returns without updating the state, thus effectively reverting to the start of the MCU. Note that this implies leaving some data unprocessed in the source/destination buffer (ie, the compressed partial MCU). The data source/destination module interfaces are specified so as to make this possible. This also implies that the data buffer must be large enough to hold a worst-case compressed MCU; a couple thousand bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman decoder has to be able to undo assignments of newly nonzero coefficients if it suspends before the MCU is complete, since decoding requires distinguishing previously-zero and previously-nonzero coefficients. This is a bit tedious but probably won't have much effect on performance. Other variants of Huffman decoding need not worry about this, since they will just store the same values again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its modifiable state is quite large and couldn't be copied cheaply. Instead it

would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary point. It does so by backing up to the start of the marker parameter segment, so the data buffer must be big enough to hold the largest marker of interest. Again, a couple KB should be adequate. (A special "skip" convention is used to bypass COM and APPn markers, so these can be larger than the buffer size without causing problems; otherwise a 64K buffer would be needed in the worst case.)

The JPEG marker writer currently does **not** cope with suspension. We feel that this is not necessary; it is much easier simply to require the application to ensure there is enough buffer space before starting. (An empty 2K buffer is more than sufficient for the header markers; and ensuring there are a dozen or two bytes available before calling `jpeg_finish_compress()` will suffice for the trailer.) This would not work for writing multi-scan JPEG files, but we simply do not intend to support that capability with suspension.

*** Memory manager services ***

The JPEG library's memory manager controls allocation and deallocation of memory, and it manages large "virtual" data arrays on machines where the operating system does not provide virtual memory. Note that the same memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or decompression master record, and they will be released when that master record is destroyed.

The memory manager does not provide explicit deallocation of objects. Instead, objects are created in "pools" of free storage, and a whole pool can be freed at once. This approach helps prevent storage-leak bugs, and it speeds up operations whenever `malloc/free` are slow (as they often are). The pools can be regarded as lifetime identifiers for objects. Two pools/lifetimes are defined:

- * `JPOOL_PERMANENT` lasts until master record is destroyed
- * `JPOOL_IMAGE` lasts until done with image (JPEG datastream)

Permanent lifetime is used for parameters and tables that should be carried across from one datastream to another; this includes all application-visible parameters. Image lifetime is used for everything else. (A third lifetime, `JPOOL_PASS` = one processing pass, was originally planned. However it was dropped as not being worthwhile. The actual usage patterns are such that the peak memory usage would be about the same anyway; and having per-pass storage substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:

1. "Small" objects. Typically these require no more than 10K-20K total.
2. "Large" objects. These may require tens to hundreds of K depending on image size. Semantically they behave the same as small objects, but we distinguish them for two reasons:
 - * On MS-DOS machines, large objects are referenced by FAR pointers, small objects by NEAR pointers.
 - * Pool allocation heuristics may differ for large and small objects.Note that individual "large" objects cannot exceed the size allowed by type `size_t`, which may be 64K or less on some machines.
3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKs (typically large enough for the entire image being processed). The memory manager provides stripwise access to these arrays. On machines without virtual memory, the rest of the array may be swapped out to a temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large objects for the data proper and small objects for the row pointers. For convenience and speed, the memory manager provides single routines to create these structures. Similarly, virtual arrays include a small control block and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is not very useful since a virtual array's *raison d'être* is to store data for multiple passes through the image.) We also expect that only "small" objects will be given permanent lifespan, though this restriction is not required by the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by making the in-memory buffers for virtual arrays be as large as possible. (For small images, the buffers might fit entirely in memory, so blind swapping would be very wasteful.) The memory manager will adjust the height of the buffers to fit within a prespecified maximum memory usage. In order to do this in a reasonably optimal fashion, the manager needs to allocate all of the virtual arrays at once. Therefore, there isn't a one-step allocation routine for virtual arrays; instead, there is a "request" routine that simply allocates the control block, and a "realize" routine (called just once) that determines space allocation and creates all of the actual buffers. The realize routine must allow for space occupied by non-virtual large objects. (We don't bother to factor in the space needed for small objects, on the grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business with the memory manager:

1. Modules must request virtual arrays (which may have only image lifespan) during the initial setup phase, i.e., in their `jinit_XXX` routines.
2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be allocated during initial setup.

3. `realize_virt_arrays` will be called at the completion of initial setup.

The above conventions ensure that sufficient information is available for it to choose a good size for virtual array buffers.

Small objects of any lifespan may be allocated at any time. We expect that the total space used for small objects will be small enough to be negligible in the `realize_virt_arrays` computation.

In a virtual-memory machine, we simply pretend that the available space is infinite, thus causing `realize_virt_arrays` to decide that it can allocate all the virtual arrays as full-size in-memory buffers. The overhead of the virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set, never-yet-written sections of the array are set to zero before being made available to the caller. If this flag is not set, never-written sections of the array contain garbage. (This feature exists primarily because the equivalent logic would otherwise be needed in `jdcoefct.c` for progressive JPEG mode; we may as well make it available for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom order; read passes, as well as any write passes after the first one, may access the array in any order. This restriction exists partly to simplify the virtual array control logic, and partly because some file systems may not support seeking beyond the current end-of-file in a temporary file. The main implication of this restriction is that rearrangement of rows (such as converting top-to-bottom data order to bottom-to-top) must be handled while reading data out of the virtual array, not while putting it in.

*** Memory manager internal structure ***

To isolate system dependencies as much as possible, we have broken the memory manager into two parts. There is a reasonably system-independent "front end" (`jmemmgr.c`) and a "back end" that contains only the code likely to change across systems. All of the memory management methods outlined above are implemented by the front end. The back end provides the following routines for use by the front end (none of these routines are known to the rest of the JPEG code):

`jpeg_mem_init`, `jpeg_mem_term` system-dependent initialization/shutdown

`jpeg_get_small`, `jpeg_free_small` interface to malloc and free library routines (or their equivalents)

`jpeg_get_large`, `jpeg_free_large` interface to FAR malloc/free in MSDOS machines; else usually the same as
`jpeg_get_small`/`jpeg_free_small`

jpeg_mem_available estimate available memory

jpeg_open_backing_store create a backing-store object

read_backing_store, manipulate a backing-store object

write_backing_store,

close_backing_store

On some systems there will be more than one type of backing-store object (specifically, in MS-DOS a backing store file might be an area of extended memory as well as a disk file). jpeg_open_backing_store is responsible for choosing how to implement a given object. The read/write/close routines are method pointers in the structure that describes a given object; this lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly released upon abnormal program termination. For example, MS-DOS won't free extended memory by itself. To support this, we will expect the main program or surrounding application to arrange to call self_destruct (typically via jpeg_destroy) upon abnormal termination. This may require a SIGINT signal handler or equivalent. We don't want to have the back end module install its own signal handler, because that would pre-empt the surrounding application's ability to control signal handling.

The IJG distribution includes several memory manager back end implementations. Usually the same back end should be suitable for all applications on a given system, but it is possible for an application to supply its own back end at need.

*** Implications of DNL marker ***

Some JPEG files may use a DNL marker to postpone definition of the image height (this would be useful for a fax-like scanner's output, for instance). In these files the SOF marker claims the image height is 0, and you only find out the true image height at the end of the first scan.

We could read these files as follows:

1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image descriptor.

This implies that control modules must avoid making copies of the image height, and must re-test for termination after each MCU row. This would be easy enough to do.

In cases where image-size data structures are allocated, this approach will result in very inefficient use of virtual memory or much-larger-than-necessary temporary files. This seems acceptable for something that probably won't be a

mainstream usage. People might have to forgo use of memory-hogging options (such as two-pass color quantization or noninterleaved JPEG files) if they want efficient conversion of such files. (One could improve efficiency by demanding a user-supplied upper bound for the height, less than 65536; in most cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height, with a DNL to give the true, smaller height at the end of the first scan. This would solve the space problems if the overestimate wasn't too great. However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:

1. Testing for a DNL marker must occur in the inner loop of the decompressor's Huffman decoder; this implies a speed penalty whether the feature is used or not.
2. There is no way to hide the last-minute change in image height from an application using the decoder. Thus *every* application using the IJG library would suffer a complexity penalty whether it cared about DNL or not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using files be preprocessed by a separate program that reads ahead to the DNL, then goes back and fixes the SOF marker. This is a much simpler solution and is probably far more efficient. Even if one wants piped input, buffering the first scan of the JPEG file needs a lot smaller temp file than is implied by the maximum-height method. For this approach we'd simply treat DNL as a no-op in the decompressor (at most, check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL. Something similar to the first scheme above could be applied if anyone ever wants to make that work.

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/structure.txt

No license file was found, but licenses were detected in source scan.

/*

* jaricom.c

*

* Developed 1997-2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains probability estimation tables for common use in

* arithmetic entropy encoding and decoding routines.

*

* This data represents Table D.3 in the JPEG spec (D.2 in the draft),

* ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81, and Table 24
* in the JBIG spec, ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82.
*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jaricom.c

No license file was found, but licenses were detected in source scan.

/*

* jcapimin.c

*

* Copyright (C) 1994-1998, Thomas G. Lane.

* Modified 2003-2010 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains application interface code for the compression half
* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-compression case or the transcoding-only
* case.

*

* Most of the routines intended to be called directly by an application
* are in this file or in jcapistd.c. But also see jcparam.c for
* parameter-setup helper routines, jcomapi.c for routines shared by
* compression and decompression, and jctrans.c for the transcoding case.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jcapimin.c

No license file was found, but licenses were detected in source scan.

/*

* jquant2.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains 2-pass color quantization (color mapping) routines.
* These routines provide selection of a custom color map for an image,
* followed by mapping of the image to that color map, with optional
* Floyd-Steinberg dithering.
* It is also possible to use just the second pass to map to an arbitrary
* externally-given color map.

*

* Note: ordered dithering is not supported, since there isn't any fast
* way to compute intercolor distances; it's unclear that ordered dither's

* fundamental assumptions even hold with an irregularly spaced color map.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jquant2.c

No license file was found, but licenses were detected in source scan.

/*

* jidctflt.c

*

* Copyright (C) 1994-1998, Thomas G. Lane.

* Modified 2010-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a floating-point implementation of the

* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine

* must also perform dequantization of the input coefficients.

*

* This implementation should be more accurate than either of the integer

* IDCT implementations. However, it may not give the same results on all

* machines because of differences in roundoff behavior. Speed will depend

* on the hardware's floating point capacity.

*

* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT

* on each row (or vice versa, but it's more convenient to emit a row at

* a time). Direct algorithms are also available, but they are much more

* complex and seem not to be any faster when reduced to code.

*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for

* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code

* is based directly on figure 4-8 in P&M.

* While an 8-point DCT cannot be done in less than 11 multiplies, it is

* possible to arrange the computation so that many of the multiplies are

* simple scalings of the final outputs. These multiplies can then be

* folded into the multiplications or divisions by the JPEG quantization

* table entries. The AA&N method leaves only 5 multiplies and 29 adds

* to be done in the DCT itself.

* The primary disadvantage of this method is that with a fixed-point

* implementation, accuracy is lost due to imprecise representation of the

* scaled quantization values. However, that problem does not arise if

* we use floating point arithmetic.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jidctflt.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdsample.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2002-2015 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains upsampling routines.
 *
 * Upsampling input data is counted in "row groups". A row group
 * is defined to be (v_samp_factor * DCT_v_scaled_size / min_DCT_v_scaled_size)
 * sample rows of each component. Upsampling will normally produce
 * max_v_samp_factor pixel rows from each row group (but this could vary
 * if the upsampler is applying a scale factor of its own).
 *
 * An excellent reference for image resampling is
 * Digital Image Warping, George Wolberg, 1990.
 * Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdsample.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jcsample.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains downsampling routines.
 *
 * Downsampling input data is counted in "row groups". A row group
 * is defined to be max_v_samp_factor pixel rows of each component,
 * from which the downsampler produces v_samp_factor sample rows.
 * A single row group is processed in each call to the downsampler module.
 *
 * The downsampler is responsible for edge-expansion of its output data
 * to fill an integral number of DCT blocks horizontally. The source buffer
 * may be modified if it is helpful for this purpose (the source buffer is
 * allocated wide enough to correspond to the desired output width).
 * The caller (the prep controller) is responsible for vertical padding.
 *
 * The downsampler may request "context rows" by setting need_context_rows
```


- * during startup. In this case, the input arrays will contain at least
- * one row group's worth of pixels above and below the passed-in data;
- * the caller will create dummy rows at image top and bottom by replicating
- * the first or last real pixel row.
- *
- * An excellent reference for image resampling is
- * Digital Image Warping, George Wolberg, 1990.
- * Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
- *
- * The downsampling algorithm used here is a simple average of the source
- * pixels covered by the output pixel. The hi-falutin sampling literature
- * refers to this as a "box filter". In general the characteristics of a box
- * filter are not very good, but for the specific cases we normally use (1:1
- * and 2:1 ratios) the box is equivalent to a "triangle filter" which is not
- * nearly so bad. If you intend to use other sampling ratios, you'd be well
- * advised to improve this code.
- *
- * A simple input-smoothing capability is provided. This is mainly intended
- * for cleaning up color-dithered GIF input files (if you find it inadequate,
- * we suggest using an external filtering program such as pnmconvol). When
- * enabled, each input pixel P is replaced by a weighted sum of itself and its
- * eight neighbors. P's weight is 1-8*SF and each neighbor's weight is SF,
- * where SF = (smoothing_factor / 1024).
- * Currently, smoothing is only supported for 2h2v sampling factors.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jcsample.c

No license file was found, but licenses were detected in source scan.

/*

* jcmarker.c

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2003-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write JPEG datastream markers.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jcmarker.c

No license file was found, but licenses were detected in source scan.

/*

* jdatasrc.c

*

- * Copyright (C) 1994-1996, Thomas G. Lane.
- * Modified 2009-2019 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains decompression data source routines for the case of
- * reading JPEG data from memory or from a file (or any stdio stream).
- * While these routines are sufficient for most applications,
- * some will want to use a different source manager.
- * IMPORTANT: we assume that fread() will correctly transcribe an array of
- * JOCTETs from 8-bit-wide elements on external storage. If char is wider
- * than 8 bits on your machine, you may need to do some tweaking.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdatasrc.c
 No license file was found, but licenses were detected in source scan.

```
/*
 * jdhuft.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2006-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains Huffman entropy decoding routines.
 * Both sequential and progressive modes are supported in this single module.
 *
 * Much of the complexity here has to do with supporting input suspension.
 * If the data source module demands suspension, we want to be able to back
 * up to the start of the current MCU. To do this, we copy state variables
 * into local working storage, and update them back to the permanent
 * storage only upon successful completion of an MCU.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdhuft.c
 No license file was found, but licenses were detected in source scan.

```
/*
 * rdppm.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2009-2019 by Bill Allombert, Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 */
```



```

* This file contains routines to read input images in PPM/PGM format.
* The extended 2-byte-per-sample raw PPM/PGM formats are supported.
* The PBMPLUS library is NOT required to compile this software
* (but it is highly useful as a set of PPM image manipulation programs).
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed PPM format).
*/
/* Portions of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/rdppm.c
No license file was found, but licenses were detected in source scan.

```

```

/*
* jccolor.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2011-2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input colorspace conversion routines.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jccolor.c
No license file was found, but licenses were detected in source scan.

```

```

/*
* jinclude.h
*
* Copyright (C) 1991-1994, Thomas G. Lane.
* Modified 2017 by Guido Vollbeding.

```



```

* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file exists to provide a single place to fix any problems with
* including the wrong system include files. (Common problems are taken
* care of by the standard jconfig symbols, but on really weird systems
* you may have to edit this file.)
*
* NOTE: this file is NOT intended to be included by applications using the
* JPEG library. Most applications need only include jpeglib.h.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jinclude.h

```

No license file was found, but licenses were detected in source scan.

```

/*
* rdgif.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in GIF format.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed GIF format).
*/

/*
* This code is loosely based on giftppm from the PBMPLUS distribution
* of Feb. 1991. That file contains the following copyright notice:
*
* +-----+
* | Copyright 1990, David Koblas.                |
* | Permission to use, copy, modify, and distribute this software |
* | and its documentation for any purpose and without fee is hereby |
* | granted, provided that the above copyright notice appear in all |
* | copies and that both that copyright notice and this permission |
* | notice appear in supporting documentation. This software is    |
* | provided "as is" without express or implied warranty.          |
* +-----+
*/

```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/rdgif.c

No license file was found, but licenses were detected in source scan.

/*

* jdct.h

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2002-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This include file contains common declarations for the forward and

* inverse DCT modules. These declarations are private to the DCT managers

* (jcdctmgr.c, jddctmgr.c) and the individual DCT algorithms.

* The individual DCT algorithms are kept in separate files to ease

* machine-dependent tuning (e.g., assembly coding).

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jdct.h

No license file was found, but licenses were detected in source scan.

/*

* ckconfig.c

*

* Copyright (C) 1991-1994, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/ckconfig.c

No license file was found, but licenses were detected in source scan.

/*

* rdjpgcom.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2009 by Bill Allombert, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a very simple stand-alone application that displays

* the text in COM (comment) markers in a JFIF file.

* This may be useful as an example of the minimum logic needed to parse

* JPEG markers.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/rdjpgcom.c

No license file was found, but licenses were detected in source scan.

/*

* jidctfst.c

*

* Copyright (C) 1994-1998, Thomas G. Lane.

* Modified 2015-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a fast, not so accurate integer implementation of the

* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine

* must also perform dequantization of the input coefficients.

*

* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT

* on each row (or vice versa, but it's more convenient to emit a row at

* a time). Direct algorithms are also available, but they are much more

* complex and seem not to be any faster when reduced to code.

*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for

* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code

* is based directly on figure 4-8 in P&M.

* While an 8-point DCT cannot be done in less than 11 multiplies, it is

* possible to arrange the computation so that many of the multiplies are

* simple scalings of the final outputs. These multiplies can then be

* folded into the multiplications or divisions by the JPEG quantization

* table entries. The AA&N method leaves only 5 multiplies and 29 adds

* to be done in the DCT itself.

* The primary disadvantage of this method is that with fixed-point math,

* accuracy is lost due to imprecise representation of the scaled

* quantization values. The smaller the quantization table entry, the less

* precise the scaled value, so this implementation does worse with high-

* quality-setting files than with low-quality ones.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jidctfst.c

No license file was found, but licenses were detected in source scan.

/*

* jcapistd.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2013 by Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains application interface code for the compression half
- * of the JPEG library. These are the "standard" API routines that are
- * used in the normal full-compression case. They are not used by a
- * transcoding-only application. Note that if an application links in
- * jpeg_start_compress, it will end up linking in the entire compressor.
- * We thus must separate this file from jcapimin.c to avoid linking the
- * whole compression library into a transcoder.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jcapistd.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jfdctint.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modification developed 2003-2018 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a slow-but-accurate integer implementation of the
 * forward DCT (Discrete Cosine Transform).
 *
 * A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
 * on each column. Direct algorithms are also available, but they are
 * much more complex and seem not to be any faster when reduced to code.
 *
 * This implementation is based on an algorithm described in
 * C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
 * Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,
 * Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
 * The primary algorithm described there uses 11 multiplies and 29 adds.
 * We use their alternate method with 12 multiplies and 32 adds.
 * The advantage of this method is that no data path contains more than one
 * multiplication; this allows a very simple and accurate implementation in
 * scaled fixed-point arithmetic, with a minimal number of shifts.
 *
 * We also provide FDCT routines with various input sample block sizes for
 * direct resolution reduction or enlargement and for direct resolving the
 * common 2x1 and 1x2 subsampling cases without additional resampling: NxN
 * (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 output DCT block.
 *
 * For N<8 we fill the remaining block coefficients with zero.
 * For N>8 we apply a partial N-point FDCT on the input samples, computing
```


- * just the lower 8 frequency coefficients and discarding the rest.
- *
- * We must scale the output coefficients of the N-point FDCT appropriately
- * to the standard 8-point FDCT level by 8/N per 1-D pass. This scaling
- * is folded into the constant multipliers (pass 2) and/or final/initial
- * shifting.
- *
- * CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
- * since there would be too many additional constants to pre-calculate.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jfdctint.c
 No license file was found, but licenses were detected in source scan.

```
/*
 * jmemdos.c
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file provides an MS-DOS-compatible implementation of the system-
 * dependent portion of the JPEG memory manager. Temporary data can be
 * stored in extended or expanded memory as well as in regular DOS files.
 *
 * If you use this file, you must be sure that NEED_FAR_POINTERS is defined
 * if you compile in a small-data memory model; it should NOT be defined if
 * you use a large-data memory model. This file is not recommended if you
 * are using a flat-memory-space 386 environment such as DJGCC or Watcom C.
 * Also, this code will NOT work if struct fields are aligned on greater than
 * 2-byte boundaries.
 *
 * Based on code contributed by Ge' Weijers.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jmemdos.c
 No license file was found, but licenses were detected in source scan.

```
/*
 * jidctint.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modification developed 2002-2018 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
```



```

* This file contains a slow-but-accurate integer implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on an algorithm described in
* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
* Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,
* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies and 29 adds.
* We use their alternate method with 12 multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*
* We also provide IDCT routines with various output sample block sizes for
* direct resolution reduction or enlargement and for direct resolving the
* common 2x1 and 1x2 subsampling cases without additional resampling: NxN
* (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 input DCT block.
*
* For N<8 we simply take the corresponding low-frequency coefficients of
* the 8x8 input DCT block and apply an NxN point IDCT on the sub-block
* to yield the downscaled outputs.
* This can be seen as direct low-pass downsampling from the DCT domain
* point of view rather than the usual spatial domain point of view,
* yielding significant computational savings and results at least
* as good as common bilinear (averaging) spatial downsampling.
*
* For N>8 we apply a partial NxN IDCT on the 8 input coefficients as
* lower frequencies and higher frequencies assumed to be zero.
* It turns out that the computational effort is similar to the 8x8 IDCT
* regarding the output size.
* Furthermore, the scaling and descaling is the same for all IDCT sizes.
*
* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
* since there would be too many additional constants to pre-calculate.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jidctint.c

```

No license file was found, but licenses were detected in source scan.

```

/*

```

```

* rdbmp.c

```



```

*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Microsoft "BMP"
* format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).
* Currently, only 8-, 24-, and 32-bit images are supported, not 1-bit or
* 4-bit (feeding such low-depth images into JPEG would be silly anyway).
* Also, we don't support RLE-compressed files.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed BMP format).
*
* This code contributed by James Arthur Boucher.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/rdbmp.c

```

No license file was found, but licenses were detected in source scan.

```

/*
* jmemmgr.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2011-2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the JPEG system-independent memory management
* routines. This code is usable across a wide variety of machines; most
* of the system dependencies have been isolated in a separate file.
* The major functions provided here are:
*   * pool-based allocation and freeing of memory;
*   * policy decisions about how to divide available memory among the
*     virtual arrays;
*   * control logic for swapping virtual arrays between main memory and
*     backing storage.
* The separate system-dependent file provides the actual backing-storage
* access code, and it contains the policy decision about how much total
* main memory to use.
* This file is system-dependent in the sense that some of its functions
* are unnecessary in some systems. For example, if there is enough virtual

```


- * memory so that backing storage will never be used, much of the virtual
- * array control logic could be removed. (Of course, if you have that much
- * memory then you shouldn't care about a little bit of unused code...)
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jmemmgr.c

No license file was found, but licenses were detected in source scan.

```
/*
 * djpeg.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2009-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a command-line user interface for the JPEG decompressor.
 * It should work on any system with Unix- or MS-DOS-style command lines.
 *
 * Two different command line styles are permitted, depending on the
 * compile-time switch TWO_FILE_COMMANDLINE:
 * djpeg [options] inputfile outputfile
 * djpeg [options] [inputfile]
 * In the second style, output is always to standard output, which you'd
 * normally redirect to a file or pipe to some other program. Input is
 * either from a named file or from standard input (typically redirected).
 * The second style is convenient on Unix but is unhelpful on systems that
 * don't support pipes. Also, you MUST use the first style if your system
 * doesn't do binary I/O to stdin/stdout.
 * To simplify script writing, the "-outfile" switch is provided. The syntax
 * djpeg [options] -outfile outputfile inputfile
 * works regardless of which command line style is used.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/djpeg.c

No license file was found, but licenses were detected in source scan.

```
/*
 * cdjpeg.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains common support routines used by the IJG application
 * programs (cjpeg, djpeg, jpegtran).
```


*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/cdjpeg.c

No license file was found, but licenses were detected in source scan.

/*

* jcrepct.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the compression preprocessing controller.

* This controller manages the color conversion, downsampling,

* and edge expansion steps.

*

* Most of the complexity here is associated with buffering input rows

* as required by the downsampler. See the comments at the head of

* jcsample.c for the downsampler's needs.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jcrepct.c

No license file was found, but licenses were detected in source scan.

/*

* rdrle.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in Utah RLE format.

* The Utah Raster Toolkit library is required (version 3.1 or later).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from

* an ordinary stdio stream. They further assume that reading begins

* at the start of the file; start_input may need work if the

* user interface has already read some data (e.g., to determine that

* the file is indeed RLE format).

*

* Based on code contributed by Mike Lijewski,

* with updates from Robert Hutchinson.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/rdrle.c

No license file was found, but licenses were detected in source scan.

/*

* jdarith.c

*

* Developed 1997-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains portable arithmetic entropy decoding routines for JPEG

* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).

*

* Both sequential and progressive modes are supported in this single module.

*

* Suspension is not currently supported in this module.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdarith.c

No license file was found, but licenses were detected in source scan.

/*

* jversion.h

*

* Copyright (C) 1991-2020, Thomas G. Lane, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains software version identification.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jversion.h

No license file was found, but licenses were detected in source scan.

/*

* jcmainct.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2003-2012 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the main buffer controller for compression.

* The main buffer lies between the pre-processor and the JPEG

* compressor proper; it holds downsampled data in the JPEG colorspace.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jcmainct.c

No license file was found, but licenses were detected in source scan.

/*

* jdmerge.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2013-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains code for merged upsampling/color conversion.

*

* This file combines functions from jdsample.c and jdcolor.c;

* read those files first to understand what's going on.

*

* When the chroma components are to be upsampled by simple replication

* (ie, box filtering), we can save some work in color conversion by

* calculating all the output pixels corresponding to a pair of chroma

* samples at one time. In the conversion equations

* $R = Y + K1 * Cr$

* $G = Y + K2 * Cb + K3 * Cr$

* $B = Y + K4 * Cb$

* only the Y term varies among the group of pixels corresponding to a pair

* of chroma samples, so the rest of the terms can be calculated just once.

* At typical sampling ratios, this eliminates half or three-quarters of the

* multiplications needed for color conversion.

*

* This file currently provides implementations for the following cases:

* YCC => RGB color conversion only (YCbCr or BG_YCC).

* Sampling ratios of 2h1v or 2h2v.

* No scaling needed at upsample time.

* Corner-aligned (non-CCIR601) sampling alignment.

* Other special cases could be added, but in most applications these are

* the only common cases. (For uncommon cases we fall back on the more

* general code in jdsample.c and jdcolor.c.)

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdmerge.c

No license file was found, but licenses were detected in source scan.

/*

* rdcolmap.c

*


```

* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file implements djpeg's "-map file" switch. It reads a source image
* and constructs a colormap to be supplied to the JPEG decompressor.
*
* Currently, these file formats are supported for the map file:
*   GIF: the contents of the GIF's global colormap are used.
*   PPM (either text or raw flavor): the entire file is read and
*       each unique pixel value is entered in the map.
* Note that reading a large PPM file will be horrendously slow.
* Typically, a PPM-format map file should contain just one pixel
* of each desired color. Such a file can be extracted from an
* ordinary image PPM file with ppmtomap(1).
*
* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not
* currently implemented.
*/

/* Portions of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/rdcolmap.c

```

No license file was found, but licenses were detected in source scan.

```

/*
* transupp.c
*
* Copyright (C) 1997-2019, Thomas G. Lane, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains image transformation routines and other utility code
* used by the jpegtran sample application. These are NOT part of the core
* JPEG library. But we keep these routines separate from jpegtran.c to
* ease the task of maintaining jpegtran-like programs that have other user
* interfaces.
*/

```


Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/transupp.c

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: FILE LIST

Copyright (C) 1994-2019, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

Here is a road map to the files in the IJG JPEG distribution. The distribution includes the JPEG library proper, plus two application programs ("cjpeg" and "djpeg") which use the library to convert JPEG files to and from some other popular image formats. A third application "jpegtran" uses the library to do lossless conversion between different variants of JPEG. There are also two stand-alone applications, "rdjpgcom" and "wrjpgcom".

THE JPEG LIBRARY

=====

Include files:

jpeglib.h JPEG library's exported data and function declarations.
jconfig.h Configuration declarations. Note: this file is not present in the distribution; it is generated during installation.
jmorecfg.h Additional configuration declarations; need not be changed for a standard installation.
jerror.h Declares JPEG library's error and trace message codes.
jinclude.h Central include file used by all IJG .c files to reference system include files.
jpegint.h JPEG library's internal data structures.
jdct.h Private declarations for forward & reverse DCT subsystems.
jmemsys.h Private declarations for memory management subsystem.
jversion.h Version information.

Applications using the library should include jpeglib.h (which in turn includes jconfig.h and jmorecfg.h). Optionally, jerror.h may be included if the application needs to reference individual JPEG error codes. The other include files are intended for internal use and would not normally be included by an application program. (cjpeg/djpeg/etc do use jinclude.h, since its function is to improve portability of the whole IJG distribution. Most other applications will directly include the system include files they want, and hence won't need jinclude.h.)

C source code files:

These files contain most of the functions intended to be called directly by an application program:

jpegim.c Application program interface: core routines for compression.
jpegstd.c Application program interface: standard compression.
jdatim.c Application program interface: core routines for decompression.
jdatstd.c Application program interface: standard decompression.
jcomapi.c Application program interface routines common to compression and decompression.
jcparm.c Compression parameter setting helper routines.
jctrans.c API and library routines for transcoding compression.
jdtrans.c API and library routines for transcoding decompression.

Compression side of the library:

jcinit.c Initialization: determines which other modules to use.
jcmaster.c Master control: setup and inter-pass sequencing logic.
jcmainct.c Main buffer controller (preprocessor => JPEG compressor).
jcprepct.c Preprocessor buffer controller.
jccoefct.c Buffer controller for DCT coefficient buffer.
jccolor.c Color space conversion.
jcsample.c Downsampling.
jcdctmgr.c DCT manager (DCT implementation selection & control).
jfdctint.c Forward DCT using slow-but-accurate integer method.
jfdctfst.c Forward DCT using faster, less accurate integer method.
jfdctflt.c Forward DCT using floating-point arithmetic.
jchuff.c Huffman entropy coding.
jcarith.c Arithmetic entropy coding.
jcmarker.c JPEG marker writing.
jdatadst.c Data destination managers for memory and stdio output.

Decompression side of the library:

jdmaster.c Master control: determines which other modules to use.
jdinput.c Input controller: controls input processing modules.
jdmainct.c Main buffer controller (JPEG decompressor => postprocessor).
jdcoefct.c Buffer controller for DCT coefficient buffer.
jdpostct.c Postprocessor buffer controller.
jdmarker.c JPEG marker reading.
jdjhuff.c Huffman entropy decoding.
jdarith.c Arithmetic entropy decoding.
jddctmgr.c IDCT manager (IDCT implementation selection & control).
jiddctint.c Inverse DCT using slow-but-accurate integer method.
jiddctfst.c Inverse DCT using faster, less accurate integer method.
jiddctflt.c Inverse DCT using floating-point arithmetic.

jdsample.c Upsampling.
jdcolor.c Color space conversion.
jdmerge.c Merged upsampling/color conversion (faster, lower quality).
jquant1.c One-pass color quantization using a fixed-spacing colormap.
jquant2.c Two-pass color quantization using a custom-generated colormap.
Also handles one-pass quantization to an externally given map.
jdatasrc.c Data source managers for memory and stdio input.

Support files for both compression and decompression:

jaricom.c Tables for common use in arithmetic entropy encoding and decoding routines.
jerror.c Standard error handling routines (application replaceable).
jmemmgr.c System-independent (more or less) memory management code.
jutils.c Miscellaneous utility routines.

jmemmgr.c relies on a system-dependent memory management module. The IJG distribution includes the following implementations of the system-dependent module:

jmemnobs.c "No backing store": assumes adequate virtual memory exists.
jmemansi.c Makes temporary files with ANSI-standard routine tmpfile().
jmemname.c Makes temporary files with program-generated file names.
jmemdos.c Custom implementation for MS-DOS (16-bit environment only):
can use extended and expanded memory as well as temp files.
jmemmac.c Custom implementation for Apple Macintosh.

Exactly one of the system-dependent modules should be configured into an installed JPEG library (see install.txt for hints about which one to use).
On unusual systems you may find it worthwhile to make a special system-dependent memory manager.

Non-C source code files:

jmemdosa.asm 80x86 assembly code support for jmemdos.c; used only in MS-DOS-specific configurations of the JPEG library.

CJPEG/DJPEG/JPEGTRAN

=====

Include files:

cdjpeg.h Declarations shared by cjpeg/djpeg/jpegtran modules.
cderror.h Additional error and trace message codes for cjpeg et al.
transupp.h Declarations for jpegtran support routines in transupp.c.

C source code files:

cjpeg.c Main program for cjpeg.

djpeg.c Main program for djpeg.

jpegtran.c Main program for jpegtran.

cdjpeg.c Utility routines used by all three programs.

rdcolmap.c Code to read a colormap file for djpeg's "-map" switch.

rdswitch.c Code to process some of cjpeg's more complex switches.

Also used by jpegtran.

transupp.c Support code for jpegtran: lossless image manipulations.

Image file reader modules for cjpeg:

rdbmp.c BMP file input.

rdgif.c GIF file input.

rdppm.c PPM/PGM file input.

rdrlc.c Utah RLE file input.

rdtarga.c Targa file input.

Image file writer modules for djpeg:

wrbmp.c BMP file output.

wrgif.c GIF file output.

wrppm.c PPM/PGM file output.

wrrlc.c Utah RLE file output.

wrtarga.c Targa file output.

RDJPGCOM/WRJPGCOM

=====

C source code files:

rdjpgcom.c Stand-alone rdjpgcom application.

wrjpgcom.c Stand-alone wrjpgcom application.

These programs do not depend on the IJG library. They do use
jconfig.h and jinclude.h, only to improve portability.

ADDITIONAL FILES

=====

Documentation (see README for a guide to the documentation files):

README Master documentation file.

*.txt Other documentation files.

*.1 Documentation in Unix man page format.

change.log Version-to-version change highlights.
example.c Sample code for calling JPEG library.

Configuration/installation files and programs (see install.txt for more info):

configure Unix shell script to perform automatic configuration.
configure.ac Source file for use with Autoconf to generate configure.
ltmain.sh Support scripts for configure (from GNU libtool).
config.guess
config.sub
depcomp
missing
ar-lib
compile
install-sh Install shell script for those Unix systems lacking one.
Makefile.in Makefile input for configure.
Makefile.am Source file for use with Automake to generate Makefile.in.
ckconfig.c Program to generate jconfig.h on non-Unix systems.
jconfig.txt Template for making jconfig.h by hand.
mak*. * Sample makefiles for particular systems.
jconfig.* Sample jconfig.h for particular systems.
libjpeg.map Script to generate shared library with versioned symbols.
libjpeg.pc.in libjpeg.pc pkg-config file input for configure.
aclocal.m4 M4 macro definitions for use with Autoconf.

Test files (see install.txt for test procedure):

test*. * Source and comparison files for confidence test.
These are binary image files, NOT text files.

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/filelist.txt
No license file was found, but licenses were detected in source scan.

```
/*
 * jccoefct.c
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 2003-2011 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the coefficient buffer controller for compression.
 * This controller is the top level of the JPEG compressor proper.
 * The coefficient buffer lies between forward-DCT and entropy encoding steps.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jccoefct.c

No license file was found, but licenses were detected in source scan.

/*

* jmemnobs.c

*

* Copyright (C) 1992-1996, Thomas G. Lane.

* Modified 2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file provides a really simple implementation of the system-

* dependent portion of the JPEG memory manager. This implementation

* assumes that no backing-store files are needed: all required space

* can be obtained from malloc().

* This is very portable in the sense that it'll compile on almost anything,

* but you'd better have lots of main memory (or virtual memory) if you want

* to process big images.

* Note that the max_memory_to_use option is respected by this implementation.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jmemnobs.c

No license file was found, but licenses were detected in source scan.

/*

* jdtrans.c

*

* Copyright (C) 1995-1997, Thomas G. Lane.

* Modified 2000-2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains library routines for transcoding decompression,

* that is, reading raw DCT coefficient arrays from an input JPEG file.

* The routines in jdapimin.c will also be needed by a transcoder.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jdtrans.c

No license file was found, but licenses were detected in source scan.

/*

* jdcoefct.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2002-2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains the coefficient buffer controller for decompression.
- * This controller is the top level of the JPEG decompressor proper.
- * The coefficient buffer lies between entropy decoding and inverse-DCT steps.
- *
- * In buffered-image mode, this controller is the interface between
- * input-oriented processing and output-oriented processing.
- * Also, the input side (only) is used when reading a file for transcoding.
- */

Found in path(s):

- * /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jdcoefct.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jcpam.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modified 2003-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains optional default-setting code for the JPEG compressor.
 * Applications do not have to use this file, but those that don't use it
 * must know a lot more about the innards of the JPEG code.
 */
```

Found in path(s):

- * /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jcpam.c

No license file was found, but licenses were detected in source scan.

```
/*
 * wrgif.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2015-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to write output images in GIF format.
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume output to
 * an ordinary stdio stream.
 */
/*
 * This code is loosely based on ppmtogif from the PBMPLUS distribution
 */
```



```

* of Feb. 1991. That file contains the following copyright notice:
* Based on GIFENCOD by David Rowley <mgardi@watdscu.waterloo.edu>.
* Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.
* Copyright (C) 1989 by Jef Poskanzer.
* Permission to use, copy, modify, and distribute this software and its
* documentation for any purpose and without fee is hereby granted, provided
* that the above copyright notice appear in all copies and that both that
* copyright notice and this permission notice appear in supporting
* documentation. This software is provided "as is" without express or
* implied warranty.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/wrgif.c

```

No license file was found, but licenses were detected in source scan.

```

/*
* jdinput.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2002-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input control logic for the JPEG decompressor.
* These routines are concerned with controlling the decompressor's input
* processing (marker reading and coefficient decoding). The actual input
* reading is done in jdmarker.c, jdhuft.c, and jdarith.c.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jdinput.c

```

No license file was found, but licenses were detected in source scan.

```

/*
* rdtarga.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2017-2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Targa format.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the

```


* user interface has already read some data (e.g., to determine that
* the file is indeed Targa format).
*
* Based on code contributed by Lee Daniel Crocker.
*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/rdtarga.c
No license file was found, but licenses were detected in source scan.

/*
* jcdctmgr.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2003-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the forward-DCT management logic.
* This code selects a particular DCT implementation to be used,
* and it performs related housekeeping chores including coefficient
* quantization.
*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jcdctmgr.c
No license file was found, but licenses were detected in source scan.

/*
* jmemansi.c
*
* Copyright (C) 1992-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides a simple generic implementation of the system-
* dependent portion of the JPEG memory manager. This implementation
* assumes that you have the ANSI-standard library routine tmpfile().
* Also, the problem of determining the amount of memory available
* is shoved onto the user.
*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jmemansi.c
No license file was found, but licenses were detected in source scan.

/*
* jerror.c


```

*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2012-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains simple error-reporting and trace-message routines.
* These are suitable for Unix-like systems and others where writing to
* stderr is the right thing to do. Many applications will want to replace
* some or all of these routines.
*
* If you define USE_WINDOWS_MESSAGEBOX in jconfig.h or in the makefile,
* you get a Windows-specific hack to display error messages in a dialog box.
* It ain't much, but it beats dropping error messages into the bit bucket,
* which is what happens to output to stderr under most Windows C compilers.
*
* These routines are used by both the compression and decompression code.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jerror.c
No license file was found, but licenses were detected in source scan.

```

```

/*
* cdjpeg.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains common declarations for the sample applications
* cjpeg and djpeg. It is NOT used by the core JPEG library.
*/

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/cdjpeg.h
No license file was found, but licenses were detected in source scan.

```

```

/*
* jdpostct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the decompression postprocessing controller.
* This controller manages the upsampling, color conversion, and color

```


- * quantization/reduction steps; specifically, it controls the buffering
- * between upsample/color conversion and color quantization/reduction.
- *
- * If no color quantization/reduction is required, then this module has no
- * work to do, and it just hands off to the upsample/color conversion code.
- * An integrated upsample/convert/quantize process would replace this module
- * entirely.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jdpostct.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdmarker.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modified 2009-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to decode JPEG datastream markers.
 * Most of the complexity arises from our desire to support input
 * suspension: if not all of the data for a marker is available,
 * we must exit back to the application.  On resumption, we reprocess
 * the marker.
 */
```

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jdmarker.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jmemmac.c
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * jmemmac.c provides an Apple Macintosh implementation of the system-
 * dependent portion of the JPEG memory manager.
 *
 * If you use jmemmac.c, then you must define USE_MAC_MEMMGR in the
 * JPEG_INTERNALS part of jconfig.h.
 *
 * jmemmac.c uses the Macintosh toolbox routines NewPtr and DisposePtr
 * instead of malloc and free.  It accurately determines the amount of
 * memory available by using CompactMem.  Notice that if left to its
```



```

* own devices, this code can chew up all available space in the
* application's zone, with the exception of the rather small "slop"
* factor computed in jpeg_mem_available(). The application can ensure
* that more space is left over by reducing max_memory_to_use.
*
* Large images are swapped to disk using temporary files and System 7.0+'s
* temporary folder functionality.
*
* Note that jmemmac.c depends on two features of MacOS that were first
* introduced in System 7: FindFolder and the FSSpec-based calls.
* If your application uses jmemmac.c and is run under System 6 or earlier,
* and the jpeg library decides it needs a temporary file, it will abort,
* printing error messages about requiring System 7. (If no temporary files
* are created, it will run fine.)
*
* If you want to use jmemmac.c in an application that might be used with
* System 6 or earlier, then you should remove dependencies on FindFolder
* and the FSSpec calls. You will need to replace FindFolder with some
* other mechanism for finding a place to put temporary files, and you
* should replace the FSSpec calls with their HFS equivalents:
*
*   FSpDelete   -> HDelete
*   FSpGetFInfo -> HGetFInfo
*   FSpCreate   -> HCreate
*   FSpOpenDF   -> HOpen    *** Note: not HOpenDF ***
*   FSMakeFSSpec -> (fill in spec by hand.)
*
* (Use HOpen instead of HOpenDF. HOpen is just a glue-interface to PBHOpen,
* which is on all HFS macs. HOpenDF is a System 7 addition which avoids the
* ages-old problem of names starting with a period.)
*
* Contributed by Sam Bushell (jsam@iagu.on.net) and
* Dan Gildor (gyld@in-touch.com).
*/

```

Found in path(s):

```
* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jmemmac.c
```

No license file was found, but licenses were detected in source scan.

The Independent JPEG Group's JPEG software

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=====
```

README for release 9d of 12-Jan-2020

```
=====
```

This distribution contains the ninth public release of the Independent JPEG Group's free JPEG software. You are welcome to redistribute this software and to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone, Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson, John Korejwa, Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers, and other members of the Independent JPEG Group.

IJG is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP

=====

This file contains the following sections:

OVERVIEW General description of JPEG and the IJG software.
LEGAL ISSUES Copyright, lack of warranty, terms of distribution.
REFERENCES Where to learn more about JPEG.
ARCHIVE LOCATIONS Where to find newer versions of this software.
ACKNOWLEDGMENTS Special thanks.
FILE FORMAT WARS Software *not* to get.
TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.txt How to configure and install the IJG software.
usage.txt Usage instructions for cjpeg, djpeg, jpegtran,
 rdjpgcom, and wrjpgcom.
*.1 Unix-style man pages for programs (same info as usage.txt).
wizard.txt Advanced usage instructions for JPEG wizards only.
change.log Version-to-version change highlights.

Programmer and internal documentation:

libjpeg.txt How to use the JPEG library in your own programs.
example.c Sample code for calling the JPEG library.
structure.txt Overview of the JPEG library's internal structure.
filelist.txt Road map of IJG files.
coderules.txt Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

OVERVIEW

=====

This package contains C software to implement JPEG image encoding, decoding, and transcoding. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and grayscale images.

This software implements JPEG baseline, extended-sequential, and progressive compression processes. Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. We have made no provision for supporting the hierarchical or lossless processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the REFERENCES section for introductory material.) Rather, it is intended to be reliable, portable, industrial-strength code. We do not claim to have achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

LEGAL ISSUES

=====

In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)

2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or fitness for a particular purpose. This software is provided "AS IS", and you, its user, assume the entire risk as to its quality and accuracy.

This software is copyright (C) 1991-2020, Thomas G. Lane, Guido Vollbeding. All Rights Reserved except as specified below.

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- (1) If any part of the source code for this software is distributed, then this README file must be included, with this copyright and no-warranty notice unaltered; and any additions, deletions, or changes to the original files must be clearly indicated in accompanying documentation.
- (2) If only executable code is distributed, then the accompanying documentation must state that "this software is based in part on the work of the Independent JPEG Group".
- (3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name in advertising or publicity relating to this software or products derived from it. This software may be referred to only as "the Independent JPEG Group's software".

We specifically permit and encourage the use of this software as the basis of commercial products, provided that all warranty or liability claims are assumed by the product vendor.

The Unix configuration script "configure" was produced with GNU Autoconf. It is copyright by the Free Software Foundation but is freely distributable. The same holds for its supporting scripts (config.guess, config.sub, ltmain.sh). Another support script, install-sh, is copyright by X Consortium but is also freely distributable.

REFERENCES

=====

We recommend reading one or more of these references before trying to understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44. (Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PDF file containing a revised version of Wallace's article is available at <http://www.iijg.org/files/Wallace.JPEG.pdf>. The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still Image Data Compression Standard" by William B. Pennebaker and Joan L. Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1. Price US\$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2).

Although this is by far the most detailed and comprehensive exposition of JPEG publicly available, we point out that it is still missing an explanation of the most essential properties and algorithms of the underlying DCT technology.

If you think that you know about DCT-based JPEG after reading this book, then you are in delusion. The real fundamentals and corresponding potential of DCT-based JPEG are not publicly known so far, and that is the reason for all the mistaken developments taking place in the image coding domain.

The original JPEG standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of

Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.

IJG JPEG 8 introduced an implementation of the JPEG SmartScale extension which is specified in two documents: A contributed document at ITU and ISO with title "ITU-T JPEG-Plus Proposal for Extending ITU-T T.81 for Advanced Image Coding", April 2006, Geneva, Switzerland. The latest version of this document is Revision 3. And a contributed document ISO/IEC JTC1/SC29/WG1 N 5799 with title "Evolution of JPEG", June/July 2011, Berlin, Germany.

IJG JPEG 9 introduces a reversible color transform for improved lossless compression which is described in a contributed document ISO/IEC JTC1/SC29/WG1 N 6080 with title "JPEG 9 Lossless Coding", June/July 2012, Paris, France.

The JPEG standard does not specify all details of an interchangeable file format. For the omitted details we follow the "JFIF" conventions, version 2. JFIF version 1 has been adopted as Recommendation ITU-T T.871 (05/2011) : Information technology - Digital compression and coding of continuous-tone still images: JPEG File Interchange Format (JFIF). It is available as a free download in PDF file format from <http://www.itu.int/rec/T-REC-T.871>. A PDF file of the older JFIF document is available at <http://www.w3.org/Graphics/JPEG/jfif3.pdf>.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from <http://www.ijg.org/files/>. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS

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The "official" archive site for this software is www.ijg.org. The most recent released version can always be found there in directory "files". This particular version will be archived as <http://www.ijg.org/files/jpegsrc.v9d.tar.gz>, and in Windows-compatible "zip" archive format as <http://www.ijg.org/files/jpegsrc9d.zip>.

The JPEG FAQ (Frequently Asked Questions) article is a source of some general information about JPEG.

It is available on the World Wide Web at <http://www.faqs.org/faqs/jpeg-faq/> and other news.answers archive sites, including the official news.answers archive at rtfm.mit.edu: <ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/>.

If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu
with body
send usenet/news.answers/jpeg-faq/part1
send usenet/news.answers/jpeg-faq/part2

ACKNOWLEDGMENTS

=====

Thank to Juergen Bruder for providing me with a copy of the common DCT algorithm article, only to find out that I had come to the same result in a more direct and comprehensible way with a more generative approach.

Thank to Istvan Sebestyen and Joan L. Mitchell for inviting me to the ITU JPEG (Study Group 16) meeting in Geneva, Switzerland.

Thank to Thomas Wiegand and Gary Sullivan for inviting me to the Joint Video Team (MPEG & ITU) meeting in Geneva, Switzerland.

Thank to Thomas Richter and Daniel Lee for inviting me to the ISO/IEC JTC1/SC29/WG1 (previously known as JPEG, together with ITU-T SG16) meeting in Berlin, Germany.

Thank to John Korejwa and Massimo Ballerini for inviting me to fruitful consultations in Boston, MA and Milan, Italy.

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FILE FORMAT WARS

=====

The ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16) currently promotes different formats containing the name "JPEG" which is misleading because these formats are incompatible with original DCT-based JPEG and are based on faulty technologies.

IJG therefore does not and will not support such momentary mistakes (see REFERENCES).

There exist also distributions under the name "OpenJPEG" promoting such kind of formats which is misleading because they don't support original JPEG images.

We have no sympathy for the promotion of inferior formats. Indeed, one of the original reasons for developing this free software was to help force convergence on common, interoperable format standards for JPEG files.

Don't use an incompatible file format!

(In any case, our decoder will remain capable of reading existing JPEG image files indefinitely.)

The ISO committee pretends to be "responsible for the popular JPEG" in their public reports which is not true because they don't respond to actual requirements for the maintenance of the original JPEG specification.

Furthermore, the ISO committee pretends to "ensure interoperability" with their standards which is not true because their "standards" support only application-specific and proprietary use cases and contain mathematically incorrect code.

There are currently different distributions in circulation containing the name "libjpeg" which is misleading because they don't have the features and are incompatible with formats supported by actual IJG libjpeg distributions.

One of those fakes is released by members of the ISO committee and just uses the name of libjpeg for misdirection of people, similar to the abuse of the name JPEG as described above, while having nothing in common with actual IJG libjpeg distributions and containing mathematically incorrect code.

The other one claims to be a "derivative" or "fork" of the original libjpeg, but violates the license conditions as described under LEGAL ISSUES above and violates basic C programming properties.

We have no sympathy for the release of misleading, incorrect and illegal distributions derived from obsolete code bases.

Don't use an obsolete code base!

According to the UCC (Uniform Commercial Code) law, IJG has the lawful and legal right to foreclose on certain standardization bodies and other institutions or corporations that knowingly perform substantial and systematic deceptive acts and practices, fraud, theft, and damaging of the value of the people of this planet without their knowing, willing and intentional consent.

The titles, ownership, and rights of these institutions and all their assets are now duly secured and held in trust for the free people of this planet.

People of the planet, on every country, may have a financial interest in

the assets of these former principals, agents, and beneficiaries of the foreclosed institutions and corporations.

IJG asserts what is: that each man, woman, and child has unalienable value and rights granted and deposited in them by the Creator and not any one of the people is subordinate to any artificial principality, corporate fiction or the special interest of another without their appropriate knowing, willing and intentional consent made by contract or accommodation agreement.

IJG expresses that which already was.

The people have already determined and demanded that public administration entities, national governments, and their supporting judicial systems must be fully transparent, accountable, and liable.

IJG has secured the value for all concerned free people of the planet.

A partial list of foreclosed institutions and corporations ("Hall of Shame") is currently prepared and will be published later.

TO DO

=====

Version 9 is the second release of a new generation JPEG standard to overcome the limitations of the original JPEG specification, and is the first true source reference JPEG codec.

More features are being prepared for coming releases...

Please send bug reports, offers of help, etc. to jpeg-info@jpegclub.org.

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/README

No license file was found, but licenses were detected in source scan.

/*

* cjpeg.c

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2003-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a command-line user interface for the JPEG compressor.

* It should work on any system with Unix- or MS-DOS-style command lines.

*

* Two different command line styles are permitted, depending on the

* compile-time switch TWO_FILE_COMMANDLINE:

* cjpeg [options] inputfile outputfile

* cjpeg [options] [inputfile]

* In the second style, output is always to standard output, which you'd

* normally redirect to a file or pipe to some other program. Input is

- * either from a named file or from standard input (typically redirected).
- * The second style is convenient on Unix but is unhelpful on systems that
- * don't support pipes. Also, you MUST use the first style if your system
- * doesn't do binary I/O to stdin/stdout.
- * To simplify script writing, the "-outfile" switch is provided. The syntax
- * cjpeg [options] -outfile outputfile inputfile
- * works regardless of which command line style is used.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/cjpeg.c

No license file was found, but licenses were detected in source scan.

/*

* transupp.h

*

* Copyright (C) 1997-2019, Thomas G. Lane, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains declarations for image transformation routines and

* other utility code used by the jpegtran sample application. These are

* NOT part of the core JPEG library. But we keep these routines separate

* from jpegtran.c to ease the task of maintaining jpegtran-like programs

* that have other user interfaces.

*

* NOTE: all the routines declared here have very specific requirements

* about when they are to be executed during the reading and writing of the

* source and destination files. See the comments in transupp.c, or see

* jpegtran.c for an example of correct usage.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/transupp.h

No license file was found, but licenses were detected in source scan.

/*

* cderror.h

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2009-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file defines the error and message codes for the cjpeg/djpeg

* applications. These strings are not needed as part of the JPEG library

* proper.

* Edit this file to add new codes, or to translate the message strings to

* some other language.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/cderror.h

No license file was found, but licenses were detected in source scan.

/*

* jquant1.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains 1-pass color quantization (color mapping) routines.

* These routines provide mapping to a fixed color map using equally spaced

* color values. Optional Floyd-Steinberg or ordered dithering is available.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/jquant1.c

No license file was found, but licenses were detected in source scan.

/*

* wrbmp.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2017-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in Microsoft "BMP"

* format (MS Windows 3.x and OS/2 1.x flavors).

* Either 8-bit colormapped or 24-bit full-color format can be written.

* No compression is supported.

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*

* This code contributed by James Arthur Boucher.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrvc-v9d-tar-gz/jpeg-9d/wrbmp.c

No license file was found, but licenses were detected in source scan.


```

/*
 * jddctmgr.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2002-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the inverse-DCT management logic.
 * This code selects a particular IDCT implementation to be used,
 * and it performs related housekeeping chores. No code in this file
 * is executed per IDCT step, only during output pass setup.
 *
 * Note that the IDCT routines are responsible for performing coefficient
 * dequantization as well as the IDCT proper. This module sets up the
 * dequantization multiplier table needed by the IDCT routine.
 */

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jddctmgr.c

```

No license file was found, but licenses were detected in source scan.

```

/*
 * jmemname.c
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file provides a generic implementation of the system-dependent
 * portion of the JPEG memory manager. This implementation assumes that
 * you must explicitly construct a name for each temp file.
 * Also, the problem of determining the amount of memory available
 * is shoved onto the user.
 */

```

Found in path(s):

```

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrc-v9d-tar-gz/jpeg-9d/jmemname.c

```

No license file was found, but licenses were detected in source scan.

```

/*
 * jpegtran.c
 *
 * Copyright (C) 1995-2019, Thomas G. Lane, Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a command-line user interface for JPEG transcoding.

```


- * It is very similar to cjpeg.c, and partly to djpeg.c, but provides
- * lossless transcoding between different JPEG file formats. It also
- * provides some lossless and sort-of-lossless transformations of JPEG data.
- */

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/jpegtran.c

No license file was found, but licenses were detected in source scan.

/*

* wrppm.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2009-2019 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in PPM/PGM format.

* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

* The PBMPLUS library is NOT required to compile this software

* (but it is highly useful as a set of PPM image manipulation programs).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*/

Found in path(s):

* /opt/cola/permits/1103550007_1605777850.47/0/jpegsrsrc-v9d-tar-gz/jpeg-9d/wrppm.c

No license file was found, but licenses were detected in source scan.

USING THE IJG JPEG LIBRARY

Copyright (C) 1994-2019, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file describes how to use the IJG JPEG library within an application program. Read it if you want to write a program that uses the library.

The file example.c provides heavily commented skeleton code for calling the JPEG library. Also see jpeglib.h (the include file to be used by application programs) for full details about data structures and function parameter lists. The library source code, of course, is the ultimate reference.

Note that there have been *major* changes from the application interface presented by IJG version 4 and earlier versions. The old design had several

inherent limitations, and it had accumulated a lot of cruft as we added features while trying to minimize application-interface changes. We have sacrificed backward compatibility in the version 5 rewrite, but we think the improvements justify this.

TABLE OF CONTENTS

Overview:

Functions provided by the library

Outline of typical usage

Basic library usage:

Data formats

Compression details

Decompression details

Mechanics of usage: include files, linking, etc

Advanced features:

Compression parameter selection

Decompression parameter selection

Special color spaces

Error handling

Compressed data handling (source and destination managers)

I/O suspension

Progressive JPEG support

Buffered-image mode

Abbreviated datastreams and multiple images

Special markers

Raw (downsampled) image data

Really raw data: DCT coefficients

Progress monitoring

Memory management

Memory usage

Library compile-time options

Portability considerations

Notes for MS-DOS implementors

You should read at least the overview and basic usage sections before trying to program with the library. The sections on advanced features can be read if and when you need them.

OVERVIEW

=====

Functions provided by the library

The IJG JPEG library provides C code to read and write JPEG-compressed image files. The surrounding application program receives or supplies image data a scanline at a time, using a straightforward uncompressed image format. All details of color conversion and other preprocessing/postprocessing can be handled by the library.

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. The application indirectly selects use of this code by specifying the format in which it wishes to supply or receive image data. For example, if colormapped output is requested, then the decompression library automatically invokes color quantization.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

A word about functions *not* provided by the library. We handle a subset of the ISO JPEG standard; most baseline, extended-sequential, and progressive JPEG processes are supported. (Our subset includes all features now in common use.) Unsupported ISO options include:

- * Hierarchical storage
- * Lossless JPEG
- * DNL marker
- * Nonintegral subsampling ratios

We support 8-bit to 12-bit data precision, but this is a compile-time choice rather than a run-time choice; hence it is difficult to use different precisions in a single application.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, this library is used by the free LIBTIFF library to support JPEG compression in TIFF.)

Outline of typical usage

The rough outline of a JPEG compression operation is:

Allocate and initialize a JPEG compression object
Specify the destination for the compressed data (eg, a file)
Set parameters for compression, including image size & colorspace
`jpeg_start_compress(...);`
while (scan lines remain to be written)
 `jpeg_write_scanlines(...);`
`jpeg_finish_compress(...);`
Release the JPEG compression object

A JPEG compression object holds parameters and working state for the JPEG library. We make creation/destruction of the object separate from starting or finishing compression of an image; the same object can be re-used for a series of image compression operations. This makes it easy to re-use the same parameter settings for a sequence of images. Re-use of a JPEG object also has important implications for processing abbreviated JPEG datastreams, as discussed later.

The image data to be compressed is supplied to `jpeg_write_scanlines()` from in-memory buffers. If the application is doing file-to-file compression, reading image data from the source file is the application's responsibility. The library emits compressed data by calling a "data destination manager", which typically will write the data into a file; but the application can provide its own destination manager to do something else.

Similarly, the rough outline of a JPEG decompression operation is:

Allocate and initialize a JPEG decompression object
Specify the source of the compressed data (eg, a file)
Call `jpeg_read_header()` to obtain image info
Set parameters for decompression
`jpeg_start_decompress(...);`
while (scan lines remain to be read)
 `jpeg_read_scanlines(...);`
`jpeg_finish_decompress(...);`
Release the JPEG decompression object

This is comparable to the compression outline except that reading the datastream header is a separate step. This is helpful because information about the image's size, colorspace, etc is available when the application selects decompression parameters. For example, the application can choose an output scaling ratio that will fit the image into the available screen size.

The decompression library obtains compressed data by calling a data source manager, which typically will read the data from a file; but other behaviors can be obtained with a custom source manager. Decompressed data is delivered into in-memory buffers passed to `jpeg_read_scanlines()`.

It is possible to abort an incomplete compression or decompression operation

by calling `jpeg_abort()`; or, if you do not need to retain the JPEG object, simply release it by calling `jpeg_destroy()`.

JPEG compression and decompression objects are two separate struct types. However, they share some common fields, and certain routines such as `jpeg_destroy()` can work on either type of object.

The JPEG library has no static variables: all state is in the compression or decompression object. Therefore it is possible to process multiple compression and decompression operations concurrently, using multiple JPEG objects.

Both compression and decompression can be done in an incremental memory-to-memory fashion, if suitable source/destination managers are used. See the section on "I/O suspension" for more details.

BASIC LIBRARY USAGE

=====

Data formats

Before diving into procedural details, it is helpful to understand the image data format that the JPEG library expects or returns.

The standard input image format is a rectangular array of pixels, with each pixel having the same number of "component" or "sample" values (color channels). You must specify how many components there are and the colorspace interpretation of the components. Most applications will use RGB data (three components per pixel) or grayscale data (one component per pixel).

PLEASE NOTE THAT RGB DATA IS THREE SAMPLES PER PIXEL, GRAYSCALE ONLY ONE.

A remarkable number of people manage to miss this, only to find that their programs don't work with grayscale JPEG files.

There is no provision for colormapped input. JPEG files are always full-color or full grayscale (or sometimes another colorspace such as CMYK). You can feed in a colormapped image by expanding it to full-color format. However JPEG often doesn't work very well with source data that has been colormapped, because of dithering noise. This is discussed in more detail in the JPEG FAQ and the other references mentioned in the README file.

Pixels are stored by scanlines, with each scanline running from left to right. The component values for each pixel are adjacent in the row; for example, R,G,B,R,G,B,R,G,B,... for 24-bit RGB color. Each scanline is an array of data type `JSAMPLE` --- which is typically "unsigned char", unless you've changed `jpegconf.h`. (You can also change the RGB pixel layout, say to B,G,R order, by modifying `jpegconf.h`. But see the restrictions listed in

that file before doing so.)

A 2-D array of pixels is formed by making a list of pointers to the starts of scanlines; so the scanlines need not be physically adjacent in memory. Even if you process just one scanline at a time, you must make a one-element pointer array to conform to this structure. Pointers to JSAMPLE rows are of type JSAMPROW, and the pointer to the pointer array is of type JSAMPARRAY.

The library accepts or supplies one or more complete scanlines per call. It is not possible to process part of a row at a time. Scanlines are always processed top-to-bottom. You can process an entire image in one call if you have it all in memory, but usually it's simplest to process one scanline at a time.

For best results, source data values should have the precision specified by BITS_IN_JSAMPLE (normally 8 bits). For instance, if you choose to compress data that's only 6 bits/channel, you should left-justify each value in a byte before passing it to the compressor. If you need to compress data that has more than 8 bits/channel, compile with BITS_IN_JSAMPLE = 9 to 12. (See "Library compile-time options", later.)

The data format returned by the decompressor is the same in all details, except that colormapped output is supported. (Again, a JPEG file is never colormapped. But you can ask the decompressor to perform on-the-fly color quantization to deliver colormapped output.) If you request colormapped output then the returned data array contains a single JSAMPLE per pixel; its value is an index into a color map. The color map is represented as a 2-D JSAMPARRAY in which each row holds the values of one color component, that is, colormap[i][j] is the value of the i'th color component for pixel value (map index) j. Note that since the colormap indexes are stored in JSAMPLEs, the maximum number of colors is limited by the size of JSAMPLE (ie, at most 256 colors for an 8-bit JPEG library).

Compression details

Here we revisit the JPEG compression outline given in the overview.

1. Allocate and initialize a JPEG compression object.

A JPEG compression object is a "struct jpeg_compress_struct". (It also has a bunch of subsidiary structures which are allocated via malloc(), but the application doesn't control those directly.) This struct can be just a local variable in the calling routine, if a single routine is going to execute the whole JPEG compression sequence. Otherwise it can be static or allocated from malloc().

You will also need a structure representing a JPEG error handler. The part of this that the library cares about is a "struct jpeg_error_mgr". If you are providing your own error handler, you'll typically want to embed the jpeg_error_mgr struct in a larger structure; this is discussed later under "Error handling". For now we'll assume you are just using the default error handler. The default error handler will print JPEG error/warning messages on stderr, and it will call exit() if a fatal error occurs.

You must initialize the error handler structure, store a pointer to it into the JPEG object's "err" field, and then call jpeg_create_compress() to initialize the rest of the JPEG object.

Typical code for this step, if you are using the default error handler, is

```
struct jpeg_compress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_compress(&cinfo);
```

jpeg_create_compress allocates a small amount of memory, so it could fail if you are out of memory. In that case it will exit via the error handler; that's why the error handler must be initialized first.

2. Specify the destination for the compressed data (eg, a file).

As previously mentioned, the JPEG library delivers compressed data to a "data destination" module. The library includes one data destination module which knows how to write to a stdio stream. You can use your own destination module if you want to do something else, as discussed later.

If you use the standard destination module, you must open the target stdio stream beforehand. Typical code for this step looks like:

```
FILE * outfile;
...
if ((outfile = fopen(filename, "wb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_dest(&cinfo, outfile);
```

where the last line invokes the standard destination module.

WARNING: it is critical that the binary compressed data be delivered to the output file unchanged. On non-Unix systems the stdio library may perform

newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You can select the data destination after setting other parameters (step 3), if that's more convenient. You may not change the destination between calling jpeg_start_compress() and jpeg_finish_compress().

3. Set parameters for compression, including image size & colorspace.

You must supply information about the source image by setting the following fields in the JPEG object (cinfo structure):

image_width Width of image, in pixels
image_height Height of image, in pixels
input_components Number of color channels (samples per pixel)
in_color_space Color space of source image

The image dimensions are, hopefully, obvious. JPEG supports image dimensions of 1 to 64K pixels in either direction. The input color space is typically RGB or grayscale, and input_components is 3 or 1 accordingly. (See "Special color spaces", later, for more info.) The in_color_space field must be assigned one of the J_COLOR_SPACE enum constants, typically JCS_RGB or JCS_GRAYSCALE.

JPEG has a large number of compression parameters that determine how the image is encoded. Most applications don't need or want to know about all these parameters. You can set all the parameters to reasonable defaults by calling jpeg_set_defaults(); then, if there are particular values you want to change, you can do so after that. The "Compression parameter selection" section tells about all the parameters.

You must set in_color_space correctly before calling jpeg_set_defaults(), because the defaults depend on the source image colorspace. However the other three source image parameters need not be valid until you call jpeg_start_compress(). There's no harm in calling jpeg_set_defaults() more than once, if that happens to be convenient.

Typical code for a 24-bit RGB source image is

```
cinfo.image_width = Width; /* image width and height, in pixels */
cinfo.image_height = Height;
cinfo.input_components = 3; /* # of color components per pixel */
cinfo.in_color_space = JCS_RGB; /* colorspace of input image */

jpeg_set_defaults(&cinfo);
```


`/* Make optional parameter settings here */`

4. `jpeg_start_compress(...);`

After you have established the data destination and set all the necessary source image info and other parameters, call `jpeg_start_compress()` to begin a compression cycle. This will initialize internal state, allocate working storage, and emit the first few bytes of the JPEG datastream header.

Typical code:

```
jpeg_start_compress(&cinfo, TRUE);
```

The "TRUE" parameter ensures that a complete JPEG interchange datastream will be written. This is appropriate in most cases. If you think you might want to use an abbreviated datastream, read the section on abbreviated datastreams, below.

Once you have called `jpeg_start_compress()`, you may not alter any JPEG parameters or other fields of the JPEG object until you have completed the compression cycle.

5. while (scan lines remain to be written)

```
jpeg_write_scanlines(...);
```

Now write all the required image data by calling `jpeg_write_scanlines()` one or more times. You can pass one or more scanlines in each call, up to the total image height. In most applications it is convenient to pass just one or a few scanlines at a time. The expected format for the passed data is discussed under "Data formats", above.

Image data should be written in top-to-bottom scanline order. The JPEG spec contains some weasel wording about how top and bottom are application-defined terms (a curious interpretation of the English language...) but if you want your files to be compatible with everyone else's, you WILL use top-to-bottom order. If the source data must be read in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently. Examples of this can be found in the sample application `cjpeg`.

The library maintains a count of the number of scanlines written so far in the `next_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like `"while (cinfo.next_scanline < cinfo.image_height)"`.

Code for this step depends heavily on the way that you store the source data. `example.c` shows the following code for the case of a full-size 2-D source

array containing 3-byte RGB pixels:

```
JSAMPROW row_pointer[1]; /* pointer to a single row */
int row_stride; /* physical row width in buffer */

row_stride = image_width * 3; /* JSAMPLEs per row in image_buffer */

while (cinfo.next_scanline < cinfo.image_height) {
    row_pointer[0] = & image_buffer[cinfo.next_scanline * row_stride];
    jpeg_write_scanlines(&cinfo, row_pointer, 1);
}
```

jpeg_write_scanlines() returns the number of scanlines actually written. This will normally be equal to the number passed in, so you can usually ignore the return value. It is different in just two cases:

- * If you try to write more scanlines than the declared image height, the additional scanlines are ignored.
- * If you use a suspending data destination manager, output buffer overrun will cause the compressor to return before accepting all the passed lines. This feature is discussed under "I/O suspension", below. The normal stdio destination manager will NOT cause this to happen.

In any case, the return value is the same as the change in the value of next_scanline.

6. jpeg_finish_compress(...);

After all the image data has been written, call jpeg_finish_compress() to complete the compression cycle. This step is ESSENTIAL to ensure that the last bufferload of data is written to the data destination.

jpeg_finish_compress() also releases working memory associated with the JPEG object.

Typical code:

```
jpeg_finish_compress(&cinfo);
```

If using the stdio destination manager, don't forget to close the output stdio stream (if necessary) afterwards.

If you have requested a multi-pass operating mode, such as Huffman code optimization, jpeg_finish_compress() will perform the additional passes using data buffered by the first pass. In this case jpeg_finish_compress() may take quite a while to complete. With the default compression parameters, this will not happen.

It is an error to call jpeg_finish_compress() before writing the necessary total number of scanlines. If you wish to abort compression, call

`jpeg_abort()` as discussed below.

After completing a compression cycle, you may dispose of the JPEG object as discussed next, or you may use it to compress another image. In that case return to step 2, 3, or 4 as appropriate. If you do not change the destination manager, the new datastream will be written to the same target. If you do not change any JPEG parameters, the new datastream will be written with the same parameters as before. Note that you can change the input image dimensions freely between cycles, but if you change the input colorspace, you should call `jpeg_set_defaults()` to adjust for the new colorspace; and then you'll need to repeat all of step 3.

7. Release the JPEG compression object.

When you are done with a JPEG compression object, destroy it by calling `jpeg_destroy_compress()`. This will free all subsidiary memory (regardless of the previous state of the object). Or you can call `jpeg_destroy()`, which works for either compression or decompression objects --- this may be more convenient if you are sharing code between compression and decompression cases. (Actually, these routines are equivalent except for the declared type of the passed pointer. To avoid gripes from ANSI C compilers, `jpeg_destroy()` should be passed a `j_common_ptr`.)

If you allocated the `jpeg_compress_struct` structure from `malloc()`, freeing it is your responsibility --- `jpeg_destroy()` won't. Ditto for the error handler structure.

Typical code:

```
jpeg_destroy_compress(&cinfo);
```

8. Aborting.

If you decide to abort a compression cycle before finishing, you can clean up in either of two ways:

- * If you don't need the JPEG object any more, just call `jpeg_destroy_compress()` or `jpeg_destroy()` to release memory. This is legitimate at any point after calling `jpeg_create_compress()` --- in fact, it's safe even if `jpeg_create_compress()` fails.

- * If you want to re-use the JPEG object, call `jpeg_abort_compress()`, or call `jpeg_abort()` which works on both compression and decompression objects. This will return the object to an idle state, releasing any working memory. `jpeg_abort()` is allowed at any time after successful object creation.

Note that cleaning up the data destination, if required, is your responsibility; neither of these routines will call `term_destination()`. (See "Compressed data handling", below, for more about that.)

`jpeg_destroy()` and `jpeg_abort()` are the only safe calls to make on a JPEG object that has reported an error by calling `error_exit` (see "Error handling" for more info). The internal state of such an object is likely to be out of whack. Either of these two routines will return the object to a known state.

Decompression details

Here we revisit the JPEG decompression outline given in the overview.

1. Allocate and initialize a JPEG decompression object.

This is just like initialization for compression, as discussed above, except that the object is a "struct `jpeg_decompress_struct`" and you call `jpeg_create_decompress()`. Error handling is exactly the same.

Typical code:

```
struct jpeg_decompress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_decompress(&cinfo);
```

(Both here and in the IJG code, we usually use variable name "cinfo" for both compression and decompression objects.)

2. Specify the source of the compressed data (eg, a file).

As previously mentioned, the JPEG library reads compressed data from a "data source" module. The library includes one data source module which knows how to read from a stdio stream. You can use your own source module if you want to do something else, as discussed later.

If you use the standard source module, you must open the source stdio stream beforehand. Typical code for this step looks like:

```
FILE * infile;
...
if ((infile = fopen(filename, "rb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
```



```
}  
jpeg_stdio_src(&cinfo, infile);
```

where the last line invokes the standard source module.

WARNING: it is critical that the binary compressed data be read unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You may not change the data source between calling jpeg_read_header() and jpeg_finish_decompress(). If you wish to read a series of JPEG images from a single source file, you should repeat the jpeg_read_header() to jpeg_finish_decompress() sequence without reinitializing either the JPEG object or the data source module; this prevents buffered input data from being discarded.

3. Call jpeg_read_header() to obtain image info.

Typical code for this step is just

```
jpeg_read_header(&cinfo, TRUE);
```

This will read the source datastream header markers, up to the beginning of the compressed data proper. On return, the image dimensions and other info have been stored in the JPEG object. The application may wish to consult this information before selecting decompression parameters.

More complex code is necessary if

- * A suspending data source is used --- in that case jpeg_read_header() may return before it has read all the header data. See "I/O suspension", below. The normal stdio source manager will NOT cause this to happen.
- * Abbreviated JPEG files are to be processed --- see the section on abbreviated datastreams. Standard applications that deal only in interchange JPEG files need not be concerned with this case either.

It is permissible to stop at this point if you just wanted to find out the image dimensions and other header info for a JPEG file. In that case, call jpeg_destroy() when you are done with the JPEG object, or call jpeg_abort() to return it to an idle state before selecting a new data source and reading another header.

4. Set parameters for decompression.

`jpeg_read_header()` sets appropriate default decompression parameters based on the properties of the image (in particular, its colorspace). However, you may well want to alter these defaults before beginning the decompression. For example, the default is to produce full color output from a color file. If you want colormapped output you must ask for it. Other options allow the returned image to be scaled and allow various speed/quality tradeoffs to be selected. "Decompression parameter selection", below, gives details.

If the defaults are appropriate, nothing need be done at this step.

Note that all default values are set by each call to `jpeg_read_header()`.

If you reuse a decompression object, you cannot expect your parameter settings to be preserved across cycles, as you can for compression.

You must set desired parameter values each time.

5. `jpeg_start_decompress(...)`;

Once the parameter values are satisfactory, call `jpeg_start_decompress()` to begin decompression. This will initialize internal state, allocate working memory, and prepare for returning data.

Typical code is just

```
jpeg_start_decompress(&cinfo);
```

If you have requested a multi-pass operating mode, such as 2-pass color quantization, `jpeg_start_decompress()` will do everything needed before data output can begin. In this case `jpeg_start_decompress()` may take quite a while to complete. With a single-scan (non progressive) JPEG file and default decompression parameters, this will not happen; `jpeg_start_decompress()` will return quickly.

After this call, the final output image dimensions, including any requested scaling, are available in the JPEG object; so is the selected colormap, if colormapped output has been requested. Useful fields include

`output_width` image width and height, as scaled

`output_height`

`out_color_components` # of color components in `out_color_space`

`output_components` # of color components returned per pixel

`colormap` the selected colormap, if any

`actual_number_of_colors` number of entries in colormap

`output_components` is 1 (a colormap index) when quantizing colors; otherwise it equals `out_color_components`. It is the number of JSAMPLE values that will be emitted per pixel in the output arrays.

Typically you will need to allocate data buffers to hold the incoming image. You will need `output_width * output_components JSAMPLEs` per scanline in your output buffer, and a total of `output_height` scanlines will be returned.

Note: if you are using the JPEG library's internal memory manager to allocate data buffers (as `djpeg` does), then the manager's protocol requires that you request large buffers **before** calling `jpeg_start_decompress()`. This is a little tricky since the `output_XXX` fields are not normally valid then. You can make them valid by calling `jpeg_calc_output_dimensions()` after setting the relevant parameters (scaling, output color space, and quantization flag).

```
6. while (scan lines remain to be read)
    jpeg_read_scanlines(...);
```

Now you can read the decompressed image data by calling `jpeg_read_scanlines()` one or more times. At each call, you pass in the maximum number of scanlines to be read (ie, the height of your working buffer); `jpeg_read_scanlines()` will return up to that many lines. The return value is the number of lines actually read. The format of the returned data is discussed under "Data formats", above. Don't forget that grayscale and color JPEGs will return different data formats!

Image data is returned in top-to-bottom scanline order. If you must write out the image in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently. Examples of this can be found in the sample application `djpeg`.

The library maintains a count of the number of scanlines returned so far in the `output_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like "`while (cinfo.output_scanline < cinfo.output_height)`". (Note that the test should NOT be against `image_height`, unless you never use scaling. The `image_height` field is the height of the original unscaled image.) The return value always equals the change in the value of `output_scanline`.

If you don't use a suspending data source, it is safe to assume that `jpeg_read_scanlines()` reads at least one scanline per call, until the bottom of the image has been reached.

If you use a buffer larger than one scanline, it is NOT safe to assume that `jpeg_read_scanlines()` fills it. (The current implementation returns only a few scanlines per call, no matter how large a buffer you pass.) So you must always provide a loop that calls `jpeg_read_scanlines()` repeatedly until the whole image has been read.

```
7. jpeg_finish_decompress(...);
```


After all the image data has been read, call `jpeg_finish_decompress()` to complete the decompression cycle. This causes working memory associated with the JPEG object to be released.

Typical code:

```
jpeg_finish_decompress(&cinfo);
```

If using the stdio source manager, don't forget to close the source stdio stream if necessary.

It is an error to call `jpeg_finish_decompress()` before reading the correct total number of scanlines. If you wish to abort decompression, call `jpeg_abort()` as discussed below.

After completing a decompression cycle, you may dispose of the JPEG object as discussed next, or you may use it to decompress another image. In that case return to step 2 or 3 as appropriate. If you do not change the source manager, the next image will be read from the same source.

8. Release the JPEG decompression object.

When you are done with a JPEG decompression object, destroy it by calling `jpeg_destroy_decompress()` or `jpeg_destroy()`. The previous discussion of destroying compression objects applies here too.

Typical code:

```
jpeg_destroy_decompress(&cinfo);
```

9. Aborting.

You can abort a decompression cycle by calling `jpeg_destroy_decompress()` or `jpeg_destroy()` if you don't need the JPEG object any more, or `jpeg_abort_decompress()` or `jpeg_abort()` if you want to reuse the object. The previous discussion of aborting compression cycles applies here too.

Mechanics of usage: include files, linking, etc

Applications using the JPEG library should include the header file `jpeglib.h` to obtain declarations of data types and routines. Before including `jpeglib.h`, include system headers that define at least the typedefs `FILE` and `size_t`. On ANSI-conforming systems, including `<stdio.h>` is sufficient; on

older Unix systems, you may need `<sys/types.h>` to define `size_t`.

If the application needs to refer to individual JPEG library error codes, also include `jerror.h` to define those symbols.

`jpeglib.h` indirectly includes the files `jconfig.h` and `jmorecfg.h`. If you are installing the JPEG header files in a system directory, you will want to install all four files: `jpeglib.h`, `jerror.h`, `jconfig.h`, `jmorecfg.h`.

The most convenient way to include the JPEG code into your executable program is to prepare a library file ("`libjpeg.a`", or a corresponding name on non-Unix machines) and reference it at your link step. If you use only half of the library (only compression or only decompression), only that much code will be included from the library, unless your linker is hopelessly brain-damaged. The supplied makefiles build `libjpeg.a` automatically (see `install.txt`).

While you can build the JPEG library as a shared library if the whim strikes you, we don't really recommend it. The trouble with shared libraries is that at some point you'll probably try to substitute a new version of the library without recompiling the calling applications. That generally doesn't work because the parameter struct declarations usually change with each new version. In other words, the library's API is **not** guaranteed binary compatible across versions; we only try to ensure source-code compatibility. (In hindsight, it might have been smarter to hide the parameter structs from applications and introduce a ton of access functions instead. Too late now, however.)

On some systems your application may need to set up a signal handler to ensure that temporary files are deleted if the program is interrupted. This is most critical if you are on MS-DOS and use the `jmemdos.c` memory manager back end; it will try to grab extended memory for temp files, and that space will NOT be freed automatically. See `cjpeg.c` or `djpeg.c` for an example signal handler.

It may be worth pointing out that the core JPEG library does not actually require the `stdio` library: only the default source/destination managers and error handler need it. You can use the library in a `stdio`-less environment if you replace those modules and use `jmemnobs.c` (or another memory manager of your own devising). More info about the minimum system library requirements may be found in `jinclude.h`.

ADVANCED FEATURES

=====

Compression parameter selection

This section describes all the optional parameters you can set for JPEG

compression, as well as the "helper" routines provided to assist in this task. Proper setting of some parameters requires detailed understanding of the JPEG standard; if you don't know what a parameter is for, it's best not to mess with it! See REFERENCES in the README file for pointers to more info about JPEG.

It's a good idea to call `jpeg_set_defaults()` first, even if you plan to set all the parameters; that way your code is more likely to work with future JPEG libraries that have additional parameters. For the same reason, we recommend you use a helper routine where one is provided, in preference to twiddling `cinfo` fields directly.

The helper routines are:

`jpeg_set_defaults (j_compress_ptr cinfo)`

This routine sets all JPEG parameters to reasonable defaults, using only the input image's color space (field `in_color_space`, which must already be set in `cinfo`). Many applications will only need to use this routine and perhaps `jpeg_set_quality()`.

`jpeg_set_colorspace (j_compress_ptr cinfo, J_COLOR_SPACE colorspace)`

Sets the JPEG file's colorspace (field `jpeg_color_space`) as specified, and sets other color-space-dependent parameters appropriately. See "Special color spaces", below, before using this. A large number of parameters, including all per-component parameters, are set by this routine; if you want to twiddle individual parameters you should call `jpeg_set_colorspace()` before rather than after.

`jpeg_default_colorspace (j_compress_ptr cinfo)`

Selects an appropriate JPEG colorspace based on `cinfo->in_color_space`, and calls `jpeg_set_colorspace()`. This is actually a subroutine of `jpeg_set_defaults()`. It's broken out in case you want to change just the colorspace-dependent JPEG parameters.

`jpeg_set_quality (j_compress_ptr cinfo, int quality, boolean force_baseline)`

Constructs JPEG quantization tables appropriate for the indicated quality setting. The quality value is expressed on the 0..100 scale recommended by IJG (cjpeg's "-quality" switch uses this routine). Note that the exact mapping from quality values to tables may change in future IJG releases as more is learned about DCT quantization. If the `force_baseline` parameter is `TRUE`, then the quantization table entries are constrained to the range 1..255 for full JPEG baseline compatibility. In the current implementation, this only makes a difference for quality settings below 25, and it effectively prevents very small/low quality files from being generated. The IJG decoder is capable of reading the non-baseline files generated at low quality settings when `force_baseline` is `FALSE`, but other decoders may not be.

`jpeg_set_linear_quality` (`j_compress_ptr` cinfo, `int` scale_factor,
 `boolean` force_baseline)

Same as `jpeg_set_quality()` except that the generated tables are the sample tables given in the JPEG spec section K.1, multiplied by the specified scale factor (which is expressed as a percentage; thus `scale_factor = 100` reproduces the spec's tables). Note that larger scale factors give lower quality. This entry point is useful for conforming to the Adobe PostScript DCT conventions, but we do not recommend linear scaling as a user-visible quality scale otherwise. `force_baseline` again constrains the computed table entries to 1..255.

`int` `jpeg_quality_scaling` (`int` quality)

Converts a value on the IJG-recommended quality scale to a linear scaling percentage. Note that this routine may change or go away in future releases --- IJG may choose to adopt a scaling method that can't be expressed as a simple scalar multiplier, in which case the premise of this routine collapses. Caveat user.

`jpeg_default_qtables` (`j_compress_ptr` cinfo, `boolean` force_baseline)
Set default quantization tables with linear `q_scale_factor[]` values (see below).

`jpeg_add_quant_table` (`j_compress_ptr` cinfo, `int` which_tbl,
 `const unsigned int` *basic_table,
 `int` scale_factor, `boolean` force_baseline)

Allows an arbitrary quantization table to be created. `which_tbl` indicates which table slot to fill. `basic_table` points to an array of 64 unsigned ints given in normal array order. These values are multiplied by `scale_factor/100` and then clamped to the range 1..65535 (or to 1..255 if `force_baseline` is TRUE).

CAUTION: prior to library version 6a, `jpeg_add_quant_table` expected the basic table to be given in JPEG zigzag order. If you need to write code that works with either older or newer versions of this routine, you must check the library version number. Something like `"#if JPEG_LIB_VERSION >= 61"` is the right test.

`jpeg_simple_progression` (`j_compress_ptr` cinfo)

Generates a default scan script for writing a progressive-JPEG file. This is the recommended method of creating a progressive file, unless you want to make a custom scan sequence. You must ensure that the JPEG color space is set correctly before calling this routine.

Compression parameters (cinfo fields) include:

`boolean` `arith_code`

If TRUE, use arithmetic coding.

If FALSE, use Huffman coding.

int block_size

Set DCT block size. All N from 1 to 16 are possible.

Default is 8 (baseline format).

Larger values produce higher compression,
smaller values produce higher quality.

An exact DCT stage is possible with 1 or 2.

With the default quality of 75 and default Luminance qtable
the DCT+Quantization stage is lossless for value 1.

Note that values other than 8 require a SmartScale capable decoder,
introduced with IJG JPEG 8. Setting the block_size parameter for
compression works with version 8c and later.

J_DCT_METHOD dct_method

Selects the algorithm used for the DCT step. Choices are:

JDCT_ISLOW: slow but accurate integer algorithm

JDCT_IFAST: faster, less accurate integer method

JDCT_FLOAT: floating-point method

JDCT_DEFAULT: default method (normally JDCT_ISLOW)

JDCT_FASTEST: fastest method (normally JDCT_IFAST)

The FLOAT method is very slightly more accurate than the ISLOW method,
but may give different results on different machines due to varying
roundoff behavior. The integer methods should give the same results
on all machines. On machines with sufficiently fast FP hardware, the
floating-point method may also be the fastest. The IFAST method is
considerably less accurate than the other two; its use is not
recommended if high quality is a concern. JDCT_DEFAULT and
JDCT_FASTEST are macros configurable by each installation.

unsigned int scale_num, scale_denom

Scale the image by the fraction scale_num/scale_denom. Default is
1/1, or no scaling. Currently, the supported scaling ratios are
M/N with all N from 1 to 16, where M is the destination DCT size,
which is 8 by default (see block_size parameter above).

(The library design allows for arbitrary scaling ratios but this
is not likely to be implemented any time soon.)

J_COLOR_SPACE jpeg_color_space

int num_components

The JPEG color space and corresponding number of components; see
"Special color spaces", below, for more info. We recommend using
jpeg_set_colorspace() if you want to change these.

J_COLOR_TRANSFORM color_transform

Internal color transform identifier, writes LSE marker if nonzero
(requires decoder with inverse color transform support, introduced
with IJG JPEG 9).

Two values are currently possible: JCT_NONE and JCT_SUBTRACT_GREEN.

Set this value for lossless RGB application **before** calling `jpeg_set_colorspace()`, because entropy table assignment in `jpeg_set_colorspace()` depends on `color_transform`.

boolean `optimize_coding`

TRUE causes the compressor to compute optimal Huffman coding tables for the image. This requires an extra pass over the data and therefore costs a good deal of space and time. The default is FALSE, which tells the compressor to use the supplied or default Huffman tables. In most cases optimal tables save only a few percent of file size compared to the default tables. Note that when this is TRUE, you need not supply Huffman tables at all, and any you do supply will be overwritten.

unsigned int `restart_interval`

int `restart_in_rows`

To emit restart markers in the JPEG file, set one of these nonzero. Set `restart_interval` to specify the exact interval in MCU blocks. Set `restart_in_rows` to specify the interval in MCU rows. (If `restart_in_rows` is not 0, then `restart_interval` is set after the image width in MCUs is computed.) Defaults are zero (no restarts). One restart marker per MCU row is often a good choice. NOTE: the overhead of restart markers is higher in grayscale JPEG files than in color files, and MUCH higher in progressive JPEGs. If you use restarts, you may want to use larger intervals in those cases.

const `jpeg_scan_info` * `scan_info`

int `num_scans`

By default, `scan_info` is NULL; this causes the compressor to write a single-scan sequential JPEG file. If not NULL, `scan_info` points to an array of scan definition records of length `num_scans`. The compressor will then write a JPEG file having one scan for each scan definition record. This is used to generate noninterleaved or progressive JPEG files. The library checks that the scan array defines a valid JPEG scan sequence. (`jpeg_simple_progression` creates a suitable scan definition array for progressive JPEG.) This is discussed further under "Progressive JPEG support".

boolean `do_fancy_downsampling`

If TRUE, use direct DCT scaling with DCT size > 8 for downsampling of chroma components.
If FALSE, use only DCT size <= 8 and simple separate downsampling.
Default is TRUE.
For better image stability in multiple generation compression cycles it is preferable that this value matches the corresponding `do_fancy_upsampling` value in decompression.

int smoothing_factor

If non-zero, the input image is smoothed; the value should be 1 for minimal smoothing to 100 for maximum smoothing. Consult `jcsample.c` for details of the smoothing algorithm. The default is zero.

boolean write_JFIF_header

If TRUE, a JFIF APP0 marker is emitted. `jpeg_set_defaults()` and `jpeg_set_colorspace()` set this TRUE if a JFIF-legal JPEG color space (ie, YCbCr or grayscale) is selected, otherwise FALSE.

UINT8 JFIF_major_version

UINT8 JFIF_minor_version

The version number to be written into the JFIF marker.

`jpeg_set_defaults()` initializes the version to 1.01 (major=minor=1).

You should set it to 1.02 (major=1, minor=2) if you plan to write any JFIF 1.02 extension markers.

UINT8 density_unit

UINT16 X_density

UINT16 Y_density

The resolution information to be written into the JFIF marker; not used otherwise. `density_unit` may be 0 for unknown, 1 for dots/inch, or 2 for dots/cm. The default values are 0,1,1 indicating square pixels of unknown size.

boolean write_Adobe_marker

If TRUE, an Adobe APP14 marker is emitted. `jpeg_set_defaults()` and `jpeg_set_colorspace()` set this TRUE if JPEG color space RGB, CMYK, or YCKK is selected, otherwise FALSE. It is generally a bad idea to set both `write_JFIF_header` and `write_Adobe_marker`. In fact, you probably shouldn't change the default settings at all --- the default behavior ensures that the JPEG file's color space can be recognized by the decoder.

JQUANT_TBL * quant_tbl_ptrs[NUM_QUANT_TBLS]

Pointers to coefficient quantization tables, one per table slot, or NULL if no table is defined for a slot. Usually these should be set via one of the above helper routines; `jpeg_add_quant_table()` is general enough to define any quantization table. The other routines will set up table slot 0 for luminance quality and table slot 1 for chrominance.

int q_scale_factor[NUM_QUANT_TBLS]

Linear quantization scaling factors (percentage, initialized 100) for use with `jpeg_default_qtables()`.

See `rdswitch.c` and `cjpeg.c` for an example of usage.

Note that the `q_scale_factor[]` fields are the "linear" scales, so you have to convert from user-defined ratings via `jpeg_quality_scaling()`.

Here is an example code which corresponds to `cjpeg -quality 90,70`:

```
jpeg_set_defaults(cinfo);

/* Set luminance quality 90. */
cinfo->q_scale_factor[0] = jpeg_quality_scaling(90);
/* Set chrominance quality 70. */
cinfo->q_scale_factor[1] = jpeg_quality_scaling(70);

jpeg_default_qtables(cinfo, force_baseline);
```

CAUTION: You must also set 1x1 subsampling for efficient separate color quality selection, since the default value used by library is 2x2:

```
cinfo->comp_info[0].v_samp_factor = 1;
cinfo->comp_info[0].h_samp_factor = 1;
```

JHUFF_TBL * dc_huff_tbl_ptrs[NUM_HUFF_TBLS]

JHUFF_TBL * ac_huff_tbl_ptrs[NUM_HUFF_TBLS]

Pointers to Huffman coding tables, one per table slot, or NULL if no table is defined for a slot. Slots 0 and 1 are filled with the JPEG sample tables by `jpeg_set_defaults()`. If you need to allocate more table structures, `jpeg_alloc_huff_table()` may be used.

Note that optimal Huffman tables can be computed for an image by setting `optimize_coding`, as discussed above; there's seldom any need to mess with providing your own Huffman tables.

The actual dimensions of the JPEG image that will be written to the file are given by the following fields. These are computed from the input image dimensions and the compression parameters by `jpeg_start_compress()`. You can also call `jpeg_calc_jpeg_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size.

JDIMENSION jpeg_width Actual dimensions of output image.

JDIMENSION jpeg_height

Per-component parameters are stored in the struct `cinfo.comp_info[i]` for component number `i`. Note that components here refer to components of the JPEG color space, *not* the source image color space. A suitably large `comp_info[]` array is allocated by `jpeg_set_defaults()`; if you choose not to use that routine, it's up to you to allocate the array.

int component_id

The one-byte identifier code to be recorded in the JPEG file for

this component. For the standard color spaces, we recommend you leave the default values alone.

int h_samp_factor

int v_samp_factor

Horizontal and vertical sampling factors for the component; must be 1..4 according to the JPEG standard. Note that larger sampling factors indicate a higher-resolution component; many people find this behavior quite unintuitive. The default values are 2,2 for luminance components and 1,1 for chrominance components, except for grayscale where 1,1 is used.

int quant_tbl_no

Quantization table number for component. The default value is 0 for luminance components and 1 for chrominance components.

int dc_tbl_no

int ac_tbl_no

DC and AC entropy coding table numbers. The default values are 0 for luminance components and 1 for chrominance components.

int component_index

Must equal the component's index in comp_info[]. (Beginning in release v6, the compressor library will fill this in automatically; you don't have to.)

Decompression parameter selection

Decompression parameter selection is somewhat simpler than compression parameter selection, since all of the JPEG internal parameters are recorded in the source file and need not be supplied by the application. (Unless you are working with abbreviated files, in which case see "Abbreviated datastreams", below.) Decompression parameters control the postprocessing done on the image to deliver it in a format suitable for the application's use. Many of the parameters control speed/quality tradeoffs, in which faster decompression may be obtained at the price of a poorer-quality image. The defaults select the highest quality (slowest) processing.

The following fields in the JPEG object are set by jpeg_read_header() and may be useful to the application in choosing decompression parameters:

JDIMENSION image_width Width and height of image

JDIMENSION image_height

int num_components Number of color components

J_COLOR_SPACE jpeg_color_space Colorspace of image

boolean saw_JFIF_marker TRUE if a JFIF APP0 marker was seen
UINT8 JFIF_major_version Version information from JFIF marker
UINT8 JFIF_minor_version
UINT8 density_unit Resolution data from JFIF marker
UINT16 X_density
UINT16 Y_density
boolean saw_Adobe_marker TRUE if an Adobe APP14 marker was seen
UINT8 Adobe_transform Color transform code from Adobe marker

The JPEG color space, unfortunately, is something of a guess since the JPEG standard proper does not provide a way to record it. In practice most files adhere to the JFIF or Adobe conventions, and the decoder will recognize these correctly. See "Special color spaces", below, for more info.

The decompression parameters that determine the basic properties of the returned image are:

J_COLOR_SPACE out_color_space
Output color space. jpeg_read_header() sets an appropriate default based on jpeg_color_space; typically it will be RGB or grayscale. The application can change this field to request output in a different colorspace. For example, set it to JCS_GRAYSCALE to get grayscale output from a color file. (This is useful for previewing: grayscale output is faster than full color since the color components need not be processed.) Note that not all possible color space transforms are currently implemented; you may need to extend jdcolor.c if you want an unusual conversion.

unsigned int scale_num, scale_denom
Scale the image by the fraction scale_num/scale_denom. Currently, the supported scaling ratios are M/N with all M from 1 to 16, where N is the source DCT size, which is 8 for baseline JPEG. (The library design allows for arbitrary scaling ratios but this is not likely to be implemented any time soon.) The values are initialized by jpeg_read_header() with the source DCT size. For baseline JPEG this is 8/8. If you change only the scale_num value while leaving the other unchanged, then this specifies the DCT scaled size to be applied on the given input. For baseline JPEG this is equivalent to M/8 scaling, since the source DCT size for baseline JPEG is 8. Smaller scaling ratios permit significantly faster decoding since fewer pixels need be processed and a simpler IDCT method can be used.

boolean quantize_colors
If set TRUE, colormapped output will be delivered. Default is FALSE, meaning that full-color output will be delivered.

The next three parameters are relevant only if quantize_colors is TRUE.

int desired_number_of_colors

Maximum number of colors to use in generating a library-supplied color map (the actual number of colors is returned in a different field).

Default 256. Ignored when the application supplies its own color map.

boolean two_pass_quantize

If TRUE, an extra pass over the image is made to select a custom color map for the image. This usually looks a lot better than the one-size-fits-all colormap that is used otherwise. Default is TRUE. Ignored when the application supplies its own color map.

J_DITHER_MODE dither_mode

Selects color dithering method. Supported values are:

JDITHER_NONE no dithering: fast, very low quality

JDITHER_ORDERED ordered dither: moderate speed and quality

JDITHER_FS Floyd-Steinberg dither: slow, high quality

Default is JDITHER_FS. (At present, ordered dither is implemented only in the single-pass, standard-colormap case. If you ask for ordered dither when two_pass_quantize is TRUE or when you supply an external color map, you'll get F-S dithering.)

When quantize_colors is TRUE, the target color map is described by the next two fields. colormap is set to NULL by jpeg_read_header(). The application can supply a color map by setting colormap non-NULL and setting actual_number_of_colors to the map size. Otherwise, jpeg_start_decompress() selects a suitable color map and sets these two fields itself.

[Implementation restriction: at present, an externally supplied colormap is only accepted for 3-component output color spaces.]

JSAMPARRAY colormap

The color map, represented as a 2-D pixel array of out_color_components rows and actual_number_of_colors columns. Ignored if not quantizing.

CAUTION: if the JPEG library creates its own colormap, the storage pointed to by this field is released by jpeg_finish_decompress().

Copy the colormap somewhere else first, if you want to save it.

int actual_number_of_colors

The number of colors in the color map.

Additional decompression parameters that the application may set include:

J_DCT_METHOD dct_method

Selects the algorithm used for the DCT step. Choices are the same as described above for compression.

boolean do_fancy_upsampling

If TRUE, use direct DCT scaling with DCT size > 8 for upsampling

of chroma components.

If FALSE, use only DCT size ≤ 8 and simple separate upsampling.

Default is TRUE.

For better image stability in multiple generation compression cycles it is preferable that this value matches the corresponding `do_fancy_downsampling` value in compression.

boolean `do_block_smoothing`

If TRUE, interblock smoothing is applied in early stages of decoding progressive JPEG files; if FALSE, not. Default is TRUE. Early progression stages look "fuzzy" with smoothing, "blocky" without. In any case, block smoothing ceases to be applied after the first few AC coefficients are known to full accuracy, so it is relevant only when using buffered-image mode for progressive images.

boolean `enable_1pass_quant`

boolean `enable_external_quant`

boolean `enable_2pass_quant`

These are significant only in buffered-image mode, which is described in its own section below.

The output image dimensions are given by the following fields. These are computed from the source image dimensions and the decompression parameters by `jpeg_start_decompress()`. You can also call `jpeg_calc_output_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size. It's also important if you are using the JPEG library's memory manager to allocate output buffer space, because you are supposed to request such buffers **before** `jpeg_start_decompress()`.

JDIMENSION `output_width` Actual dimensions of output image.

JDIMENSION `output_height`

int `out_color_components` Number of color components in `out_color_space`.

int `output_components` Number of color components returned.

int `rec_outbuf_height` Recommended height of scanline buffer.

When quantizing colors, `output_components` is 1, indicating a single color map index per pixel. Otherwise it equals `out_color_components`. The output arrays are required to be `output_width * output_components` JSAMPLEs wide.

`rec_outbuf_height` is the recommended minimum height (in scanlines) of the buffer passed to `jpeg_read_scanlines()`. If the buffer is smaller, the library will still work, but time will be wasted due to unnecessary data copying. In high-quality modes, `rec_outbuf_height` is always 1, but some faster, lower-quality modes set it to larger values (typically 2 to 4).

If you are going to ask for a high-speed processing mode, you may as well go to the trouble of honoring `rec_outbuf_height` so as to avoid data copying.

(An output buffer larger than `rec_outbuf_height` lines is OK, but won't provide any material speed improvement over that height.)

Special color spaces

The JPEG standard itself is "color blind" and doesn't specify any particular color space. It is customary to convert color data to a luminance/chrominance color space before compressing, since this permits greater compression. The existing JPEG file interchange format standards specify YCbCr or GRAYSCALE data (JFIF version 1), GRAYSCALE, RGB, YCbCr, CMYK, or YCCK (Adobe), or BG_RGB or BG_YCC (big gamut color spaces, JFIF version 2). For special applications such as multispectral images, other color spaces can be used, but it must be understood that such files will be unportable.

The JPEG library can handle the most common colorspace conversions (namely RGB \Leftrightarrow YCbCr and CMYK \Leftrightarrow YCCK). It can also deal with data of an unknown color space, passing it through without conversion. If you deal extensively with an unusual color space, you can easily extend the library to understand additional color spaces and perform appropriate conversions.

For compression, the source data's color space is specified by field `in_color_space`. This is transformed to the JPEG file's color space given by `jpeg_color_space`. `jpeg_set_defaults()` chooses a reasonable JPEG color space depending on `in_color_space`, but you can override this by calling `jpeg_set_colorspace()`. Of course you must select a supported transformation. `jccolor.c` currently supports the following transformations:

RGB \Rightarrow YCbCr

RGB \Rightarrow GRAYSCALE

RGB \Rightarrow BG_YCC

YCbCr \Rightarrow GRAYSCALE

YCbCr \Rightarrow BG_YCC

CMYK \Rightarrow YCCK

plus the null transforms: GRAYSCALE \Rightarrow GRAYSCALE, RGB \Rightarrow RGB, BG_RGB \Rightarrow BG_RGB, YCbCr \Rightarrow YCbCr, BG_YCC \Rightarrow BG_YCC, CMYK \Rightarrow CMYK, YCCK \Rightarrow YCCK, and UNKNOWN \Rightarrow UNKNOWN.

The file interchange format standards (JFIF and Adobe) specify APPn markers that indicate the color space of the JPEG file. It is important to ensure that these are written correctly, or omitted if the JPEG file's color space is not one of the ones supported by the interchange standards.

`jpeg_set_colorspace()` will set the compression parameters to include or omit the APPn markers properly, so long as it is told the truth about the JPEG color space. For example, if you are writing some random 3-component color space without conversion, don't try to fake out the library by setting `in_color_space` and `jpeg_color_space` to `JCS_YCbCr`; use `JCS_UNKNOWN`. You may want to write an APPn marker of your own devising to identify

the colorspace --- see "Special markers", below.

When told that the color space is UNKNOWN, the library will default to using luminance-quality compression parameters for all color components. You may well want to change these parameters. See the source code for `jpeg_set_colorspace()`, in `jcparam.c`, for details.

For decompression, the JPEG file's color space is given in `jpeg_color_space`, and this is transformed to the output color space `out_color_space`. `jpeg_read_header`'s setting of `jpeg_color_space` can be relied on if the file conforms to JFIF or Adobe conventions, but otherwise it is no better than a guess. If you know the JPEG file's color space for certain, you can override `jpeg_read_header`'s guess by setting `jpeg_color_space`. `jpeg_read_header` also selects a default output color space based on (its guess of) `jpeg_color_space`; set `out_color_space` to override this. Again, you must select a supported transformation. `jdcolor.c` currently supports

YCbCr => RGB

YCbCr => GRAYSCALE

BG_YCC => RGB

BG_YCC => GRAYSCALE

RGB => GRAYSCALE

GRAYSCALE => RGB

YCK => CMYK

as well as the null transforms. (Since GRAYSCALE=>RGB is provided, an application can force grayscale JPEGs to look like color JPEGs if it only wants to handle one case.)

The two-pass color quantizer, `jquant2.c`, is specialized to handle RGB data (it weights distances appropriately for RGB colors). You'll need to modify the code if you want to use it for non-RGB output color spaces. Note that `jquant2.c` is used to map to an application-supplied colormap as well as for the normal two-pass colormap selection process.

CAUTION: it appears that Adobe Photoshop writes inverted data in CMYK JPEG files: 0 represents 100% ink coverage, rather than 0% ink as you'd expect. This is arguably a bug in Photoshop, but if you need to work with Photoshop CMYK files, you will have to deal with it in your application. We cannot "fix" this in the library by inverting the data during the CMYK<=>YCK transform, because that would break other applications, notably Ghostscript. Photoshop versions prior to 3.0 write EPS files containing JPEG-encoded CMYK data in the same inverted-YCK representation used in bare JPEG files, but the surrounding PostScript code performs an inversion using the PS image operator. I am told that Photoshop 3.0 will write uninverted YCK in EPS/JPEG files, and will omit the PS-level inversion. (But the data polarity used in bare JPEG files will not change in 3.0.) In either case, the JPEG library must not invert the data itself, or else Ghostscript would read these EPS files incorrectly.

Error handling

When the default error handler is used, any error detected inside the JPEG routines will cause a message to be printed on stderr, followed by exit(). You can supply your own error handling routines to override this behavior and to control the treatment of nonfatal warnings and trace/debug messages. The file example.c illustrates the most common case, which is to have the application regain control after an error rather than exiting.

The JPEG library never writes any message directly; it always goes through the error handling routines. Three classes of messages are recognized:

- * Fatal errors: the library cannot continue.
- * Warnings: the library can continue, but the data is corrupt, and a damaged output image is likely to result.
- * Trace/informational messages. These come with a trace level indicating the importance of the message; you can control the verbosity of the program by adjusting the maximum trace level that will be displayed.

You may, if you wish, simply replace the entire JPEG error handling module (jerror.c) with your own code. However, you can avoid code duplication by only replacing some of the routines depending on the behavior you need. This is accomplished by calling jpeg_std_error() as usual, but then overriding some of the method pointers in the jpeg_error_mgr struct, as illustrated by example.c.

All of the error handling routines will receive a pointer to the JPEG object (a j_common_ptr which points to either a jpeg_compress_struct or a jpeg_decompress_struct; if you need to tell which, test the is_decompressor field). This struct includes a pointer to the error manager struct in its "err" field. Frequently, custom error handler routines will need to access additional data which is not known to the JPEG library or the standard error handler. The most convenient way to do this is to embed either the JPEG object or the jpeg_error_mgr struct in a larger structure that contains additional fields; then casting the passed pointer provides access to the additional fields. Again, see example.c for one way to do it. (Beginning with IJG version 6b, there is also a void pointer "client_data" in each JPEG object, which the application can also use to find related data. The library does not touch client_data at all.)

The individual methods that you might wish to override are:

error_exit (j_common_ptr cinfo)

Receives control for a fatal error. Information sufficient to generate the error message has been stored in cinfo->err; call output_message to display it. Control must NOT return to the caller; generally this routine will exit() or longjmp() somewhere.

Typically you would override this routine to get rid of the exit() default behavior. Note that if you continue processing, you should clean up the JPEG object with jpeg_abort() or jpeg_destroy().

output_message (j_common_ptr cinfo)

Actual output of any JPEG message. Override this to send messages somewhere other than stderr. Note that this method does not know how to generate a message, only where to send it.

format_message (j_common_ptr cinfo, char * buffer)

Constructs a readable error message string based on the error info stored in cinfo->err. This method is called by output_message. Few applications should need to override this method. One possible reason for doing so is to implement dynamic switching of error message language.

emit_message (j_common_ptr cinfo, int msg_level)

Decide whether or not to emit a warning or trace message; if so, calls output_message. The main reason for overriding this method would be to abort on warnings. msg_level is -1 for warnings, 0 and up for trace messages.

Only error_exit() and emit_message() are called from the rest of the JPEG library; the other two are internal to the error handler.

The actual message texts are stored in an array of strings which is pointed to by the field err->jpeg_message_table. The messages are numbered from 0 to err->last_jpeg_message, and it is these code numbers that are used in the JPEG library code. You could replace the message texts (for instance, with messages in French or German) by changing the message table pointer. See jerror.h for the default texts. CAUTION: this table will almost certainly change or grow from one library version to the next.

It may be useful for an application to add its own message texts that are handled by the same mechanism. The error handler supports a second "add-on" message table for this purpose. To define an addon table, set the pointer err->addon_message_table and the message numbers err->first_addon_message and err->last_addon_message. If you number the addon messages beginning at 1000 or so, you won't have to worry about conflicts with the library's built-in messages. See the sample applications cjpeg/djpeg for an example of using addon messages (the addon messages are defined in cderror.h).

Actual invocation of the error handler is done via macros defined in jerror.h:

ERREXITn(...) for fatal errors

WARNMSn(...) for corrupt-data warnings

TRACEMSn(...) for trace and informational messages.

These macros store the message code and any additional parameters into the error handler struct, then invoke the error_exit() or emit_message() method.

The variants of each macro are for varying numbers of additional parameters. The additional parameters are inserted into the generated message using standard printf() format codes.

See jerror.h and jerror.c for further details.

Compressed data handling (source and destination managers)

The JPEG compression library sends its compressed data to a "destination manager" module. The default destination manager just writes the data to a memory buffer or to a stdio stream, but you can provide your own manager to do something else. Similarly, the decompression library calls a "source manager" to obtain the compressed data; you can provide your own source manager if you want the data to come from somewhere other than a memory buffer or a stdio stream.

In both cases, compressed data is processed a bufferload at a time: the destination or source manager provides a work buffer, and the library invokes the manager only when the buffer is filled or emptied. (You could define a one-character buffer to force the manager to be invoked for each byte, but that would be rather inefficient.) The buffer's size and location are controlled by the manager, not by the library. For example, the memory source manager just makes the buffer pointer and length point to the original data in memory. In this case the buffer-reload procedure will be invoked only if the decompressor ran off the end of the datastream, which would indicate an erroneous datastream.

The work buffer is defined as an array of datatype JOCTET, which is generally "char" or "unsigned char". On a machine where char is not exactly 8 bits wide, you must define JOCTET as a wider data type and then modify the data source and destination modules to transcribe the work arrays into 8-bit units on external storage.

A data destination manager struct contains a pointer and count defining the next byte to write in the work buffer and the remaining free space:

```
JOCTET * next_output_byte; /* => next byte to write in buffer */
size_t free_in_buffer;    /* # of byte spaces remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is filled. The manager's empty_output_buffer method must reset the pointer and count. The manager is expected to remember the buffer's starting address and total size in private fields not visible to the library.

A data destination manager provides three methods:

`init_destination (j_compress_ptr cinfo)`

Initialize destination. This is called by `jpeg_start_compress()` before any data is actually written. It must initialize `next_output_byte` and `free_in_buffer`. `free_in_buffer` must be initialized to a positive value.

`empty_output_buffer (j_compress_ptr cinfo)`

This is called whenever the buffer has filled (`free_in_buffer` reaches zero). In typical applications, it should write out the *entire* buffer (use the saved start address and buffer length; ignore the current state of `next_output_byte` and `free_in_buffer`). Then reset the pointer & count to the start of the buffer, and return TRUE indicating that the buffer has been dumped. `free_in_buffer` must be set to a positive value when TRUE is returned. A FALSE return should only be used when I/O suspension is desired (this operating mode is discussed in the next section).

`term_destination (j_compress_ptr cinfo)`

Terminate destination --- called by `jpeg_finish_compress()` after all data has been written. In most applications, this must flush any data remaining in the buffer. Use either `next_output_byte` or `free_in_buffer` to determine how much data is in the buffer.

`term_destination()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the destination manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_destination_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "dest" field of the JPEG compression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_dest()` or `jpeg_mem_dest()` routines of the supplied destination managers.

Decompression source managers follow a parallel design, but with some additional frammishes. The source manager struct contains a pointer and count defining the next byte to read from the work buffer and the number of bytes remaining:

```
const JOCTET * next_input_byte; /* => next byte to read from buffer */
size_t bytes_in_buffer;        /* # of bytes remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is emptied. The manager's `fill_input_buffer` method must reset the pointer and count. In most applications, the manager must remember the buffer's starting address and total size in private fields not visible to the library.

A data source manager provides five methods:

`init_source (j_decompress_ptr cinfo)`

Initialize source. This is called by `jpeg_read_header()` before any data is actually read. Unlike `init_destination()`, it may leave `bytes_in_buffer` set to 0 (in which case a `fill_input_buffer()` call will occur immediately).

`fill_input_buffer (j_decompress_ptr cinfo)`

This is called whenever `bytes_in_buffer` has reached zero and more data is wanted. In typical applications, it should read fresh data into the buffer (ignoring the current state of `next_input_byte` and `bytes_in_buffer`), reset the pointer & count to the start of the buffer, and return TRUE indicating that the buffer has been reloaded. It is not necessary to fill the buffer entirely, only to obtain at least one more byte. `bytes_in_buffer` MUST be set to a positive value if TRUE is returned. A FALSE return should only be used when I/O suspension is desired (this mode is discussed in the next section).

`skip_input_data (j_decompress_ptr cinfo, long num_bytes)`

Skip `num_bytes` worth of data. The buffer pointer and count should be advanced over `num_bytes` input bytes, refilling the buffer as needed. This is used to skip over a potentially large amount of uninteresting data (such as an APPn marker). In some applications it may be possible to optimize away the reading of the skipped data, but it's not clear that being smart is worth much trouble; large skips are uncommon. `bytes_in_buffer` may be zero on return. A zero or negative skip count should be treated as a no-op.

`resync_to_restart (j_decompress_ptr cinfo, int desired)`

This routine is called only when the decompressor has failed to find a restart (RSTn) marker where one is expected. Its mission is to find a suitable point for resuming decompression. For most applications, we recommend that you just use the default resync procedure, `jpeg_resync_to_restart()`. However, if you are able to back up in the input data stream, or if you have a-priori knowledge about the likely location of restart markers, you may be able to do better. Read the `read_restart_marker()` and `jpeg_resync_to_restart()` routines in `jdmarker.c` if you think you'd like to implement your own resync procedure.

`term_source (j_decompress_ptr cinfo)`

Terminate source --- called by `jpeg_finish_decompress()` after all data has been read. Often a no-op.

For both `fill_input_buffer()` and `skip_input_data()`, there is no such thing as an EOF return. If the end of the file has been reached, the routine has a choice of exiting via `ERREXIT()` or inserting fake data into the buffer. In most cases, generating a warning message and inserting a fake EOI marker

is the best course of action --- this will allow the decompressor to output however much of the image is there. In pathological cases, the decompressor may swallow the EOI and again demand data ... just keep feeding it fake EOIs. `jdatasrc.c` illustrates the recommended error recovery behavior.

`term_source()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the source manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_source_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "src" field of the JPEG decompression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_src()` or `jpeg_mem_src()` routines of the supplied source managers.

For more information, consult the memory and stdio source and destination managers in `jdatasrc.c` and `jdatadst.c`.

I/O suspension

Some applications need to use the JPEG library as an incremental memory-to-memory filter: when the compressed data buffer is filled or emptied, they want control to return to the outer loop, rather than expecting that the buffer can be emptied or reloaded within the data source/destination manager subroutine. The library supports this need by providing an "I/O suspension" mode, which we describe in this section.

The I/O suspension mode is not a panacea: nothing is guaranteed about the maximum amount of time spent in any one call to the library, so it will not eliminate response-time problems in single-threaded applications. If you need guaranteed response time, we suggest you "bite the bullet" and implement a real multi-tasking capability.

To use I/O suspension, cooperation is needed between the calling application and the data source or destination manager; you will always need a custom source/destination manager. (Please read the previous section if you haven't already.) The basic idea is that the `empty_output_buffer()` or `fill_input_buffer()` routine is a no-op, merely returning FALSE to indicate that it has done nothing. Upon seeing this, the JPEG library suspends operation and returns to its caller. The surrounding application is responsible for emptying or refilling the work buffer before calling the JPEG library again.

Compression suspension:

For compression suspension, use an `empty_output_buffer()` routine that returns FALSE; typically it will not do anything else. This will cause the

compressor to return to the caller of `jpeg_write_scanlines()`, with the return value indicating that not all the supplied scanlines have been accepted. The application must make more room in the output buffer, adjust the output buffer pointer/count appropriately, and then call `jpeg_write_scanlines()` again, pointing to the first unconsumed scanline.

When forced to suspend, the compressor will backtrack to a convenient stopping point (usually the start of the current MCU); it will regenerate some output data when restarted. Therefore, although `empty_output_buffer()` is only called when the buffer is filled, you should NOT write out the entire buffer after a suspension. Write only the data up to the current position of `next_output_byte/free_in_buffer`. The data beyond that point will be regenerated after resumption.

Because of the backtracking behavior, a good-size output buffer is essential for efficiency; you don't want the compressor to suspend often. (In fact, an overly small buffer could lead to infinite looping, if a single MCU required more data than would fit in the buffer.) We recommend a buffer of at least several Kbytes. You may want to insert explicit code to ensure that you don't call `jpeg_write_scanlines()` unless there is a reasonable amount of space in the output buffer; in other words, flush the buffer before trying to compress more data.

The compressor does not allow suspension while it is trying to write JPEG markers at the beginning and end of the file. This means that:

- * At the beginning of a compression operation, there must be enough free space in the output buffer to hold the header markers (typically 600 or so bytes). The recommended buffer size is bigger than this anyway, so this is not a problem as long as you start with an empty buffer. However, this restriction might catch you if you insert large special markers, such as a JFIF thumbnail image, without flushing the buffer afterwards.
- * When you call `jpeg_finish_compress()`, there must be enough space in the output buffer to emit any buffered data and the final EOI marker. In the current implementation, half a dozen bytes should suffice for this, but for safety's sake we recommend ensuring that at least 100 bytes are free before calling `jpeg_finish_compress()`.

A more significant restriction is that `jpeg_finish_compress()` cannot suspend. This means you cannot use suspension with multi-pass operating modes, namely Huffman code optimization and multiple-scan output. Those modes write the whole file during `jpeg_finish_compress()`, which will certainly result in buffer overrun. (Note that this restriction applies only to compression, not decompression. The decompressor supports input suspension in all of its operating modes.)

Decompression suspension:

For decompression suspension, use a `fill_input_buffer()` routine that simply

returns FALSE (except perhaps during error recovery, as discussed below).

This will cause the decompressor to return to its caller with an indication that suspension has occurred. This can happen at four places:

- * `jpeg_read_header()`: will return `JPEG_SUSPENDED`.
- * `jpeg_start_decompress()`: will return FALSE, rather than its usual TRUE.
- * `jpeg_read_scanlines()`: will return the number of scanlines already completed (possibly 0).
- * `jpeg_finish_decompress()`: will return FALSE, rather than its usual TRUE.

The surrounding application must recognize these cases, load more data into the input buffer, and repeat the call. In the case of `jpeg_read_scanlines()`, increment the passed pointers past any scanlines successfully read.

Just as with compression, the decompressor will typically backtrack to a convenient restart point before suspending. When `fill_input_buffer()` is called, `next_input_byte/bytes_in_buffer` point to the current restart point, which is where the decompressor will backtrack to if FALSE is returned. The data beyond that position must NOT be discarded if you suspend; it needs to be re-read upon resumption. In most implementations, you'll need to shift this data down to the start of your work buffer and then load more data after it. Again, this behavior means that a several-Kbyte work buffer is essential for decent performance; furthermore, you should load a reasonable amount of new data before resuming decompression. (If you loaded, say, only one new byte each time around, you could waste a LOT of cycles.)

The `skip_input_data()` source manager routine requires special care in a suspension scenario. This routine is NOT granted the ability to suspend the decompressor; it can decrement `bytes_in_buffer` to zero, but no more. If the requested skip distance exceeds the amount of data currently in the input buffer, then `skip_input_data()` must set `bytes_in_buffer` to zero and record the additional skip distance somewhere else. The decompressor will immediately call `fill_input_buffer()`, which should return FALSE, which will cause a suspension return. The surrounding application must then arrange to discard the recorded number of bytes before it resumes loading the input buffer. (Yes, this design is rather baroque, but it avoids complexity in the far more common case where a non-suspending source manager is used.)

If the input data has been exhausted, we recommend that you emit a warning and insert dummy EOI markers just as a non-suspending data source manager would do. This can be handled either in the surrounding application logic or within `fill_input_buffer()`; the latter is probably more efficient. If `fill_input_buffer()` knows that no more data is available, it can set the pointer/count to point to a dummy EOI marker and then return TRUE just as though it had read more data in a non-suspending situation.

The decompressor does not attempt to suspend within standard JPEG markers; instead it will backtrack to the start of the marker and reprocess the whole marker next time. Hence the input buffer must be large enough to hold the longest standard marker in the file. Standard JPEG markers should normally

not exceed a few hundred bytes each (DHT tables are typically the longest). We recommend at least a 2K buffer for performance reasons, which is much larger than any correct marker is likely to be. For robustness against damaged marker length counts, you may wish to insert a test in your application for the case that the input buffer is completely full and yet the decoder has suspended without consuming any data --- otherwise, if this situation did occur, it would lead to an endless loop. (The library can't provide this test since it has no idea whether "the buffer is full", or even whether there is a fixed-size input buffer.)

The input buffer would need to be 64K to allow for arbitrary COM or APPn markers, but these are handled specially: they are either saved into allocated memory, or skipped over by calling `skip_input_data()`. In the former case, suspension is handled correctly, and in the latter case, the problem of buffer overrun is placed on `skip_input_data`'s shoulders, as explained above. Note that if you provide your own marker handling routine for large markers, you should consider how to deal with buffer overflow.

Multiple-buffer management:

In some applications it is desirable to store the compressed data in a linked list of buffer areas, so as to avoid data copying. This can be handled by having `empty_output_buffer()` or `fill_input_buffer()` set the pointer and count to reference the next available buffer; `FALSE` is returned only if no more buffers are available. Although seemingly straightforward, there is a pitfall in this approach: the backtrack that occurs when `FALSE` is returned could back up into an earlier buffer. For example, when `fill_input_buffer()` is called, the current pointer & count indicate the backtrack restart point. Since `fill_input_buffer()` will set the pointer and count to refer to a new buffer, the restart position must be saved somewhere else. Suppose a second call to `fill_input_buffer()` occurs in the same library call, and no additional input data is available, so `fill_input_buffer` must return `FALSE`. If the JPEG library has not moved the pointer/count forward in the current buffer, then *the correct restart point is the saved position in the prior buffer*. Prior buffers may be discarded only after the library establishes a restart point within a later buffer. Similar remarks apply for output into a chain of buffers.

The library will never attempt to backtrack over a `skip_input_data()` call, so any skipped data can be permanently discarded. You still have to deal with the case of skipping not-yet-received data, however.

It's much simpler to use only a single buffer; when `fill_input_buffer()` is called, move any unconsumed data (beyond the current pointer/count) down to the beginning of this buffer and then load new data into the remaining buffer space. This approach requires a little more data copying but is far easier to get right.

Progressive JPEG rearranges the stored data into a series of scans of increasing quality. In situations where a JPEG file is transmitted across a slow communications link, a decoder can generate a low-quality image very quickly from the first scan, then gradually improve the displayed quality as more scans are received. The final image after all scans are complete is identical to that of a regular (sequential) JPEG file of the same quality setting. Progressive JPEG files are often slightly smaller than equivalent sequential JPEG files, but the possibility of incremental display is the main reason for using progressive JPEG.

The IJG encoder library generates progressive JPEG files when given a suitable "scan script" defining how to divide the data into scans. Creation of progressive JPEG files is otherwise transparent to the encoder. Progressive JPEG files can also be read transparently by the decoder library. If the decoding application simply uses the library as defined above, it will receive a final decoded image without any indication that the file was progressive. Of course, this approach does not allow incremental display. To perform incremental display, an application needs to use the decoder library's "buffered-image" mode, in which it receives a decoded image multiple times.

Each displayed scan requires about as much work to decode as a full JPEG image of the same size, so the decoder must be fairly fast in relation to the data transmission rate in order to make incremental display useful. However, it is possible to skip displaying the image and simply add the incoming bits to the decoder's coefficient buffer. This is fast because only Huffman decoding need be done, not IDCT, upsampling, colorspace conversion, etc. The IJG decoder library allows the application to switch dynamically between displaying the image and simply absorbing the incoming bits. A properly coded application can automatically adapt the number of display passes to suit the time available as the image is received. Also, a final higher-quality display cycle can be performed from the buffered data after the end of the file is reached.

Progressive compression:

To create a progressive JPEG file (or a multiple-scan sequential JPEG file), set the scan_info cinfo field to point to an array of scan descriptors, and perform compression as usual. Instead of constructing your own scan list, you can call the jpeg_simple_progression() helper routine to create a recommended progression sequence; this method should be used by all applications that don't want to get involved in the nitty-gritty of progressive scan sequence design. (If you want to provide user control of scan sequences, you may wish to borrow the scan script reading code found

in rdswitch.c, so that you can read scan script files just like cjpeg's.) When scan_info is not NULL, the compression library will store DCT'd data into a buffer array as jpeg_write_scanlines() is called, and will emit all the requested scans during jpeg_finish_compress(). This implies that multiple-scan output cannot be created with a suspending data destination manager, since jpeg_finish_compress() does not support suspension. We should also note that the compressor currently forces Huffman optimization mode when creating a progressive JPEG file, because the default Huffman tables are unsuitable for progressive files.

Progressive decompression:

When buffered-image mode is not used, the decoder library will read all of a multi-scan file during jpeg_start_decompress(), so that it can provide a final decoded image. (Here "multi-scan" means either progressive or multi-scan sequential.) This makes multi-scan files transparent to the decoding application. However, existing applications that used suspending input with version 5 of the IJG library will need to be modified to check for a suspension return from jpeg_start_decompress().

To perform incremental display, an application must use the library's buffered-image mode. This is described in the next section.

Buffered-image mode

In buffered-image mode, the library stores the partially decoded image in a coefficient buffer, from which it can be read out as many times as desired. This mode is typically used for incremental display of progressive JPEG files, but it can be used with any JPEG file. Each scan of a progressive JPEG file adds more data (more detail) to the buffered image. The application can display in lockstep with the source file (one display pass per input scan), or it can allow input processing to outrun display processing. By making input and display processing run independently, it is possible for the application to adapt progressive display to a wide range of data transmission rates.

The basic control flow for buffered-image decoding is

```
jpeg_create_decompress()
set data source
jpeg_read_header()
set overall decompression parameters
cinfo.buffered_image = TRUE; /* select buffered-image mode */
jpeg_start_decompress()
for (each output pass) {
    adjust output decompression parameters if required
```



```

jpeg_start_output() /* start a new output pass */
for (all scanlines in image) {
    jpeg_read_scanlines()
    display scanlines
}
jpeg_finish_output() /* terminate output pass */
}
jpeg_finish_decompress()
jpeg_destroy_decompress()

```

This differs from ordinary unbuffered decoding in that there is an additional level of looping. The application can choose how many output passes to make and how to display each pass.

The simplest approach to displaying progressive images is to do one display pass for each scan appearing in the input file. In this case the outer loop condition is typically

```
while (! jpeg_input_complete(&cinfo))
```

and the start-output call should read

```
jpeg_start_output(&cinfo, cinfo.input_scan_number);
```

The second parameter to `jpeg_start_output()` indicates which scan of the input file is to be displayed; the scans are numbered starting at 1 for this purpose. (You can use a loop counter starting at 1 if you like, but using the library's input scan counter is easier.) The library automatically reads data as necessary to complete each requested scan, and `jpeg_finish_output()` advances to the next scan or end-of-image marker (hence `input_scan_number` will be incremented by the time control arrives back at `jpeg_start_output()`). With this technique, data is read from the input file only as needed, and input and output processing run in lockstep.

After reading the final scan and reaching the end of the input file, the buffered image remains available; it can be read additional times by repeating the `jpeg_start_output()/jpeg_read_scanlines()/jpeg_finish_output()` sequence. For example, a useful technique is to use fast one-pass color quantization for display passes made while the image is arriving, followed by a final display pass using two-pass quantization for highest quality. This is done by changing the library parameters before the final output pass. Changing parameters between passes is discussed in detail below.

In general the last scan of a progressive file cannot be recognized as such until after it is read, so a post-input display pass is the best approach if you want special processing in the final pass.

When done with the image, be sure to call `jpeg_finish_decompress()` to release the buffered image (or just use `jpeg_destroy_decompress()`).

If input data arrives faster than it can be displayed, the application can cause the library to decode input data in advance of what's needed to produce

output. This is done by calling the routine `jpeg_consume_input()`.

The return value is one of the following:

`JPEG_REACHED_SOS`: reached an SOS marker (the start of a new scan)

`JPEG_REACHED_EOI`: reached the EOI marker (end of image)

`JPEG_ROW_COMPLETED`: completed reading one MCU row of compressed data

`JPEG_SCAN_COMPLETED`: completed reading last MCU row of current scan

`JPEG_SUSPENDED`: suspended before completing any of the above

(`JPEG_SUSPENDED` can occur only if a suspending data source is used.) This

routine can be called at any time after initializing the JPEG object. It

reads some additional data and returns when one of the indicated significant

events occurs. (If called after the EOI marker is reached, it will

immediately return `JPEG_REACHED_EOI` without attempting to read more data.)

The library's output processing will automatically call `jpeg_consume_input()`

whenever the output processing overtakes the input; thus, simple lockstep

display requires no direct calls to `jpeg_consume_input()`. But by adding

calls to `jpeg_consume_input()`, you can absorb data in advance of what is

being displayed. This has two benefits:

- * You can limit buildup of unprocessed data in your input buffer.

- * You can eliminate extra display passes by paying attention to the state of the library's input processing.

The first of these benefits only requires interspersing calls to

`jpeg_consume_input()` with your display operations and any other processing

you may be doing. To avoid wasting cycles due to backtracking, it's best to

call `jpeg_consume_input()` only after a hundred or so new bytes have arrived.

This is discussed further under "I/O suspension", above. (Note: the JPEG

library currently is not thread-safe. You must not call `jpeg_consume_input()`

from one thread of control if a different library routine is working on the

same JPEG object in another thread.)

When input arrives fast enough that more than one new scan is available

before you start a new output pass, you may as well skip the output pass

corresponding to the completed scan. This occurs for free if you pass

`cinfo.input_scan_number` as the target scan number to `jpeg_start_output()`.

The `input_scan_number` field is simply the index of the scan currently being

consumed by the input processor. You can ensure that this is up-to-date by

emptying the input buffer just before calling `jpeg_start_output()`: call

`jpeg_consume_input()` repeatedly until it returns `JPEG_SUSPENDED` or

`JPEG_REACHED_EOI`.

The target scan number passed to `jpeg_start_output()` is saved in the

`cinfo.output_scan_number` field. The library's output processing calls

`jpeg_consume_input()` whenever the current input scan number and row within

that scan is less than or equal to the current output scan number and row.

Thus, input processing can "get ahead" of the output processing but is not

allowed to "fall behind". You can achieve several different effects by

manipulating this interlock rule. For example, if you pass a target scan

number greater than the current input scan number, the output processor will wait until that scan starts to arrive before producing any output. (To avoid an infinite loop, the target scan number is automatically reset to the last scan number when the end of image is reached. Thus, if you specify a large target scan number, the library will just absorb the entire input file and then perform an output pass. This is effectively the same as what `jpeg_start_decompress()` does when you don't select buffered-image mode.) When you pass a target scan number equal to the current input scan number, the image is displayed no faster than the current input scan arrives. The final possibility is to pass a target scan number less than the current input scan number; this disables the input/output interlock and causes the output processor to simply display whatever it finds in the image buffer, without waiting for input. (However, the library will not accept a target scan number less than one, so you can't avoid waiting for the first scan.)

When data is arriving faster than the output display processing can advance through the image, `jpeg_consume_input()` will store data into the buffered image beyond the point at which the output processing is reading data out again. If the input arrives fast enough, it may "wrap around" the buffer to the point where the input is more than one whole scan ahead of the output. If the output processing simply proceeds through its display pass without paying attention to the input, the effect seen on-screen is that the lower part of the image is one or more scans better in quality than the upper part. Then, when the next output scan is started, you have a choice of what target scan number to use. The recommended choice is to use the current input scan number at that time, which implies that you've skipped the output scans corresponding to the input scans that were completed while you processed the previous output scan. In this way, the decoder automatically adapts its speed to the arriving data, by skipping output scans as necessary to keep up with the arriving data.

When using this strategy, you'll want to be sure that you perform a final output pass after receiving all the data; otherwise your last display may not be full quality across the whole screen. So the right outer loop logic is something like this:

```
do {
    absorb any waiting input by calling jpeg_consume_input()
    final_pass = jpeg_input_complete(&cinfo);
    adjust output decompression parameters if required
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
} while (! final_pass);
```

rather than quitting as soon as `jpeg_input_complete()` returns TRUE. This arrangement makes it simple to use higher-quality decoding parameters for the final pass. But if you don't want to use special parameters for the final pass, the right loop logic is like this:

```
for (;;) {
```



```

    absorb any waiting input by calling jpeg_consume_input()
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
    if (jpeg_input_complete(&cinfo) &&
        cinfo.input_scan_number == cinfo.output_scan_number)
        break;
}

```

In this case you don't need to know in advance whether an output pass is to be the last one, so it's not necessary to have reached EOF before starting the final output pass; rather, what you want to test is whether the output pass was performed in sync with the final input scan. This form of the loop will avoid an extra output pass whenever the decoder is able (or nearly able) to keep up with the incoming data.

When the data transmission speed is high, you might begin a display pass, then find that much or all of the file has arrived before you can complete the pass. (You can detect this by noting the JPEG_REACHED_EOI return code from jpeg_consume_input(), or equivalently by testing jpeg_input_complete().) In this situation you may wish to abort the current display pass and start a new one using the newly arrived information. To do so, just call jpeg_finish_output() and then start a new pass with jpeg_start_output().

A variant strategy is to abort and restart display if more than one complete scan arrives during an output pass; this can be detected by noting JPEG_REACHED_SOS returns and/or examining cinfo.input_scan_number. This idea should be employed with caution, however, since the display process might never get to the bottom of the image before being aborted, resulting in the lower part of the screen being several passes worse than the upper. In most cases it's probably best to abort an output pass only if the whole file has arrived and you want to begin the final output pass immediately.

When receiving data across a communication link, we recommend always using the current input scan number for the output target scan number; if a higher-quality final pass is to be done, it should be started (aborting any incomplete output pass) as soon as the end of file is received. However, many other strategies are possible. For example, the application can examine the parameters of the current input scan and decide whether to display it or not. If the scan contains only chroma data, one might choose not to use it as the target scan, expecting that the scan will be small and will arrive quickly. To skip to the next scan, call jpeg_consume_input() until it returns JPEG_REACHED_SOS or JPEG_REACHED_EOI. Or just use the next higher number as the target scan for jpeg_start_output(); but that method doesn't let you inspect the next scan's parameters before deciding to display it.

In buffered-image mode, jpeg_start_decompress() never performs input and thus never suspends. An application that uses input suspension with

buffered-image mode must be prepared for suspension returns from these routines:

- * `jpeg_start_output()` performs input only if you request 2-pass quantization and the target scan isn't fully read yet. (This is discussed below.)

- * `jpeg_read_scanlines()`, as always, returns the number of scanlines that it was able to produce before suspending.

- * `jpeg_finish_output()` will read any markers following the target scan, up to the end of the file or the SOS marker that begins another scan. (But it reads no input if `jpeg_consume_input()` has already reached the end of the file or a SOS marker beyond the target output scan.)

- * `jpeg_finish_decompress()` will read until the end of file, and thus can suspend if the end hasn't already been reached (as can be tested by calling `jpeg_input_complete()`).

`jpeg_start_output()`, `jpeg_finish_output()`, and `jpeg_finish_decompress()` all return TRUE if they completed their tasks, FALSE if they had to suspend.

In the event of a FALSE return, the application must load more input data and repeat the call. Applications that use non-suspending data sources need not check the return values of these three routines.

It is possible to change decoding parameters between output passes in the buffered-image mode. The decoder library currently supports only very limited changes of parameters. ONLY THE FOLLOWING parameter changes are allowed after `jpeg_start_decompress()` is called:

- * `dct_method` can be changed before each call to `jpeg_start_output()`.

For example, one could use a fast DCT method for early scans, changing to a higher quality method for the final scan.

- * `dither_mode` can be changed before each call to `jpeg_start_output()`; of course this has no impact if not using color quantization. Typically one would use ordered dither for initial passes, then switch to Floyd-Steinberg dither for the final pass. Caution: changing dither mode can cause more memory to be allocated by the library. Although the amount of memory involved is not large (a scanline or so), it may cause the initial `max_memory_to_use` specification to be exceeded, which in the worst case would result in an out-of-memory failure.

- * `do_block_smoothing` can be changed before each call to `jpeg_start_output()`. This setting is relevant only when decoding a progressive JPEG image. During the first DC-only scan, block smoothing provides a very "fuzzy" look instead of the very "blocky" look seen without it; which is better seems a matter of personal taste. But block smoothing is nearly always a win during later stages, especially when decoding a successive-approximation image: smoothing helps to hide the slight blockiness that otherwise shows up on smooth gradients until the lowest coefficient bits are sent.

- * Color quantization mode can be changed under the rules described below. You *cannot* change between full-color and quantized output (because that would alter the required I/O buffer sizes), but you can change which quantization method is used.

When generating color-quantized output, changing quantization method is a very useful way of switching between high-speed and high-quality display.

The library allows you to change among its three quantization methods:

1. Single-pass quantization to a fixed color cube.

Selected by `cinfo.two_pass_quantize = FALSE` and `cinfo.colormap = NULL`.

2. Single-pass quantization to an application-supplied colormap.

Selected by setting `cinfo.colormap` to point to the colormap (the value of `two_pass_quantize` is ignored); also set `cinfo.actual_number_of_colors`.

3. Two-pass quantization to a colormap chosen specifically for the image.

Selected by `cinfo.two_pass_quantize = TRUE` and `cinfo.colormap = NULL`.

(This is the default setting selected by `jpeg_read_header`, but it is probably NOT what you want for the first pass of progressive display!)

These methods offer successively better quality and lesser speed. However, only the first method is available for quantizing in non-RGB color spaces.

IMPORTANT: because the different quantizer methods have very different working-storage requirements, the library requires you to indicate which one(s) you intend to use before you call `jpeg_start_decompress()`. (If we did not require this, the `max_memory_to_use` setting would be a complete fiction.)

You do this by setting one or more of these three `cinfo` fields to `TRUE`:

`enable_1pass_quant` Fixed color cube colormap

`enable_external_quant` Externally-supplied colormap

`enable_2pass_quant` Two-pass custom colormap

All three are initialized `FALSE` by `jpeg_read_header()`. But

`jpeg_start_decompress()` automatically sets `TRUE` the one selected by the current `two_pass_quantize` and `colormap` settings, so you only need to set the enable flags for any other quantization methods you plan to change to later.

After setting the enable flags correctly at `jpeg_start_decompress()` time, you can change to any enabled quantization method by setting `two_pass_quantize` and `colormap` properly just before calling `jpeg_start_output()`. The following special rules apply:

1. You must explicitly set `cinfo.colormap` to `NULL` when switching to 1-pass or 2-pass mode from a different mode, or when you want the 2-pass quantizer to be re-run to generate a new colormap.

2. To switch to an external colormap, or to change to a different external colormap than was used on the prior pass, you must call `jpeg_new_colormap()` after setting `cinfo.colormap`.

NOTE: if you want to use the same colormap as was used in the prior pass, you should not do either of these things. This will save some nontrivial switchover costs.

(These requirements exist because `cinfo.colormap` will always be non-`NULL` after completing a prior output pass, since both the 1-pass and 2-pass quantizers set it to point to their output colormaps. Thus you have to do one of these two things to notify the library that something has changed. Yup, it's a bit klugy, but it's necessary to do it this way for backwards compatibility.)

Note that in buffered-image mode, the library generates any requested colormap during `jpeg_start_output()`, not during `jpeg_start_decompress()`.

When using two-pass quantization, `jpeg_start_output()` makes a pass over the buffered image to determine the optimum color map; it therefore may take a significant amount of time, whereas ordinarily it does little work. The progress monitor hook is called during this pass, if defined. It is also important to realize that if the specified target scan number is greater than or equal to the current input scan number, `jpeg_start_output()` will attempt to consume input as it makes this pass. If you use a suspending data source, you need to check for a FALSE return from `jpeg_start_output()` under these conditions. The combination of 2-pass quantization and a not-yet-fully-read target scan is the only case in which `jpeg_start_output()` will consume input.

Application authors who support buffered-image mode may be tempted to use it for all JPEG images, even single-scan ones. This will work, but it is inefficient: there is no need to create an image-sized coefficient buffer for single-scan images. Requesting buffered-image mode for such an image wastes memory. Worse, it can cost time on large images, since the buffered data has to be swapped out or written to a temporary file. If you are concerned about maximum performance on baseline JPEG files, you should use buffered-image mode only when the incoming file actually has multiple scans. This can be tested by calling `jpeg_has_multiple_scans()`, which will return a correct result at any time after `jpeg_read_header()` completes.

It is also worth noting that when you use `jpeg_consume_input()` to let input processing get ahead of output processing, the resulting pattern of access to the coefficient buffer is quite nonsequential. It's best to use the memory manager `jmemnobs.c` if you can (ie, if you have enough real or virtual main memory). If not, at least make sure that `max_memory_to_use` is set as high as possible. If the JPEG memory manager has to use a temporary file, you will probably see a lot of disk traffic and poor performance. (This could be improved with additional work on the memory manager, but we haven't gotten around to it yet.)

In some applications it may be convenient to use `jpeg_consume_input()` for all input processing, including reading the initial markers; that is, you may wish to call `jpeg_consume_input()` instead of `jpeg_read_header()` during startup. This works, but note that you must check for `JPEG_REACHED_SOS` and `JPEG_REACHED_EOI` return codes as the equivalent of `jpeg_read_header's` codes. Once the first SOS marker has been reached, you must call `jpeg_start_decompress()` before `jpeg_consume_input()` will consume more input; it'll just keep returning `JPEG_REACHED_SOS` until you do. If you read a tables-only file this way, `jpeg_consume_input()` will return `JPEG_REACHED_EOI` without ever returning `JPEG_REACHED_SOS`; be sure to check for this case. If this happens, the decompressor will not read any more input until you call `jpeg_abort()` to reset it. It is OK to call `jpeg_consume_input()` even when not

using buffered-image mode, but in that case it's basically a no-op after the initial markers have been read: it will just return JPEG_SUSPENDED.

Abbreviated datastreams and multiple images

A JPEG compression or decompression object can be reused to process multiple images. This saves a small amount of time per image by eliminating the "create" and "destroy" operations, but that isn't the real purpose of the feature. Rather, reuse of an object provides support for abbreviated JPEG datastreams. Object reuse can also simplify processing a series of images in a single input or output file. This section explains these features.

A JPEG file normally contains several hundred bytes worth of quantization and Huffman tables. In a situation where many images will be stored or transmitted with identical tables, this may represent an annoying overhead. The JPEG standard therefore permits tables to be omitted. The standard defines three classes of JPEG datastreams:

- * "Interchange" datastreams contain an image and all tables needed to decode the image. These are the usual kind of JPEG file.
- * "Abbreviated image" datastreams contain an image, but are missing some or all of the tables needed to decode that image.
- * "Abbreviated table specification" (henceforth "tables-only") datastreams contain only table specifications.

To decode an abbreviated image, it is necessary to load the missing table(s) into the decoder beforehand. This can be accomplished by reading a separate tables-only file. A variant scheme uses a series of images in which the first image is an interchange (complete) datastream, while subsequent ones are abbreviated and rely on the tables loaded by the first image. It is assumed that once the decoder has read a table, it will remember that table until a new definition for the same table number is encountered.

It is the application designer's responsibility to figure out how to associate the correct tables with an abbreviated image. While abbreviated datastreams can be useful in a closed environment, their use is strongly discouraged in any situation where data exchange with other applications might be needed. Caveat designer.

The JPEG library provides support for reading and writing any combination of tables-only datastreams and abbreviated images. In both compression and decompression objects, a quantization or Huffman table will be retained for the lifetime of the object, unless it is overwritten by a new table definition.

To create abbreviated image datastreams, it is only necessary to tell the compressor not to emit some or all of the tables it is using. Each quantization and Huffman table struct contains a boolean field "sent_table",

which normally is initialized to FALSE. For each table used by the image, the header-writing process emits the table and sets `sent_table = TRUE` unless it is already TRUE. (In normal usage, this prevents outputting the same table definition multiple times, as would otherwise occur because the chroma components typically share tables.) Thus, setting this field to TRUE before calling `jpeg_start_compress()` will prevent the table from being written at all.

If you want to create a "pure" abbreviated image file containing no tables, just call `"jpeg_suppress_tables(&cinfo, TRUE)"` after constructing all the tables. If you want to emit some but not all tables, you'll need to set the individual `sent_table` fields directly.

To create an abbreviated image, you must also call `jpeg_start_compress()` with a second parameter of FALSE, not TRUE. Otherwise `jpeg_start_compress()` will force all the `sent_table` fields to FALSE. (This is a safety feature to prevent abbreviated images from being created accidentally.)

To create a tables-only file, perform the same parameter setup that you normally would, but instead of calling `jpeg_start_compress()` and so on, call `jpeg_write_tables(&cinfo)`. This will write an abbreviated datastream containing only SOI, DQT and/or DHT markers, and EOI. All the quantization and Huffman tables that are currently defined in the compression object will be emitted unless their `sent_tables` flag is already TRUE, and then all the `sent_tables` flags will be set TRUE.

A sure-fire way to create matching tables-only and abbreviated image files is to proceed as follows:

```
create JPEG compression object
set JPEG parameters
set destination to tables-only file
jpeg_write_tables(&cinfo);
set destination to image file
jpeg_start_compress(&cinfo, FALSE);
write data...
jpeg_finish_compress(&cinfo);
```

Since the JPEG parameters are not altered between writing the table file and the abbreviated image file, the same tables are sure to be used. Of course, you can repeat the `jpeg_start_compress()` ... `jpeg_finish_compress()` sequence many times to produce many abbreviated image files matching the table file.

You cannot suppress output of the computed Huffman tables when Huffman optimization is selected. (If you could, there'd be no way to decode the image...) Generally, you don't want to set `optimize_coding = TRUE` when you are trying to produce abbreviated files.

In some cases you might want to compress an image using tables which are not stored in the application, but are defined in an interchange or tables-only file readable by the application. This can be done by setting up a JPEG decompression object to read the specification file, then copying the tables into your compression object. See `jpeg_copy_critical_parameters()` for an example of copying quantization tables.

To read abbreviated image files, you simply need to load the proper tables into the decompression object before trying to read the abbreviated image. If the proper tables are stored in the application program, you can just allocate the table structs and fill in their contents directly. For example, to load a fixed quantization table into table slot "n":

```
if (cinfo.quant_tbl_ptrs[n] == NULL)
    cinfo.quant_tbl_ptrs[n] = jpeg_alloc_quant_table((j_common_ptr) &cinfo);
quant_ptr = cinfo.quant_tbl_ptrs[n]; /* quant_ptr is JQUANT_TBL */
for (i = 0; i < 64; i++) {
    /* Qtable[] is desired quantization table, in natural array order */
    quant_ptr->quantval[i] = Qtable[i];
}
```

Code to load a fixed Huffman table is typically (for AC table "n"):

```
if (cinfo.ac_huff_tbl_ptrs[n] == NULL)
    cinfo.ac_huff_tbl_ptrs[n] = jpeg_alloc_huff_table((j_common_ptr) &cinfo);
huff_ptr = cinfo.ac_huff_tbl_ptrs[n]; /* huff_ptr is JHUFF_TBL */
for (i = 1; i <= 16; i++) {
    /* counts[i] is number of Huffman codes of length i bits, i=1..16 */
    huff_ptr->bits[i] = counts[i];
}
for (i = 0; i < 256; i++) {
    /* symbols[] is the list of Huffman symbols, in code-length order */
    huff_ptr->huffval[i] = symbols[i];
}
```

(Note that trying to set `cinfo.quant_tbl_ptrs[n]` to point directly at a constant `JQUANT_TBL` object is not safe. If the incoming file happened to contain a quantization table definition, your master table would get overwritten! Instead allocate a working table copy and copy the master table into it, as illustrated above. Ditto for Huffman tables, of course.)

You might want to read the tables from a tables-only file, rather than hard-wiring them into your application. The `jpeg_read_header()` call is sufficient to read a tables-only file. You must pass a second parameter of `FALSE` to indicate that you do not require an image to be present. Thus, the typical scenario is


```
create JPEG decompression object
set source to tables-only file
jpeg_read_header(&cinfo, FALSE);
set source to abbreviated image file
jpeg_read_header(&cinfo, TRUE);
set decompression parameters
jpeg_start_decompress(&cinfo);
read data...
jpeg_finish_decompress(&cinfo);
```

In some cases, you may want to read a file without knowing whether it contains an image or just tables. In that case, pass `FALSE` and check the return value from `jpeg_read_header()`: it will be `JPEG_HEADER_OK` if an image was found, `JPEG_HEADER_TABLES_ONLY` if only tables were found. (A third return value, `JPEG_SUSPENDED`, is possible when using a suspending data source manager.) Note that `jpeg_read_header()` will not complain if you read an abbreviated image for which you haven't loaded the missing tables; the missing-table check occurs later, in `jpeg_start_decompress()`.

It is possible to read a series of images from a single source file by repeating the `jpeg_read_header()` ... `jpeg_finish_decompress()` sequence, without releasing/recreating the JPEG object or the data source module. (If you did reinitialize, any partial bufferload left in the data source buffer at the end of one image would be discarded, causing you to lose the start of the next image.) When you use this method, stored tables are automatically carried forward, so some of the images can be abbreviated images that depend on tables from earlier images.

If you intend to write a series of images into a single destination file, you might want to make a specialized data destination module that doesn't flush the output buffer at `term_destination()` time. This would speed things up by some trifling amount. Of course, you'd need to remember to flush the buffer after the last image. You can make the later images be abbreviated ones by passing `FALSE` to `jpeg_start_compress()`.

Special markers

Some applications may need to insert or extract special data in the JPEG datastream. The JPEG standard provides marker types "COM" (comment) and "APP0" through "APP15" (application) to hold application-specific data. Unfortunately, the use of these markers is not specified by the standard. COM markers are fairly widely used to hold user-supplied text. The JFIF file format spec uses APP0 markers with specified initial strings to hold certain data. Adobe applications use APP14 markers beginning with the string "Adobe" for miscellaneous data. Other APPn markers are rarely seen, but might

contain almost anything.

If you wish to store user-supplied text, we recommend you use COM markers and place readable 7-bit ASCII text in them. Newline conventions are not standardized --- expect to find LF (Unix style), CR/LF (DOS style), or CR (Mac style). A robust COM reader should be able to cope with random binary garbage, including nulls, since some applications generate COM markers containing non-ASCII junk. (But yours should not be one of them.)

For program-supplied data, use an APPn marker, and be sure to begin it with an identifying string so that you can tell whether the marker is actually yours. It's probably best to avoid using APP0 or APP14 for any private markers. (NOTE: the upcoming SPIFF standard will use APP8 markers; we recommend you not use APP8 markers for any private purposes, either.)

Keep in mind that at most 65533 bytes can be put into one marker, but you can have as many markers as you like.

By default, the IJG compression library will write a JFIF APP0 marker if the selected JPEG colorspace is grayscale or YCbCr, or an Adobe APP14 marker if the selected colorspace is RGB, CMYK, or YCCK. You can disable this, but we don't recommend it. The decompression library will recognize JFIF and Adobe markers and will set the JPEG colorspace properly when one is found.

You can write special markers immediately following the datastream header by calling `jpeg_write_marker()` after `jpeg_start_compress()` and before the first call to `jpeg_write_scanlines()`. When you do this, the markers appear after the SOI and the JFIF APP0 and Adobe APP14 markers (if written), but before all else. Specify the marker type parameter as "JPEG_COM" for COM or "JPEG_APP0 + n" for APPn. (Actually, `jpeg_write_marker` will let you write any marker type, but we don't recommend writing any other kinds of marker.) For example, to write a user comment string pointed to by `comment_text`:

```
jpeg_write_marker(cinfo, JPEG_COM, comment_text, strlen(comment_text));
```

If it's not convenient to store all the marker data in memory at once, you can instead call `jpeg_write_m_header()` followed by multiple calls to `jpeg_write_m_byte()`. If you do it this way, it's your responsibility to call `jpeg_write_m_byte()` exactly the number of times given in the length parameter to `jpeg_write_m_header()`. (This method lets you empty the output buffer partway through a marker, which might be important when using a suspending data destination module. In any case, if you are using a suspending destination, you should flush its buffer after inserting any special markers. See "I/O suspension".)

Or, if you prefer to synthesize the marker byte sequence yourself, you can just cram it straight into the data destination module.

If you are writing JFIF 1.02 extension markers (thumbnail images), don't forget to set `cinfo.JFIF_minor_version = 2` so that the encoder will write the correct JFIF version number in the JFIF header marker. The library's default is to write version 1.01, but that's wrong if you insert any 1.02 extension markers. (We could probably get away with just defaulting to 1.02, but there used to be broken decoders that would complain about unknown minor version numbers. To reduce compatibility risks it's safest not to write 1.02 unless you are actually using 1.02 extensions.)

When reading, two methods of handling special markers are available:

1. You can ask the library to save the contents of COM and/or APPn markers into memory, and then examine them at your leisure afterwards.
2. You can supply your own routine to process COM and/or APPn markers on-the-fly as they are read.

The first method is simpler to use, especially if you are using a suspending data source; writing a marker processor that copes with input suspension is not easy (consider what happens if the marker is longer than your available input buffer). However, the second method conserves memory since the marker data need not be kept around after it's been processed.

For either method, you'd normally set up marker handling after creating a decompression object and before calling `jpeg_read_header()`, because the markers of interest will typically be near the head of the file and so will be scanned by `jpeg_read_header`. Once you've established a marker handling method, it will be used for the life of that decompression object (potentially many datastreams), unless you change it. Marker handling is determined separately for COM markers and for each APPn marker code.

To save the contents of special markers in memory, call `jpeg_save_markers(cinfo, marker_code, length_limit)` where `marker_code` is the marker type to save, `JPEG_COM` or `JPEG_APP0+n`. (To arrange to save all the special marker types, you need to call this routine 17 times, for COM and APP0-APP15.) If the incoming marker is longer than `length_limit` data bytes, only `length_limit` bytes will be saved; this parameter allows you to avoid chewing up memory when you only need to see the first few bytes of a potentially large marker. If you want to save all the data, set `length_limit` to `0xFFFF`; that is enough since marker lengths are only 16 bits. As a special case, setting `length_limit` to 0 prevents that marker type from being saved at all. (That is the default behavior, in fact.)

After `jpeg_read_header()` completes, you can examine the special markers by following the `cinfo->marker_list` pointer chain. All the special markers in the file appear in this list, in order of their occurrence in the file (but omitting any markers of types you didn't ask for). Both the original data length and the saved data length are recorded for each list entry; the latter will not exceed `length_limit` for the particular marker type. Note that these

lengths exclude the marker length word, whereas the stored representation within the JPEG file includes it. (Hence the maximum data length is really only 65533.)

It is possible that additional special markers appear in the file beyond the SOS marker at which `jpeg_read_header` stops; if so, the marker list will be extended during reading of the rest of the file. This is not expected to be common, however. If you are short on memory you may want to reset the length limit to zero for all marker types after finishing `jpeg_read_header`, to ensure that the `max_memory_to_use` setting cannot be exceeded due to addition of later markers.

The marker list remains stored until you call `jpeg_finish_decompress` or `jpeg_abort`, at which point the memory is freed and the list is set to empty. (`jpeg_destroy` also releases the storage, of course.)

Note that the library is internally interested in APP0 and APP14 markers; if you try to set a small nonzero length limit on these types, the library will silently force the length up to the minimum it wants. (But you can set a zero length limit to prevent them from being saved at all.) Also, in a 16-bit environment, the maximum length limit may be constrained to less than 65533 by `malloc()` limitations. It is therefore best not to assume that the effective length limit is exactly what you set it to be.

If you want to supply your own marker-reading routine, you do it by calling `jpeg_set_marker_processor()`. A marker processor routine must have the signature

```
boolean jpeg_marker_parser_method (j_decompress_ptr cinfo)
```

Although the marker code is not explicitly passed, the routine can find it in `cinfo->unread_marker`. At the time of call, the marker proper has been read from the data source module. The processor routine is responsible for reading the marker length word and the remaining parameter bytes, if any. Return TRUE to indicate success. (FALSE should be returned only if you are using a suspending data source and it tells you to suspend. See the standard marker processors in `jdmarker.c` for appropriate coding methods if you need to use a suspending data source.)

If you override the default APP0 or APP14 processors, it is up to you to recognize JFIF and Adobe markers if you want colorspace recognition to occur properly. We recommend copying and extending the default processors if you want to do that. (A better idea is to save these marker types for later examination by calling `jpeg_save_markers()`; that method doesn't interfere with the library's own processing of these markers.)

`jpeg_set_marker_processor()` and `jpeg_save_markers()` are mutually exclusive --- if you call one it overrides any previous call to the other, for the particular marker type specified.

A simple example of an external COM processor can be found in `djpeg.c`. Also, see `jpegtran.c` for an example of using `jpeg_save_markers`.

Raw (downsampled) image data

Some applications need to supply already-downsampled image data to the JPEG compressor, or to receive raw downsampled data from the decompressor. The library supports this requirement by allowing the application to write or read raw data, bypassing the normal preprocessing or postprocessing steps. The interface is different from the standard one and is somewhat harder to use. If your interest is merely in bypassing color conversion, we recommend that you use the standard interface and simply set `jpeg_color_space = in_color_space` (or `jpeg_color_space = out_color_space` for decompression). The mechanism described in this section is necessary only to supply or receive downsampled image data, in which not all components have the same dimensions.

To compress raw data, you must supply the data in the colorspace to be used in the JPEG file (please read the earlier section on Special color spaces) and downsampled to the sampling factors specified in the JPEG parameters. You must supply the data in the format used internally by the JPEG library, namely a JSAMPIMAGE array. This is an array of pointers to two-dimensional arrays, each of type JSAMPARRAY. Each 2-D array holds the values for one color component. This structure is necessary since the components are of different sizes. If the image dimensions are not a multiple of the MCU size, you must also pad the data correctly (usually, this is done by replicating the last column and/or row). The data must be padded to a multiple of a DCT block in each component: that is, each downsampled row must contain a multiple of `DCT_h_scaled_size` valid samples, and there must be a multiple of `DCT_v_scaled_size` sample rows for each component. (For applications such as conversion of digital TV images, the standard image size is usually a multiple of the DCT block size, so that no padding need actually be done.)

The procedure for compression of raw data is basically the same as normal compression, except that you call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. Before calling `jpeg_start_compress()`, you must do the following:

- * Set `cinfo->raw_data_in` to TRUE. (It is set FALSE by `jpeg_set_defaults()`.) This notifies the library that you will be supplying raw data.
- * Ensure `jpeg_color_space` is correct --- an explicit `jpeg_set_colorspace()` call is a good idea. Note that since color conversion is bypassed, `in_color_space` is ignored, except that `jpeg_set_defaults()` uses it to choose the default `jpeg_color_space` setting.
- * Ensure the sampling factors, `cinfo->comp_info[i].h_samp_factor` and

`cinfo->comp_info[i].v_samp_factor`, are correct. Since these indicate the dimensions of the data you are supplying, it's wise to set them explicitly, rather than assuming the library's defaults are what you want.

To pass raw data to the library, call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. The two routines work similarly except that `jpeg_write_raw_data` takes a JSAMPIMAGE data array rather than JSAMPARRAY. The scanlines count passed to and returned from `jpeg_write_raw_data` is measured in terms of the component with the largest `v_samp_factor`.

`jpeg_write_raw_data()` processes one MCU row per call, which is to say `v_samp_factor*min_DCT_v_scaled_size` sample rows of each component. The passed `num_lines` value must be at least `max_v_samp_factor*min_DCT_v_scaled_size`, and the return value will be exactly that amount (or possibly some multiple of that amount, in future library versions). This is true even on the last call at the bottom of the image; don't forget to pad your data as necessary.

The required dimensions of the supplied data can be computed for each component as

```
cinfo->comp_info[i].width_in_blocks *  
cinfo->comp_info[i].DCT_h_scaled_size  samples per row  
cinfo->comp_info[i].height_in_blocks *  
cinfo->comp_info[i].DCT_v_scaled_size  rows in image
```

after `jpeg_start_compress()` has initialized those fields. If the valid data is smaller than this, it must be padded appropriately. For some sampling factors and image sizes, additional dummy DCT blocks are inserted to make the image a multiple of the MCU dimensions. The library creates such dummy blocks itself; it does not read them from your supplied data. Therefore you need never pad by more than `DCT_scaled_size` samples.

An example may help here. Assume 2h2v downsampling of YCbCr data, that is

```
cinfo->comp_info[0].h_samp_factor = 2  for Y  
cinfo->comp_info[0].v_samp_factor = 2  
cinfo->comp_info[1].h_samp_factor = 1  for Cb  
cinfo->comp_info[1].v_samp_factor = 1  
cinfo->comp_info[2].h_samp_factor = 1  for Cr  
cinfo->comp_info[2].v_samp_factor = 1
```

and suppose that the nominal image dimensions (`cinfo->image_width` and `cinfo->image_height`) are 101x101 pixels. Then `jpeg_start_compress()` will compute `downsampled_width = 101` and `width_in_blocks = 13` for Y, `downsampled_width = 51` and `width_in_blocks = 7` for Cb and Cr (and the same for the height fields). You must pad the Y data to at least $13 \times 8 = 104$ columns and rows, the Cb/Cr data to at least $7 \times 8 = 56$ columns and rows. The MCU height is `max_v_samp_factor = 2` DCT rows so you must pass at least 16 scanlines on each call to `jpeg_write_raw_data()`, which is to say 16 actual sample rows of Y and 8 each of Cb and Cr. A total of 7 MCU rows are needed, so you must pass a total of $7 \times 16 = 112$ "scanlines". The last DCT block row of Y data is dummy, so it doesn't matter what you pass for it in the data arrays, but the scanlines count must total up to 112 so that all of the Cb

and Cr data gets passed.

Output suspension is supported with raw-data compression: if the data destination module suspends, `jpeg_write_raw_data()` will return 0. In this case the same data rows must be passed again on the next call.

Decompression with raw data output implies bypassing all postprocessing: you cannot ask for color quantization, for instance. More seriously, you must deal with the color space and sampling factors present in the incoming file. If your application only handles, say, 2h1v YCbCr data, you must check for and fail on other color spaces or other sampling factors. The library will not convert to a different color space for you.

To obtain raw data output, set `cinfo->raw_data_out = TRUE` before `jpeg_start_decompress()` (it is set `FALSE` by `jpeg_read_header()`). Be sure to verify that the color space and sampling factors are ones you can handle. Then call `jpeg_read_raw_data()` in place of `jpeg_read_scanlines()`. The decompression process is otherwise the same as usual.

`jpeg_read_raw_data()` returns one MCU row per call, and thus you must pass a buffer of at least `max_v_samp_factor*min_DCT_v_scaled_size` scanlines (scanline counting is the same as for raw-data compression). The buffer you pass must be large enough to hold the actual data plus padding to DCT-block boundaries. As with compression, any entirely dummy DCT blocks are not processed so you need not allocate space for them, but the total scanline count includes them. The above example of computing buffer dimensions for raw-data compression is equally valid for decompression.

Input suspension is supported with raw-data decompression: if the data source module suspends, `jpeg_read_raw_data()` will return 0. You can also use buffered-image mode to read raw data in multiple passes.

Really raw data: DCT coefficients

It is possible to read or write the contents of a JPEG file as raw DCT coefficients. This facility is mainly intended for use in lossless transcoding between different JPEG file formats. Other possible applications include lossless cropping of a JPEG image, lossless reassembly of a multi-strip or multi-tile TIFF/JPEG file into a single JPEG datastream, etc.

To read the contents of a JPEG file as DCT coefficients, open the file and do `jpeg_read_header()` as usual. But instead of calling `jpeg_start_decompress()` and `jpeg_read_scanlines()`, call `jpeg_read_coefficients()`. This will read the entire image into a set of virtual coefficient-block arrays, one array per component. The return value is a pointer to an array of virtual-array

descriptors. Each virtual array can be accessed directly using the JPEG memory manager's `access_virt_barray` method (see Memory management, below, and also read `structure.txt`'s discussion of virtual array handling). Or, for simple transcoding to a different JPEG file format, the array list can just be handed directly to `jpeg_write_coefficients()`.

Each block in the block arrays contains quantized coefficient values in normal array order (not JPEG zigzag order). The block arrays contain only DCT blocks containing real data; any entirely-dummy blocks added to fill out interleaved MCUs at the right or bottom edges of the image are discarded during reading and are not stored in the block arrays. (The size of each block array can be determined from the `width_in_blocks` and `height_in_blocks` fields of the component's `comp_info` entry.) This is also the data format expected by `jpeg_write_coefficients()`.

When you are done using the virtual arrays, call `jpeg_finish_decompress()` to release the array storage and return the decompression object to an idle state; or just call `jpeg_destroy()` if you don't need to reuse the object.

If you use a suspending data source, `jpeg_read_coefficients()` will return NULL if it is forced to suspend; a non-NULL return value indicates successful completion. You need not test for a NULL return value when using a non-suspending data source.

It is also possible to call `jpeg_read_coefficients()` to obtain access to the decoder's coefficient arrays during a normal decode cycle in buffered-image mode. This frammish might be useful for progressively displaying an incoming image and then re-encoding it without loss. To do this, decode in buffered-image mode as discussed previously, then call `jpeg_read_coefficients()` after the last `jpeg_finish_output()` call. The arrays will be available for your use until you call `jpeg_finish_decompress()`.

To write the contents of a JPEG file as DCT coefficients, you must provide the DCT coefficients stored in virtual block arrays. You can either pass block arrays read from an input JPEG file by `jpeg_read_coefficients()`, or allocate virtual arrays from the JPEG compression object and fill them yourself. In either case, `jpeg_write_coefficients()` is substituted for `jpeg_start_compress()` and `jpeg_write_scanlines()`. Thus the sequence is

- * Create compression object
- * Set all compression parameters as necessary
- * Request virtual arrays if needed
- * `jpeg_write_coefficients()`
- * `jpeg_finish_compress()`
- * Destroy or re-use compression object

`jpeg_write_coefficients()` is passed a pointer to an array of virtual block array descriptors; the number of arrays is equal to `cinfo.num_components`.

The virtual arrays need only have been requested, not realized, before `jpeg_write_coefficients()` is called. A side-effect of `jpeg_write_coefficients()` is to realize any virtual arrays that have been requested from the compression object's memory manager. Thus, when obtaining the virtual arrays from the compression object, you should fill the arrays after calling `jpeg_write_coefficients()`. The data is actually written out when you call `jpeg_finish_compress()`; `jpeg_write_coefficients()` only writes the file header.

When writing raw DCT coefficients, it is crucial that the JPEG quantization tables and sampling factors match the way the data was encoded, or the resulting file will be invalid. For transcoding from an existing JPEG file, we recommend using `jpeg_copy_critical_parameters()`. This routine initializes all the compression parameters to default values (like `jpeg_set_defaults()`), then copies the critical information from a source decompression object. The decompression object should have just been used to read the entire JPEG input file --- that is, it should be awaiting `jpeg_finish_decompress()`.

`jpeg_write_coefficients()` marks all tables stored in the compression object as needing to be written to the output file (thus, it acts like `jpeg_start_compress(cinfo, TRUE)`). This is for safety's sake, to avoid emitting abbreviated JPEG files by accident. If you really want to emit an abbreviated JPEG file, call `jpeg_suppress_tables()`, or set the tables' individual `sent_table` flags, between calling `jpeg_write_coefficients()` and `jpeg_finish_compress()`.

Progress monitoring

Some applications may need to regain control from the JPEG library every so often. The typical use of this feature is to produce a percent-done bar or other progress display. (For a simple example, see `cjpeg.c` or `djpeg.c`.) Although you do get control back frequently during the data-transferring pass (the `jpeg_read_scanlines` or `jpeg_write_scanlines` loop), any additional passes will occur inside `jpeg_finish_compress` or `jpeg_start_decompress`; those routines may take a long time to execute, and you don't get control back until they are done.

You can define a progress-monitor routine which will be called periodically by the library. No guarantees are made about how often this call will occur, so we don't recommend you use it for mouse tracking or anything like that. At present, a call will occur once per MCU row, scanline, or sample row group, whichever unit is convenient for the current processing mode; so the wider the image, the longer the time between calls. During the data transferring pass, only one call occurs per call of `jpeg_read_scanlines` or `jpeg_write_scanlines`, so don't pass a large number of scanlines at once if you want fine resolution in the progress count. (If you really need to use

the callback mechanism for time-critical tasks like mouse tracking, you could insert additional calls inside some of the library's inner loops.)

To establish a progress-monitor callback, create a struct `jpeg_progress_mgr`, fill in its `progress_monitor` field with a pointer to your callback routine, and set `cinfo->progress` to point to the struct. The callback will be called whenever `cinfo->progress` is non-NULL. (This pointer is set to NULL by `jpeg_create_compress` or `jpeg_create_decompress`; the library will not change it thereafter. So if you allocate dynamic storage for the progress struct, make sure it will live as long as the JPEG object does. Allocating from the JPEG memory manager with lifetime `JPOOL_PERMANENT` will work nicely.) You can use the same callback routine for both compression and decompression.

The `jpeg_progress_mgr` struct contains four fields which are set by the library:

```
long pass_counter; /* work units completed in this pass */
long pass_limit; /* total number of work units in this pass */
int completed_passes; /* passes completed so far */
int total_passes; /* total number of passes expected */
```

During any one pass, `pass_counter` increases from 0 up to (not including) `pass_limit`; the step size is usually but not necessarily 1. The `pass_limit` value may change from one pass to another. The expected total number of passes is in `total_passes`, and the number of passes already completed is in `completed_passes`. Thus the fraction of work completed may be estimated as

$$\frac{\text{completed_passes} + (\text{pass_counter}/\text{pass_limit})}{\text{total_passes}}$$

ignoring the fact that the passes may not be equal amounts of work.

When decompressing, `pass_limit` can even change within a pass, because it depends on the number of scans in the JPEG file, which isn't always known in advance. The computed fraction-of-work-done may jump suddenly (if the library discovers it has overestimated the number of scans) or even decrease (in the opposite case). It is not wise to put great faith in the work estimate.

When using the decompressor's buffered-image mode, the progress monitor work estimate is likely to be completely unhelpful, because the library has no way to know how many output passes will be demanded of it. Currently, the library sets `total_passes` based on the assumption that there will be one more output pass if the input file end hasn't yet been read (`jpeg_input_complete()` isn't TRUE), but no more output passes if the file end has been reached when the output pass is started. This means that `total_passes` will rise as additional output passes are requested. If you have a way of determining the input file size, estimating progress based on the fraction of the file that's been read will probably be more useful than using the library's value.

Memory management

This section covers some key facts about the JPEG library's built-in memory manager. For more info, please read `structure.txt`'s section about the memory manager, and consult the source code if necessary.

All memory and temporary file allocation within the library is done via the memory manager. If necessary, you can replace the "back end" of the memory manager to control allocation yourself (for example, if you don't want the library to use `malloc()` and `free()` for some reason).

Some data is allocated "permanently" and will not be freed until the JPEG object is destroyed. Most data is allocated "per image" and is freed by `jpeg_finish_compress`, `jpeg_finish_decompress`, or `jpeg_abort`. You can call the memory manager yourself to allocate structures that will automatically be freed at these times. Typical code for this is

```
ptr = (*cinfo->mem->alloc_small) ((j_common_ptr) cinfo, JPOOL_IMAGE, size);
```

Use `JPOOL_PERMANENT` to get storage that lasts as long as the JPEG object.

Use `alloc_large` instead of `alloc_small` for anything bigger than a few Kbytes.

There are also `alloc_sarray` and `alloc_barray` routines that automatically build 2-D sample or block arrays.

The library's minimum space requirements to process an image depend on the image's width, but not on its height, because the library ordinarily works with "strip" buffers that are as wide as the image but just a few rows high. Some operating modes (eg, two-pass color quantization) require full-image buffers. Such buffers are treated as "virtual arrays": only the current strip need be in memory, and the rest can be swapped out to a temporary file.

If you use the simplest memory manager back end (`jmemnobs.c`), then no temporary files are used; virtual arrays are simply `malloc()`'d. Images bigger than memory can be processed only if your system supports virtual memory. The other memory manager back ends support temporary files of various flavors and thus work in machines without virtual memory. They may also be useful on Unix machines if you need to process images that exceed available swap space.

When using temporary files, the library will make the in-memory buffers for its virtual arrays just big enough to stay within a "maximum memory" setting. Your application can set this limit by setting `cinfo->mem->max_memory_to_use` after creating the JPEG object. (Of course, there is still a minimum size for the buffers, so the max-memory setting is effective only if it is bigger than the minimum space needed.) If you allocate any large structures yourself, you must allocate them before `jpeg_start_compress()` or `jpeg_start_decompress()` in order to have them counted against the max memory limit. Also keep in mind that space allocated with `alloc_small()` is ignored, on the assumption that it's too small to be worth worrying about; so a reasonable safety margin should be left when setting `max_memory_to_use`.

If you use the `jmemname.c` or `jmemdos.c` memory manager back end, it is

important to clean up the JPEG object properly to ensure that the temporary files get deleted. (This is especially crucial with `jmemdos.c`, where the "temporary files" may be extended-memory segments; if they are not freed, DOS will require a reboot to recover the memory.) Thus, with these memory managers, it's a good idea to provide a signal handler that will trap any early exit from your program. The handler should call either `jpeg_abort()` or `jpeg_destroy()` for any active JPEG objects. A handler is not needed with `jmemnobs.c`, and shouldn't be necessary with `jmemansi.c` or `jmemmac.c` either, since the C library is supposed to take care of deleting files made with `tmpfile()`.

Memory usage

Working memory requirements while performing compression or decompression depend on image dimensions, image characteristics (such as colorspace and JPEG process), and operating mode (application-selected options).

As of v6b, the decompressor requires:

1. About 24K in more-or-less-fixed-size data. This varies a bit depending on operating mode and image characteristics (particularly color vs. grayscale), but it doesn't depend on image dimensions.
2. Strip buffers (of size proportional to the image width) for IDCT and upsampling results. The worst case for commonly used sampling factors is about 34 bytes * width in pixels for a color image. A grayscale image only needs about 8 bytes per pixel column.
3. A full-image DCT coefficient buffer is needed to decode a multi-scan JPEG file (including progressive JPEGs), or whenever you select buffered-image mode. This takes 2 bytes/coefficient. At typical 2x2 sampling, that's 3 bytes per pixel for a color image. Worst case (1x1 sampling) requires 6 bytes/pixel. For grayscale, figure 2 bytes/pixel.
4. To perform 2-pass color quantization, the decompressor also needs a 128K color lookup table and a full-image pixel buffer (3 bytes/pixel). This does not count any memory allocated by the application, such as a buffer to hold the final output image.

The above figures are valid for 8-bit JPEG data precision and a machine with 32-bit ints. For 9-bit to 12-bit JPEG data, double the size of the strip buffers and quantization pixel buffer. The "fixed-size" data will be somewhat smaller with 16-bit ints, larger with 64-bit ints. Also, CMYK or other unusual color spaces will require different amounts of space.

The full-image coefficient and pixel buffers, if needed at all, do not have to be fully RAM resident; you can have the library use temporary files instead when the total memory usage would exceed a limit you set. (But if your OS supports virtual memory, it's probably better to just use `jmemnobs` and let the OS do the swapping.)

The compressor's memory requirements are similar, except that it has no need for color quantization. Also, it needs a full-image DCT coefficient buffer if Huffman-table optimization is asked for, even if progressive mode is not requested.

If you need more detailed information about memory usage in a particular situation, you can enable the MEM_STATS code in jmemmgr.c.

Library compile-time options

A number of compile-time options are available by modifying jmorecfg.h.

The IJG code currently supports 8-bit to 12-bit sample data precision by defining BITS_IN_JSAMPLE as 8, 9, 10, 11, or 12.

Note that a value larger than 8 causes JSAMPLE to be larger than a char, so it affects the surrounding application's image data.

The sample applications cjpeg and djpeg can support deeper than 8-bit data only for PPM and GIF file formats; you must disable the other file formats to compile a 9-bit to 12-bit cjpeg or djpeg. (install.txt has more information about that.)

Run-time selection and conversion of data precision are currently not supported and may be added later.

Exception: The transcoding part (jpegtran) supports all settings in a single instance, since it operates on the level of DCT coefficients and not sample values.

(If you need to include an 8-bit library and a 9-bit to 12-bit library for compression or decompression in a single application, you could probably do it by defining NEED_SHORT_EXTERNAL_NAMES for just one of the copies. You'd have to access the 8-bit and the 9-bit to 12-bit copies from separate application source files. This is untested ... if you try it, we'd like to hear whether it works!)

Note that the standard Huffman tables are only valid for 8-bit data precision. If you selected more than 8-bit data precision, cjpeg uses arithmetic coding by default. The Huffman encoder normally uses entropy optimization to compute usable tables for higher precision. Otherwise, you'll have to supply different default Huffman tables. You may also want to supply your own DCT quantization tables; the existing quality-scaling code has been developed for 8-bit use, and probably doesn't generate especially good tables for 9-bit to 12-bit.

The maximum number of components (color channels) in the image is determined by MAX_COMPONENTS. The JPEG standard allows up to 255 components, but we expect that few applications will need more than four or so.

On machines with unusual data type sizes, you may be able to improve performance or reduce memory space by tweaking the various typedefs in `jmorecfg.h`. In particular, on some RISC CPUs, access to arrays of "short"s is quite slow; consider trading memory for speed by making `JCOEF`, `INT16`, and `UINT16` be "int" or "unsigned int". `UINT8` is also a candidate to become int. You probably don't want to make `JSAMPLE` be int unless you have lots of memory to burn.

You can reduce the size of the library by compiling out various optional functions. To do this, undefine `xxx_SUPPORTED` symbols as necessary.

You can also save a few K by not having text error messages in the library; the standard error message table occupies about 5Kb. This is particularly reasonable for embedded applications where there's no good way to display a message anyway. To do this, remove the creation of the message table (`jpeg_std_message_table[]`) from `jerror.c`, and alter `format_message` to do something reasonable without it. You could output the numeric value of the message code number, for example. If you do this, you can also save a couple more K by modifying the `TRACEMSn()` macros in `jerror.h` to expand to nothing; you don't need trace capability anyway, right?

Portability considerations

The JPEG library has been written to be extremely portable; the sample applications `cjpeg` and `djpeg` are slightly less so. This section summarizes the design goals in this area. (If you encounter any bugs that cause the library to be less portable than is claimed here, we'd appreciate hearing about them.)

The code works fine on ANSI C, C++, and pre-ANSI C compilers, using any of the popular system include file setups, and some not-so-popular ones too. See `install.txt` for configuration procedures.

The code is not dependent on the exact sizes of the C data types. As distributed, we make the assumptions that

- char is at least 8 bits wide
- short is at least 16 bits wide
- int is at least 16 bits wide
- long is at least 32 bits wide

(These are the minimum requirements of the ANSI C standard.) Wider types will work fine, although memory may be used inefficiently if char is much larger than 8 bits or short is much bigger than 16 bits. The code should work equally well with 16- or 32-bit ints.

In a system where these assumptions are not met, you may be able to make the code work by modifying the typedefs in `jmorecfg.h`. However, you will probably

have difficulty if `int` is less than 16 bits wide, since references to plain `int` abound in the code.

`char` can be either signed or unsigned, although the code runs faster if an unsigned `char` type is available. If `char` is wider than 8 bits, you will need to redefine `JOCTET` and/or provide custom data source/destination managers so that `JOCTET` represents exactly 8 bits of data on external storage.

The JPEG library proper does not assume ASCII representation of characters. But some of the image file I/O modules in `cjpeg/djpeg` do have ASCII dependencies in file-header manipulation; so does `cjpeg`'s `select_file_type()` routine.

The JPEG library does not rely heavily on the C library. In particular, C `stdio` is used only by the data source/destination modules and the error handler, all of which are application-replaceable. (`cjpeg/djpeg` are more heavily dependent on `stdio`.) `malloc` and `free` are called only from the memory manager "back end" module, so you can use a different memory allocator by replacing that one file.

The code generally assumes that C names must be unique in the first 15 characters. However, global function names can be made unique in the first 6 characters by defining `NEED_SHORT_EXTERNAL_NAMES`.

More info about porting the code may be gleaned by reading `jconfig.txt`, `jmorecfg.h`, and `jinclue.h`.

Notes for MS-DOS implementors

The IJG code is designed to work efficiently in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile `cjpeg` or `djpeg` by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model (perhaps 10%-25%), and you should avoid "huge" model if at all possible.

The JPEG library typically needs 2Kb-3Kb of stack space. It will also `malloc` about 20K-30K of near heap space while executing (and lots of far heap, but that doesn't count in this calculation). This figure will vary depending on selected operating mode, and to a lesser extent on image size. There is also about 5Kb-6Kb of constant data which will be allocated in the near data segment (about 4Kb of this is the error message table). Thus you have perhaps 20K available for other modules' static data and near heap space before you need to go to a larger memory model. The C library's

static data will account for several K of this, but that still leaves a good deal for your needs. (If you are tight on space, you could reduce the sizes of the I/O buffers allocated by `jdatasrc.c` and `jdatadst.c`, say from 4K to 1K. Another possibility is to move the error message table to far memory; this should be doable with only localized hacking on `jerror.c`.)

About 2K of the near heap space is "permanent" memory that will not be released until you destroy the JPEG object. This is only an issue if you save a JPEG object between compression or decompression operations.

Far data space may also be a tight resource when you are dealing with large images. The most memory-intensive case is decompression with two-pass color quantization, or single-pass quantization to an externally supplied color map. This requires a 128Kb color lookup table plus strip buffers amounting to about 40 bytes per column for typical sampling ratios (eg, about 25600 bytes for a 640-pixel-wide image). You may not be able to process wide images if you have large data structures of your own.

Of course, all of these concerns vanish if you use a 32-bit flat-memory-model compiler, such as DJGPP or Watcom C. We highly recommend flat model if you can use it; the JPEG library is significantly faster in flat model.

Found in path(s):

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/*

* `jcinit.c`

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2003-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains initialization logic for the JPEG compressor.

* This routine is in charge of selecting the modules to be executed and

* making an initialization call to each one.

*

* Logically, this code belongs in `jcmaster.c`. It's split out because

* linking this routine implies linking the entire compression library.

* For a transcoding-only application, we want to be able to use `jcmaster.c`

* without linking in the whole library.

*/

Found in path(s):

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```

/*
 * jcarith.c
 *
 * Developed 1997-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains portable arithmetic entropy encoding routines for JPEG
 * (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
 *
 * Both sequential and progressive modes are supported in this single module.
 *
 * Suspension is not currently supported in this module.
 */

```

Found in path(s):

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1.18 icu 56

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1.19 pcre 10.36

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1.20 harfbuzz 1.7.4

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1.21 libdouble-conversion 3.1.5

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1.23 gstreamer 1.16.2

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/
```

Found in path(s):

```
* /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/PacketUtil.java
* /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/Acknowledgement.java
* /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/TestServerSocket.java
* /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDPEndPoint.java
* /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/Shutdown.java
```


- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTSession.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/ReceiveFile.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/receiver/ReceiverLossList.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTInputStream.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/TestSocket.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/sender/SenderLossList.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/UDTStatistics.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/PacketFactory.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTPacket.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/ConnectionHandshake.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/SendFile.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTServerSocket2.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/ControlInformation.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/receiver/PacketHistoryWindow.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/DataPacket.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/receiver/PacketPairWindow.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/receiver/AckHistoryEntry.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTReceiver.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/unicore/FufexSend.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/ControlPacket.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/unicore/FufexReceive.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/ClientSession.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/UserDefined.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/MessageDropRequest.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/receiver/ReceiverLossListEntry.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/receiver/AckHistoryWindow.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/Acknowledgment2.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTSocket.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTClient.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTServerSocket.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/Util.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/Destination.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/ServerSession.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTSender.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/UDTThreadFactory.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/NegativeAcknowledgement.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/UDTOutputStream.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/util/CircularArray.java
- * /opt/cola/permits/1129996060_1612418600.87/0/udt-1-0-3-sources-1-jar/udt/packets/KeepAlive.java

1.25 libtiff 4.1.0

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1.26 sql-cipher 4.4.2

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1.27 expat 2.2.10

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1.28 glib 2.66.4

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Version 2.1, February 1999

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1.30 openssl 1.1.1i

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1.34 libpng 1.6.37

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```
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/*

* SpanDSP - a series of DSP components for telephony

*

* g722_decode.c - The ITU G.722 codec, decode part.

- *
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 - *
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 - * Based in part on a single channel G.722 codec which is:
 - *
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 - * Computer Science, Speech Group
 - * Chengxiang Lu and Alex Hauptmann

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* MODP_B64 - High performance base64 encoder/decoder

* Version 1.3 -- 17-Mar-2006

* <http://modp.com/release/base64>

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3.1.0 / 2017-09-26

=====

- * Add `DEBUG_HIDE_DATE` env var (#486)
- * Remove ReDoS regexp in %o formatter (#504)
- * Remove "component" from package.json
- * Remove `component.json`
- * Ignore package-lock.json
- * Examples: fix colors printout
- * Fix: browser detection
- * Fix: spelling mistake (#496, @EdwardBetts)

3.0.1 / 2017-08-24

=====

- * Fix: Disable colors in Edge and Internet Explorer (#489)

3.0.0 / 2017-08-08

=====

- * Breaking: Remove DEBUG_FD (#406)
- * Breaking: Use `Date#toISOString()` instead to `Date#toUTCString()` when output is not a TTY (#418)
- * Breaking: Make millisecond timer namespace specific and allow 'always enabled' output (#408)
- * Addition: document `enabled` flag (#465)
- * Addition: add 256 colors mode (#481)
- * Addition: `enabled()` updates existing debug instances, add `destroy()` function (#440)
- * Update: component: update "ms" to v2.0.0
- * Update: separate the Node and Browser tests in Travis-CI
- * Update: refactor Readme, fixed documentation, added "Namespace Colors" section, redid screenshots
- * Update: separate Node.js and web browser examples for organization
- * Update: update "browserify" to v14.4.0
- * Fix: fix Readme typo (#473)

2.6.9 / 2017-09-22

=====

- * remove ReDoS regexp in %o formatter (#504)

2.6.8 / 2017-05-18

=====

- * Fix: Check for undefined on browser globals (#462, @marbemac)

2.6.7 / 2017-05-16

=====

- * Fix: Update ms to 2.0.0 to fix regular expression denial of service vulnerability (#458, @hubdotcom)
- * Fix: Inline extend function in node implementation (#452, @dougwilson)
- * Docs: Fix typo (#455, @msasad)

2.6.5 / 2017-04-27

=====

- * Fix: null reference check on window.documentElement.style.WebkitAppearance (#447, @thebigredgeek)
- * Misc: clean up browser reference checks (#447, @thebigredgeek)
- * Misc: add npm-debug.log to .gitignore (@thebigredgeek)

2.6.4 / 2017-04-20

=====

- * Fix: bug that would occur if process.env.DEBUG is a non-string value. (#444, @LucianBuzzo)
- * Chore: ignore bower.json in npm installations. (#437, @joaovieira)
- * Misc: update "ms" to v0.7.3 (@tootallnate)

2.6.3 / 2017-03-13

=====

- * Fix: Electron reference to `process.env.DEBUG` (#431, @paulcbetts)
- * Docs: Changelog fix (@thebigredgeek)

2.6.2 / 2017-03-10

=====

- * Fix: DEBUG_MAX_ARRAY_LENGTH (#420, @slavaGanzin)
- * Docs: Add backers and sponsors from Open Collective (#422, @pamancini)
- * Docs: Add Slackin invite badge (@tootallnate)

2.6.1 / 2017-02-10

=====

- * Fix: Module's `export default` syntax fix for IE8 `Expected identifier` error
- * Fix: Whitelist DEBUG_FD for values 1 and 2 only (#415, @pi0)
- * Fix: IE8 "Expected identifier" error (#414, @vgoma)
- * Fix: Namespaces would not disable once enabled (#409, @musikov)

2.6.0 / 2016-12-28

=====

- * Fix: added better null pointer checks for browser useColors (@thebigredgeek)
- * Improvement: removed explicit `window.debug` export (#404, @tootallnate)
- * Improvement: deprecated `DEBUG_FD` environment variable (#405, @tootallnate)

2.5.2 / 2016-12-25

=====

- * Fix: reference error on window within webworkers (#393, @KlausTrainer)
- * Docs: fixed README typo (#391, @lurch)
- * Docs: added notice about v3 api discussion (@thebigredgeek)

2.5.1 / 2016-12-20

=====

- * Fix: babel-core compatibility

2.5.0 / 2016-12-20

=====

- * Fix: wrong reference in bower file (@thebigredgeek)
- * Fix: webworker compatibility (@thebigredgeek)
- * Fix: output formatting issue (#388, @kribblo)
- * Fix: babel-loader compatibility (#383, @escwald)
- * Misc: removed built asset from repo and publications (@thebigredgeek)
- * Misc: moved source files to /src (#378, @yamikuronue)
- * Test: added karma integration and replaced babel with browserify for browser tests (#378, @yamikuronue)
- * Test: coveralls integration (#378, @yamikuronue)
- * Docs: simplified language in the opening paragraph (#373, @yamikuronue)

2.4.5 / 2016-12-17

=====

- * Fix: `navigator` undefined in Rhino (#376, @jochenberger)
- * Fix: custom log function (#379, @hsiliev)
- * Improvement: bit of cleanup + linting fixes (@thebigredgeek)
- * Improvement: rm non-maintained `dist` dir (#375, @freewil)
- * Docs: simplified language in the opening paragraph. (#373, @yamikuronue)

2.4.4 / 2016-12-14

=====

- * Fix: work around debug being loaded in preload scripts for electron (#368, @paulcbetts)

2.4.3 / 2016-12-14

=====

- * Fix: navigation.userAgent error for react native (#364, @escwald)

2.4.2 / 2016-12-14

=====

- * Fix: browser colors (#367, @tootallnate)
- * Misc: travis ci integration (@thebigredgeek)
- * Misc: added linting and testing boilerplate with sanity check (@thebigredgeek)

2.4.1 / 2016-12-13

=====

- * Fix: typo that broke the package (#356)

2.4.0 / 2016-12-13

=====

- * Fix: bower.json references unbuilt src entry point (#342, @justmatt)
- * Fix: revert "handle regex special characters" (@tootallnate)
- * Feature: configurable util.inspect() options for NodeJS (#327, @tootallnate)
- * Feature: %O (big O) pretty-prints objects (#322, @tootallnate)

- * Improvement: allow colors in workers (#335, @botverse)
- * Improvement: use same color for same namespace. (#338, @lchenay)

2.3.3 / 2016-11-09

=====

- * Fix: Catch `JSON.stringify()` errors (#195, Jovan Alleyne)
- * Fix: Returning `localStorage` saved values (#331, Levi Thomason)
- * Improvement: Don't create an empty object when no `process` (Nathan Rajlich)

2.3.2 / 2016-11-09

=====

- * Fix: be super-safe in index.js as well (@TooTallNate)
- * Fix: should check whether process exists (Tom Newby)

2.3.1 / 2016-11-09

=====

- * Fix: Added electron compatibility (#324, @paulcbetts)
- * Improvement: Added performance optimizations (@tootallnate)
- * Readme: Corrected PowerShell environment variable example (#252, @gimre)
- * Misc: Removed yarn lock file from source control (#321, @fengmk2)

2.3.0 / 2016-11-07

=====

- * Fix: Consistent placement of ms diff at end of output (#215, @gorangajic)
- * Fix: Escaping of regex special characters in namespace strings (#250, @zacronos)
- * Fix: Fixed bug causing crash on react-native (#282, @vkarпов15)
- * Feature: Enabled ES6+ compatible import via default export (#212 @bucaran)
- * Feature: Added %O formatter to reflect Chrome's console.log capability (#279, @oncletom)
- * Package: Update "ms" to 0.7.2 (#315, @DevSide)
- * Package: removed superfluous version property from bower.json (#207 @kkirsche)
- * Readme: fix USE_COLORS to DEBUG_COLORS
- * Readme: Doc fixes for format string sugar (#269, @mluciool)
- * Readme: Updated docs for DEBUG_FD and DEBUG_COLORS environment variables (#232, @mattlyons0)
- * Readme: doc fixes for PowerShell (#271 #243, @exoticknight @unreadable)
- * Readme: better docs for browser support (#224, @matthewmueller)
- * Tooling: Added yarn integration for development (#317, @thebigredgeek)
- * Misc: Renamed History.md to CHANGELOG.md (@thebigredgeek)
- * Misc: Added license file (#226 #274, @CantemoInternal @sdaitzman)
- * Misc: Updated contributors (@thebigredgeek)

2.2.0 / 2015-05-09

=====

- * package: update "ms" to v0.7.1 (#202, @dougwilson)

- * README: add logging to file example (#193, @DanielOchoa)
- * README: fixed a typo (#191, @amir-s)
- * browser: expose `storage` (#190, @stephenmathieson)
- * Makefile: add a `distclean` target (#189, @stephenmathieson)

2.1.3 / 2015-03-13

=====

- * Updated stdout/stderr example (#186)
- * Updated example/stdout.js to match debug current behaviour
- * Renamed example/stderr.js to stdout.js
- * Update Readme.md (#184)
- * replace high intensity foreground color for bold (#182, #183)

2.1.2 / 2015-03-01

=====

- * dist: recompile
- * update "ms" to v0.7.0
- * package: update "browserify" to v9.0.3
- * component: fix "ms.js" repo location
- * changed bower package name
- * updated documentation about using debug in a browser
- * fix: security error on safari (#167, #168, @yields)

2.1.1 / 2014-12-29

=====

- * browser: use `typeof` to check for `console` existence
- * browser: check for `console.log` truthiness (fix IE 8/9)
- * browser: add support for Chrome apps
- * Readme: added Windows usage remarks
- * Add `bower.json` to properly support bower install

2.1.0 / 2014-10-15

=====

- * node: implement `DEBUG_FD` env variable support
- * package: update "browserify" to v6.1.0
- * package: add "license" field to package.json (#135, @panuhorsmalahiti)

2.0.0 / 2014-09-01

=====

- * package: update "browserify" to v5.11.0
- * node: use stderr rather than stdout for logging (#29, @stephenmathieson)

1.0.4 / 2014-07-15

- =====
- * dist: recompile
 - * example: remove `console.info()` log usage
 - * example: add "Content-Type" UTF-8 header to browser example
 - * browser: place %c marker after the space character
 - * browser: reset the "content" color via `color: inherit`
 - * browser: add colors support for Firefox >= v31
 - * debug: prefer an instance `log()` function over the global one (#119)
 - * Readme: update documentation about styled console logs for FF v31 (#116, @wryk)

1.0.3 / 2014-07-09

=====

- * Add support for multiple wildcards in namespaces (#122, @seegno)
- * browser: fix lint

1.0.2 / 2014-06-10

=====

- * browser: update color palette (#113, @gscottolson)
- * common: make console logging function configurable (#108, @timoxley)
- * node: fix %o colors on old node <= 0.8.x
- * Makefile: find node path using shell/which (#109, @timoxley)

1.0.1 / 2014-06-06

=====

- * browser: use `removeItem()` to clear localStorage
- * browser, node: don't set DEBUG if namespaces is undefined (#107, @leedm777)
- * package: add "contributors" section
- * node: fix comment typo
- * README: list authors

1.0.0 / 2014-06-04

=====

- * make ms diff be global, not be scope
- * debug: ignore empty strings in enable()
- * node: make DEBUG_COLORS able to disable coloring
- * *: export the `colors` array
- * npmignore: don't publish the `dist` dir
- * Makefile: refactor to use browserify
- * package: add "browserify" as a dev dependency
- * Readme: add Web Inspector Colors section
- * node: reset terminal color for the debug content
- * node: map "%o" to `util.inspect()`
- * browser: map "%j" to `JSON.stringify()`

- * debug: add custom "formatters"
- * debug: use "ms" module for humanizing the diff
- * Readme: add "bash" syntax highlighting
- * browser: add Firebug color support
- * browser: add colors for WebKit browsers
- * node: apply log to `console`
- * rewrite: abstract common logic for Node & browsers
- * add .jshintrc file

0.8.1 / 2014-04-14

=====

- * package: re-add the "component" section

0.8.0 / 2014-03-30

=====

- * add `enable()` method for nodejs. Closes #27
- * change from stderr to stdout
- * remove unnecessary index.js file

0.7.4 / 2013-11-13

=====

- * remove "browserify" key from package.json (fixes something in browserify)

0.7.3 / 2013-10-30

=====

- * fix: catch localStorage security error when cookies are blocked (Chrome)
- * add debug(err) support. Closes #46
- * add .browser prop to package.json. Closes #42

0.7.2 / 2013-02-06

=====

- * fix package.json
- * fix: Mobile Safari (private mode) is broken with debug
- * fix: Use unicode to send escape character to shell instead of octal to work with strict mode javascript

0.7.1 / 2013-02-05

=====

- * add repository URL to package.json
- * add DEBUG_COLORED to force colored output
- * add browserify support
- * fix component. Closes #24

0.7.0 / 2012-05-04

=====

- * Added .component to package.json
- * Added debug.component.js build

0.6.0 / 2012-03-16

=====

- * Added support for "-" prefix in DEBUG [Vinay Pulim]
- * Added `.enabled` flag to the node version [TooTallNate]

0.5.0 / 2012-02-02

=====

- * Added: humanize diffs. Closes #8
- * Added `debug.disable()` to the CS variant
- * Removed padding. Closes #10
- * Fixed: persist client-side variant again. Closes #9

0.4.0 / 2012-02-01

=====

- * Added browser variant support for older browsers [TooTallNate]
- * Added `debug.enable('project:*')` to browser variant [TooTallNate]
- * Added padding to diff (moved it to the right)

0.3.0 / 2012-01-26

=====

- * Added millisecond diff when isatty, otherwise UTC string

0.2.0 / 2012-01-22

=====

- * Added wildcard support

0.1.0 / 2011-12-02

=====

- * Added: remove colors unless stderr isatty [TooTallNate]

0.0.1 / 2010-01-03

=====

- * Initial release

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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Specifically, the GPL parts of FFmpeg are:

- libpostproc
- optional x86 optimization in the files
 - ``libavcodec/x86/flac_dsp_gpl.asm``
 - ``libavcodec/x86/idct_mmx.c``
 - ``libavfilter/x86/vf_removegrain.asm``
- the following building and testing tools
 - ``compat/solaris/make_sunver.pl``
 - ``doc/t2h.pm``
 - ``doc/text2pod.pl``
 - ``libswresample/tests/swresample.c``
 - ``tests/checkasm/*``
 - ``tests/tiny_ssim.c``
- the following filters in libavfilter:
 - ``signature_lookup.c``

- `vf_blackframe.c`
- `vf_boxblur.c`
- `vf_colormatrix.c`
- `vf_cover_rect.c`
- `vf_cropdetect.c`
- `vf_delogo.c`
- `vf_eq.c`
- `vf_find_rect.c`
- `vf_fspp.c`
- `vf_geq.c`
- `vf_histeq.c`
- `vf_hqdn3d.c`
- `vf_kerndeint.c`
- `vf_lensfun.c` (GPL version 3 or later)
- `vf_mcdeint.c`
- `vf_mpdecimate.c`
- `vf_nnedi.c`
- `vf_owdenoise.c`
- `vf_perspective.c`
- `vf_phase.c`
- `vf_pp.c`
- `vf_pp7.c`
- `vf_pullup.c`
- `vf_repeatfields.c`
- `vf_sab.c`
- `vf_signature.c`
- `vf_smartblur.c`
- `vf_spp.c`
- `vf_stereo3d.c`
- `vf_super2xsai.c`
- `vf_tinterlace.c`
- `vf_uspp.c`
- `vf_vaguedenoiser.c`
- `vsrc_mptestsrc.c`

Should you, for whatever reason, prefer to use version 3 of the (L)GPL, then the configure parameter `--enable-version3` will activate this licensing option for you. Read the file `COPYING.LGPLv3` or, if you have enabled GPL parts, `COPYING.GPLv3` to learn the exact legal terms that apply in this case.

There are a handful of files under other licensing terms, namely:

* The files `libavcodec/jfdctfst.c`, `libavcodec/jfdctint_template.c` and `libavcodec/jrevdct.c` are taken from libjpeg, see the top of the files for licensing details. Specifically note that you must credit the IJG in the documentation accompanying your program if you only distribute executables. You must also indicate any changes including additions and deletions to those three files in the documentation.

* `tests/reference.pnm` is under the expat license.

External libraries

FFmpeg can be combined with a number of external libraries, which sometimes affect the licensing of binaries resulting from the combination.

Compatible libraries

The following libraries are under GPL version 2:

- avisynth
- frei0r
- libcdio
- libdavs2
- librubberband
- libvidstab
- libx264
- libx265
- libxavs
- libxavs2
- libxvid

When combining them with FFmpeg, FFmpeg needs to be licensed as GPL as well by passing `--enable-gpl` to configure.

The following libraries are under LGPL version 3:

- gmp
- libaribb24
- liblensfun

When combining them with FFmpeg, use the configure option `--enable-version3` to upgrade FFmpeg to the LGPL v3.

The VMAF, mbedTLS, RK MPI, OpenCORE and VisualOn libraries are under the Apache License 2.0. That license is incompatible with the LGPL v2.1 and the GPL v2, but not with version 3 of those licenses. So to combine these libraries with FFmpeg, the license version needs to be upgraded by passing `--enable-version3` to configure.

The smbclient library is under the GPL v3, to combine it with FFmpeg, the options `--enable-gpl` and `--enable-version3` have to be passed to configure to upgrade FFmpeg to the GPL v3.

Incompatible libraries

There are certain libraries you can combine with FFmpeg whose licenses are not compatible with the GPL and/or the LGPL. If you wish to enable these libraries, even in circumstances that their license may be incompatible, pass

`--enable-nonfree` to configure. This will cause the resulting binary to be unredistributable.

The Fraunhofer FDK AAC and OpenSSL libraries are under licenses which are incompatible with the GPLv2 and v3. To the best of our knowledge, they are compatible with the LGPL.

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```

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/* o reverse lookup table for the decode function
/* o reserve string buffer space in advance
/*
*****/
```

wcwidth.js: JavaScript Portng of Markus Kuhn's wcwidth() Implementation

=====
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This package is a JavaScript porting of `wcwidth()` implementation
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timers-browserify

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The code in this library is an extension of Bala Vatti's clipping algorithm:

"A generic solution to polygon clipping"

Communications of the ACM, Vol 35, Issue 7 (July 1992) pp 56-63.

<http://portal.acm.org/citation.cfm?id=129906>

Computer graphics and geometric modeling: implementation and algorithms

By Max K. Agoston

Springer; 1 edition (January 4, 2005)

<http://books.google.com/books?q=vatti+clipping+agoston>

See also:

"Polygon Offsetting by Computing Winding Numbers"

Paper no. DETC2005-85513 pp. 565-575

ASME 2005 International Design Engineering Technical Conferences
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Qt port of geosimplify.js, <https://github.com/mapbox/geosimplify-js>

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Based on simplify-js by Vladimir Agafonkin - <http://mourner.github.io/simplify-js/>
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Version 3, 29 June 2007

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language: node_js

node_js:

- "6"

- "8"

cache:

directories:

- "node_modules"

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debug

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A tiny JavaScript debugging utility modelled after Node.js core's debugging technique. Works in Node.js and web browsers.

Installation

```
``bash
$ npm install debug
``
```

Usage

`debug` exposes a function; simply pass this function the name of your module, and it will return a decorated version of `console.error` for you to pass debug statements to. This will allow you to toggle the debug output for different parts of your module as well as the module as a whole.

Example [_app.js_](./examples/node/app.js):

```
``js
var debug = require('debug')('http')
, http = require('http')
, name = 'My App';
```



```
// fake app

debug('booting %o', name);

http.createServer(function(req, res){
  debug(req.method + ' ' + req.url);
  res.end('hello\n');
}).listen(3000, function(){
  debug('listening');
});
```

// fake worker of some kind

```
require('./worker');
```
```

Example [\_worker.js\_](./examples/node/worker.js):

```
```js
var a = require('debug')('worker:a')
    , b = require('debug')('worker:b');

function work() {
  a('doing lots of uninteresting work');
  setTimeout(work, Math.random() * 1000);
}

work();

function workb() {
  b('doing some work');
  setTimeout(workb, Math.random() * 2000);
}

workb();
```
```

The `DEBUG` environment variable is then used to enable these based on space or comma-delimited names.

Here are some examples:

  
   
 



#### #### Windows command prompt notes

##### ##### CMD

On Windows the environment variable is set using the `set` command.

```
```cmd
set DEBUG=*,-not_this
```
```

Example:

```
```cmd
set DEBUG=* & node app.js
```
```

##### ##### PowerShell (VS Code default)

PowerShell uses different syntax to set environment variables.

```
```cmd
$env:DEBUG = "*,-not_this"
```
```

Example:

```
```cmd
$env:DEBUG='app';node app.js
```
```

Then, run the program to be debugged as usual.

npm script example:

```
```js
"windowsDebug": "@powershell -Command $env:DEBUG='*';node app.js",
```
```

#### ## Namespace Colors

Every debug instance has a color generated for it based on its namespace name. This helps when visually parsing the debug output to identify which debug instance a debug line belongs to.

#### #### Node.js

In Node.js, colors are enabled when stderr is a TTY. You also should install the `[`supports-color`](https://npmjs.org/supports-color)` module alongside debug,



otherwise debug will only use a small handful of basic colors.



#### #### Web Browser

Colors are also enabled on "Web Inspectors" that understand the ``%c`` formatting option. These are WebKit web inspectors, Firefox ([since version 31](https://hacks.mozilla.org/2014/05/editable-box-model-multiple-selection-sublime-text-keys-much-more-firefox-developer-tools-episode-31/)) and the Firebug plugin for Firefox (any version).



#### ## Millisecond diff

When actively developing an application it can be useful to see when the time spent between one ``debug()`` call and the next. Suppose for example you invoke ``debug()`` before requesting a resource, and after as well, the `"+NNNms"` will show you how much time was spent between calls.



When stdout is not a TTY, ``Date#toISOString()`` is used, making it more useful for logging the debug information as shown below:



#### ## Conventions

If you're using this in one or more of your libraries, you should use the name of your library so that developers may toggle debugging as desired without guessing names. If you have more than one debuggers you should prefix them with your library name and use `":"` to separate features. For example "bodyParser" from Connect would then be "connect:bodyParser". If you append a `"*"` to the end of your name, it will always be enabled regardless of the setting of the `DEBUG` environment variable. You can then use it for normal output as well as debug output.

#### ## Wildcards

The ``*`` character may be used as a wildcard. Suppose for example your library has debuggers named "connect:bodyParser", "connect:compress", "connect:session", instead of listing all three with

``DEBUG=connect:bodyParser,connect:compress,connect:session``, you may simply do ``DEBUG=connect:*``, or to run everything using this module simply use ``DEBUG=*``.



You can also exclude specific debuggers by prefixing them with a "-" character. For example, ``DEBUG=*,-connect:*`` would include all debuggers except those starting with "connect:".

## ## Environment Variables

When running through Node.js, you can set a few environment variables that will change the behavior of the debug logging:

| Name                             | Purpose                                           |
|----------------------------------|---------------------------------------------------|
| -----                            | -----                                             |
| <code>`DEBUG`</code>             | Enables/disables specific debugging namespaces.   |
| <code>`DEBUG_HIDE_DATE`</code>   | Hide date from debug output (non-TTY).            |
| <code>`DEBUG_COLORS`</code>      | Whether or not to use colors in the debug output. |
| <code>`DEBUG_DEPTH`</code>       | Object inspection depth.                          |
| <code>`DEBUG_SHOW_HIDDEN`</code> | Shows hidden properties on inspected objects.     |

\_\_Note:\_\_ The environment variables beginning with ``DEBUG_`` end up being converted into an Options object that gets used with ``%o`/^%O`` formatters. See the Node.js documentation for `[util.inspect()]`([https://nodejs.org/api/util.html#util\\_util\\_inspect\\_object\\_options](https://nodejs.org/api/util.html#util_util_inspect_object_options)) for the complete list.

## ## Formatters

Debug uses `[printf-style]`([https://wikipedia.org/wiki/Printf\\_format\\_string](https://wikipedia.org/wiki/Printf_format_string)) formatting. Below are the officially supported formatters:

| Formatter         | Representation                                                                            |
|-------------------|-------------------------------------------------------------------------------------------|
| -----             | -----                                                                                     |
| <code>`%O`</code> | Pretty-print an Object on multiple lines.                                                 |
| <code>`%o`</code> | Pretty-print an Object all on a single line.                                              |
| <code>`%s`</code> | String.                                                                                   |
| <code>`%d`</code> | Number (both integer and float).                                                          |
| <code>`%j`</code> | JSON. Replaced with the string '[Circular]' if the argument contains circular references. |
| <code>`%%`</code> | Single percent sign ('%'). This does not consume an argument.                             |

## ### Custom formatters

You can add custom formatters by extending the ``debug.formatters`` object. For example, if you wanted to add support for rendering a Buffer as hex with ``%h``, you could do something like:

```
```js
const createDebug = require('debug')
```



```

createDebug.formatters.h = (v) => {
  return v.toString('hex')
}

// elsewhere
const debug = createDebug('foo')
debug('this is hex: %h', new Buffer('hello world'))
// foo this is hex: 68656c6c6f20776f72266421 +0ms
...

```

Browser Support

You can build a browser-ready script using [browserify](https://github.com/substack/node-browserify), or just use the [browserify-as-a-service](https://wzrd.in/) [build](https://wzrd.in/standalone/debug@latest), if you don't want to build it yourself.

Debug's enable state is currently persisted by `localStorage`. Consider the situation shown below where you have `worker:a` and `worker:b`, and wish to debug both. You can enable this using `localStorage.debug`:

```

```js
localStorage.debug = 'worker:*'
...

```

And then refresh the page.

```

```js
a = debug('worker:a');
b = debug('worker:b');

setInterval(function(){
  a('doing some work');
}, 1000);

setInterval(function(){
  b('doing some work');
}, 1200);
...

```

Output streams

By default `debug` will log to stderr, however this can be configured per-namespace by overriding the `log` method:

Example [_stdout.js](./examples/node/stdout.js):


```

```js
var debug = require('debug');
var error = debug('app:error');

// by default stderr is used
error('goes to stderr!');

var log = debug('app:log');
// set this namespace to log via console.log
log.log = console.log.bind(console); // don't forget to bind to console!
log('goes to stdout');
error('still goes to stderr!');

// set all output to go via console.info
// overrides all per-namespace log settings
debug.log = console.info.bind(console);
error('now goes to stdout via console.info');
log('still goes to stdout, but via console.info now');
```

```

Extend

You can simply extend debugger

```

```js
const log = require('debug')('auth');

//creates new debug instance with extended namespace
const logSign = log.extend('sign');
const logLogin = log.extend('login');

log('hello'); // auth hello
logSign('hello'); //auth:sign hello
logLogin('hello'); //auth:login hello
```

```

Set dynamically

You can also enable debug dynamically by calling the `enable()` method :

```

```js
let debug = require('debug');

console.log(1, debug.enabled('test'));

debug.enable('test');
console.log(2, debug.enabled('test'));

debug.disable();
console.log(3, debug.enabled('test'));
```

```



```
...
```

```
print :
```

```
...
```

```
1 false
```

```
2 true
```

```
3 false
```

```
...
```

Usage :

```
`enable(namespaces)`
```

`namespaces` can include modes separated by a colon and wildcards.

Note that calling `enable()` completely overrides previously set DEBUG variable :

```
...
```

```
$ DEBUG=foo node -e 'var dbg = require("debug"); dbg.enable("bar"); console.log(dbg.enabled("foo"))'
```

```
=> false
```

```
...
```

Checking whether a debug target is enabled

After you've created a debug instance, you can determine whether or not it is enabled by checking the `enabled` property:

```
```javascript
```

```
const debug = require('debug')('http');
```

```
if (debug.enabled) {
```

```
 // do stuff...
```

```
}
```

```
```
```

You can also manually toggle this property to force the debug instance to be enabled or disabled.

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/*

* SpanDSP - a series of DSP components for telephony

*

* g711.h - In line A-law and u-law conversion routines

*

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- ./test/inverse.cpp

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./test/product_trsolve.cpp
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./test/geo_homogeneous.cpp
./test/determinant.cpp
./test/array_reverse.cpp
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./test/stdlist.cpp
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./test/corners.cpp
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./test/visitor.cpp
./test/geo_alignedbox.cpp
./test/diagonalmatrices.cpp
./test/product_small.cpp
./test/eigensolver_generalized_real.cpp
./test/umfpack_support.cpp
./test/first_aligned.cpp
./test/qr_fullpivoting.cpp
./test/array_replicate.cpp
./test/geo_parametrizedline.cpp
./test/eigen2/eigen2_unalignedassert.cpp
./test/eigen2/eigen2_prec_inverse_4x4.cpp
./test/eigen2/eigen2_alignedbox.cpp
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./test/eigen2/eigen2_meta.cpp
./test/eigen2/eigen2_nomalloc.cpp
./test/eigen2/eigen2_visitor.cpp
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./test/eigen2/eigen2_svd.cpp
./test/eigen2/eigen2_mixingtypes.cpp
./test/eigen2/eigen2_qr.cpp
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./test/eigen2/eigen2_geometry_with_eigen2_prefix.cpp
./test/eigen2/eigen2_smallvectors.cpp
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./test/eigen2/eigen2_sparse_solvers.cpp
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./test/eigen2/eigen2_parametrizedline.cpp
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./test/eigen2/eigen2_submatrices.cpp
./test/eigen2/sparse.h
./test/eigen2/eigen2_swap.cpp

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./test/eigen2/gsl_helper.h
./test/eigen2/eigen2_dynalloc.cpp
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./test/eigen2/eigen2_map.cpp
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./test/eigen2/eigen2_misctrices.cpp
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./test/eigen2/eigen2_inverse.cpp
./test/eigen2/eigen2_regression.cpp
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./test/eigen2/product.h
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./test/bandmatrix.cpp
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./test/jacobi.cpp
./test/diagonal.cpp
./test/schur_complex.cpp
./test/sizeoverflow.cpp
./bench/BenchTimer.h
./bench/benchFFT.cpp
./bench/eig33.cpp
./bench/spbench/spbenchsolver.h
./bench/spbench/spbenchstyle.h
./lapack/complex_double.cpp
./lapack/cholesky.cpp
./lapack/lapack_common.h
./lapack/eigenvalues.cpp
./lapack/single.cpp
./lapack/lu.cpp
./lapack/complex_single.cpp

./lapack/double.cpp
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./demos/opengl/camera.h
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./unsupported/test/bdcsvd.cpp
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./unsupported/test/BVH.cpp
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./unsupported/Eigen/src/IterativeSolvers/MINRES.h

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./unsupported/Eigen/ArpackSupport
./unsupported/Eigen/AutoDiff

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./unsupported/Eigen/Polynomials
./unsupported/Eigen/NumericalDiff
./unsupported/Eigen/Skyline
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./Eigen/Eigen2Support
./Eigen/src/Eigen2Support/VectorBlock.h
./Eigen/src/Eigen2Support/Cwise.h
./Eigen/src/Eigen2Support/Minor.h
./Eigen/src/Eigen2Support/Lazy.h
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./Eigen/src/SparseCore/SparseTranspose.h

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./Eigen/src/plugins/MatrixCwiseBinaryOps.h
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./Eigen/src/Core/Fuzzy.h
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./Eigen/src/Core/Transpositions.h
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./Eigen/src/Core/IO.h
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./Eigen/src/Core/DiagonalProduct.h
./Eigen/src/Core/Assign.h
./Eigen/src/Core/Redux.h
./Eigen/src/Core/ForceAlignedAccess.h
./Eigen/src/Core/BandMatrix.h
./Eigen/src/Core/PlainObjectBase.h
./Eigen/src/Core/DenseBase.h
./Eigen/src/Core/Flagged.h
./Eigen/src/Core/CwiseBinaryOp.h
./Eigen/src/Core/ProductBase.h
./Eigen/src/Core/TriangularMatrix.h
./Eigen/src/Core/Transpose.h

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./Eigen/src/Core/Functors.h
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./Eigen/SparseLU
./Eigen/StdList
./Eigen/StdDeque
./Eigen/SparseCholesky
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./scripts/relicense.py
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./blas/level1_real_impl.h
./blas/level3_impl.h
./blas/single.cpp
./blas/level2_cplx_impl.h
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./blas/Rank2Update.h
./blas/complex_single.cpp
./blas/PackedTriangularSolverVector.h
./blas/double.cpp
./blas/common.h
./blas/level2_impl.h
./blas/GeneralRank1Update.h

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Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

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The OpenGL Extension Wrangler Library

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gradle

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java/android_libs/protobuf_nano

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java_src/android_libs/protobuf_nano/v2

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jpeg

(extracted from src/README)

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libunwind

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libvorbis

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libxcb

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libxml

Libxml2, an XML C Parser

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lodepng

LodePNG

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minizip

zlib

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| | |
|------------------|---------------------------|
| Jean-loup Gailly | Mark Adler |
| jloup@gzip.org | madler@alumni.caltech.edu |

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mongoose

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objective_c/gtm_session_fetcher

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utf

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xmpmeta

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"Licensees SDK Contractors" shall mean Contractors of Licensee, who have purchased or received SDK from the Licensee relating to the Program.

"License Fee" shall mean the fee charged to the Licensee for rights granted under the terms of this Agreement.

"Licensed Software" shall mean all versions of The Qt Company's computer software products, online or electronic documentation, associated media and printed materials, including the source code, example programs and the documentation, licensed to the Licensee under this Agreement. Licensed Software does not include Third Party Software (as defined in Section 4) or Open Source Qt.

"Modified Software" shall mean bug-fixes, error corrections, patches or modifications made to the Licensed Software by Licensee, including documentation related thereto.

"Online Services" shall mean any services or access to systems made available by The Qt Company to the Licensee over the Internet relating to the Licensed Software or for the purpose of use by the Licensee of the Licensed Software or Support. Use of any such Online Services is discretionary for the Licensee and some of them may be subject to additional fees.

"Open Source Qt" shall mean all versions of The Qt Company's Qt computer software products, online or electronic documentation, associated media and

printed materials, including the source code, example programs and the documentation available under the terms of the GNU Lesser General Public License, version 2.1 or later ("LGPL") or the GNU General Public License, version 2.0 or later ("GPL").

"Party" or "Parties" shall mean Licensee and/or The Qt Company.

"Program" shall mean Licensees business program for which purpose the Licensee is entitled to use the Licensed Software and grant the Licensee's SDK Contractors a right to use the Licensed Software as part of a SDK.

"Redistributables" shall mean the portions of the Licensed Software set forth in Appendix 1, Section 1 that may be distributed pursuant to the terms of this Agreement in object code form only, including any relevant documentation. Where relevant, any reference to Licensed Software in this Agreement shall include and refer also to Redistributables.

"SDK" or "Software Development Kit" shall mean a combination of software modules including Licensed Software intended to be utilized in connection with the Program.

"Submitted Modified Software" shall have the meaning as set forth in Section 2.3.

"Support" shall mean standard developer support that is provided by The Qt Company to assist Designated Users in using the Licensed Software in accordance with The Qt Company's standard support terms.

"Support Renewal Term" shall mean a time period of twelve (12) months, calculated from the end of the Initial Support Term or previous Support Renewal Term, as applicable.

"Support Term" shall mean the Initial Support Term and any possible Support Renewal Terms(s) during which time the Licensee is eligible to receive for Support for the Licensed Software.

"Taxes" shall have the meaning set forth in Section 10.5.

"Term" shall mean the validity period of this Agreement, as set forth in the License Certificate.

The Qt Company shall mean:

(i) in the event Licensee is an individual residing in the United States or a legal entity incorporated in the United States or having its headquarters in the United States, The Qt Company Inc., a Delaware corporation with its office at 2350 Mission College Blvd., Suite 1020, Santa Clara, CA 95054, USA.; or

(ii) in the event the Licensee is an individual residing outside of the United States or a legal entity incorporated outside of the United States or having its registered office outside of the United States, The Qt Company Ltd., a Finnish company with its registered office at Bertel Jungin aukio D3A, 02600 Espoo, Finland.

"Updates" shall mean a release or version of the Licensed Software containing bug fixes, error corrections and other changes that are generally made available to users of the Licensed Software that have contracted for Support. Updates are generally depicted as a change to the digits following the decimal in the Licensed Software version number. The Qt Company shall make Updates available to the Licensee under the Support. Updates shall be considered as part of the Licensed Software hereunder.

"Upgrades" shall mean a release or version of the Licensed Software containing enhancements and new features and are generally depicted as a change to the first digit of the Licensed Software version number. In the event Upgrades are provided to the Licensee under this Agreement, they shall be considered as part of the Licensed Software hereunder.

2. OWNERSHIP 2.1

Ownership of The Qt Company

The Licensed Software is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The Licensed Software is licensed, not sold.

All The Qt Company's Intellectual Property Rights are and shall remain the exclusive property of The Qt Company or its licensors respectively.

2.2 Ownership of Licensee

All the Licensee's Intellectual Property Rights are and shall remain the exclusive property of the Licensee or its licensors respectively.

All Intellectual Property Rights to the Modified Software, Applications and Devices shall remain with the Licensee and no rights thereto shall be granted by the Licensee to The Qt Company under this Agreement (except as set forth in Section 2.3 below).

2.3 Modified Software

Licensee may create Modified Software that breaks the source or binary compatibility with the Licensed Software. This includes, but is not limited to, changing the application programming interfaces ("API") by adding, changing or deleting any variable, method, or class signature in the Licensed Software and/or any inter-process protocols, services or standards in the Licensed

Software libraries. To the extent that Licensee breaks source or binary compatibility with the Licensed Software, Licensee acknowledges that The Qt Company's ability to provide Support may be prevented or limited and Licensee's ability to make use of Updates may be restricted.

To the extent Licensee submits Modified Software to The Qt Company ("Submitted Modified Software"), Licensee hereby grants The Qt Company a sublicensable, assignable, irrevocable, perpetual, worldwide, non-exclusive, royalty-free and fully paid-up license, under all of Licensee's Intellectual Property Rights, to reproduce, adapt, translate, modify, and prepare derivative works of, publicly display, publicly perform, sublicense, make available and distribute such Submitted Modified Software as The Qt Company sees fit at its free and absolute discretion. For the sake of clarity, the Licensee shall have no obligation to provide Modified Software to The Qt Company.

3. LICENSES GRANTED

3.1 Development with Licensed Software

Subject to the terms of this Agreement, The Qt Company grants to Licensee a personal, worldwide, non-exclusive, non-transferable license, valid for the Term, to use, modify and copy the Licensed Software by Designated Users on the Development Platforms for the sole purposes of designing, developing, demonstrating and testing Application(s) and/or Devices, and to provide thereto related support and other services to end-user Customers.

Licensee may install copies of the Licensed Software on an unlimited number of computers provided that (i) only the Designated Users may use the Licensed Software, and (ii) all Designated Users must have a valid Development License to use Licensed Software.

Licensee may at any time designate another Designated User to replace a then-current Designated User by notifying The Qt Company in writing, provided that any Designated User may be replaced only once during any six-month period.

3.2 Distribution of Redistributables

Subject to the terms of this Agreement, The Qt Company grants to Licensee a personal, worldwide, non-exclusive, non-transferable license, valid for the Term, to (i) distribute, by itself or through its Contractors, Redistributables as installed, incorporated or integrated into Applications for execution on the Deployment Platforms, and (ii) distribute, by itself or through one or more tiers of Contractors, Redistributables as installed, incorporated or integrated, or intended to be installed, incorporated or integrated into Devices for execution on the Deployment Platforms, and (iii) grant sublicenses to Redistributables, as distributed hereunder, for Customers solely for Customer's internal use and to the extent necessary in order for the Customers to use the Applications and/or Devices for their respective intended purposes.

Right to distribute the Redistributables as provided herein is conditional upon the Licensee having purchased and paid the appropriate amount of Development and Distribution Licenses from The Qt Company before distributing any Redistributables to Customers.

For the avoidance of any doubt it is specifically acknowledged and agreed that distribution of Redistributables solely as installed, incorporated or integrated into Applications for execution on the Deployment Platform(s), as specified in (i) of the first paragraph of Section 3.2 above, i.e. with no connection to Devices or intention to use in connection therewith, shall not require a Distribution License.

3.3 SDK License

The Qt Company grants to Licensee a personal, worldwide, non-exclusive, non-transferable license, valid for the Term, to (i) distribute Licensed Software as a part of the SDK to Licensees SDK Contractors in connection with the Program and (ii) in connection with the Program, by itself or by Licensee's SDK Contractors, combine, incorporate or integrate Licensed Software with, or use Licensed Software for creation of, any software created with or incorporating Open Source Qt, provided, however, that:

- (i) the Licensees SDK Contractors are only entitled to use the Licensed Software as part of SDK and for the sole purpose of developing software for Devices that are distributed under the Program; and
- (ii) Licensees SDK Contractors shall not be entitled to distribute the SDK or any part thereof to any third parties.

For the avoidance of any doubt, the distribution of such software development tools that do not contain Licensed Software shall not be covered by this Agreement.

3.4 Further Requirements

The licenses granted above in this Section 3 by The Qt Company to Licensee are conditional and subject to Licensee's compliance with the following terms:

- (i) Licensee shall not remove or alter any copyright, trademark or other proprietary rights notice contained in any portion of the Licensed Software;
- (ii) Applications and SDKs must add primary and substantial functionality to the Licensed Software;
- (iii) Applications may not pass on functionality which in any way makes it possible for others to create software with the Licensed Software; provided however that Licensee may use the Licensed Software's scripting and QML ("Qt

Quick") functionality solely in order to enable scripting, themes and styles that augment the functionality and appearance of the Application(s) without adding primary and substantial functionality to the Application(s);

(iv) Applications and SDKs must not compete with the Licensed Software;

(v) Licensee shall not use The Qt Company's or any of its suppliers' names, logos, or trademarks to market Applications or SDKs, except that Licensee may use "Built with Qt" logo to indicate that Application(s) was developed using the Licensed Software;

(vi) Except as expressly provided in Section 3.3, Licensee shall not distribute, sublicense or disclose source code of Licensed Software to any third party (provided however that Licensee may appoint employee(s) of Contractors as Designated Users to use Licensed Software pursuant to this Agreement);

(vii) Licensee shall not grant the Customers a right to (i) make copies of the Redistributables except when and to the extent required to use the Applications and/or Devices for their intended purpose, (ii) modify the Redistributables or create derivative works thereof, (iii) decompile, disassemble or otherwise reverse engineer Redistributables, or (iv) redistribute any copy or portion of the Redistributables to any third party, except as part of the onward sale of the Device on which the Redistributables are installed;

(viii) Except as expressly provided in Section 3.3, Licensee shall not and shall cause that its Affiliates, Contractors and Licensee's SDK Contractors shall not a) in any way, combine, incorporate or integrate Licensed Software with, or use Licensed Software for creation of, any software created with or incorporating Open Source Qt or b) incorporate or integrate Applications into a hardware device or product other than a Device, unless Licensee has received an advance written permission from The Qt Company to do so. Unless specifically otherwise agreed, any and all distribution by the Licensee during the Term of a hardware device or product a) which incorporate or integrate any part of Licensed Software or Open Source Qt; or b) where the main user interface or substantial functionality is provided by software build with Licensed Software or Open Source Qt or otherwise depends on the Licensed Software or Open Source Qt, shall be considered as distribution under this Agreement and dependent on compliance thereof (including but not limited to obligation to pay applicable License Fees for such distribution);

(ix) Licensee shall cause all of its Affiliates and Contractors entitled to make use of the licenses granted under this Agreement, to be contractually bound to comply with the relevant terms of this Agreement and not to use the Licensed Software beyond the terms hereof and for any purposes other than operating within the scope of their services for Licensee. Licensee shall be responsible for any and all actions and omissions of its Affiliates and Contractors relating to the Licensed Software and use thereof (including but not limited to payment of all applicable License Fees);

(x) Except when and to the extent explicitly provided in this Section 3, Licensee shall not transfer, publish, disclose, display or otherwise make available the Licensed Software;

(xi) Licensee shall not take any action inconsistent with The Qt Company's Intellectual Property Rights; and

(xii) Attempt or enlist a third party to conduct or attempt to conduct any of the above.

Above terms shall not be applicable if and to the extent they conflict with any mandatory provisions of any applicable laws.

Any use of Licensed Software beyond the provisions of this Agreement is strictly prohibited and requires an additional license from The Qt Company.

4. THIRD PARTY SOFTWARE

The Licensed Software may provide links to third party libraries or code (collectively "Third Party Software") to implement various functions. Third Party Software does not comprise part of the Licensed Software. In some cases, access to Third Party Software may be included in the Licensed Software. Such Third Party Software will be listed in the ".../src/3rdparty" source tree delivered with the Licensed Software or documented in the Licensed Software, as such may be amended from time to time. Licensee acknowledges that use or distribution of Third Party Software is in all respects subject to applicable license terms of applicable third party right holders.

5. PRE-RELEASE CODE

The Licensed Software may contain pre-release code and functionality marked or otherwise stated as "Technology Preview", "Alpha", "Beta" or similar designation. Such pre-release code may be present in order to provide experimental support for new platforms or preliminary versions of one or more new functionalities. The pre-release code may not be at the level of performance and compatibility of a final, generally available, product offering of the Licensed Software. The pre-release parts of the Licensed Software may not operate correctly, may contain errors and may be substantially modified by The Qt Company prior to the first commercial product release, if any. The Qt Company is under no obligation to make pre-release code commercially available, or provide any Support or Updates relating thereto. The Qt Company assumes no liability whatsoever regarding any pre-release code, but any use thereof is exclusively at Licensee's own risk and expense.

6. LIMITED WARRANTY AND WARRANTY DISCLAIMER

The Qt Company hereby represents and warrants that it has the power and authority to grant the rights and licenses granted to Licensee under this Agreement.

Except as set forth above, the Licensed Software is licensed to Licensee "as is".

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, THE QT COMPANY ON BEHALF OF ITSELF AND ITS LICENSORS, SUPPLIERS AND AFFILIATES, DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT WITH REGARD TO THE LICENSED SOFTWARE. THE QT COMPANY DOES NOT WARRANT THAT THE LICENSED SOFTWARE WILL SATISFY LICENSEE'S REQUIREMENTS OR THAT IT WILL OPERATE WITHOUT DEFECT OR ERROR OR THAT THE OPERATION THEREOF WILL BE UNINTERRUPTED. ALL USE OF AND RELIANCE ON THE LICENSED SOFTWARE IS AT THE SOLE RISK OF AND RESPONSIBILITY OF LICENSEE.

Licensee's exclusive remedy and The Qt Company's entire liability for Licensed Software shall be limited, at The Qt Company's option, to correction of the error, replacement of the Licensed Software or return of the applicable fees paid for the defective Licensed Software for the time period during which the License is not able to utilize the Licensed Software under the terms of this Agreement.

7. INDEMNIFICATION AND LIMITATION OF LIABILITY

7.1 Limitation of Liability

EXCEPT FOR (I) CASES OF GROSS NEGLIGENCE OR INTENTIONAL MISCONDUCT, (II) LICENSEE'S DUTY TO PAY ALL APPLICABLE LICENSE FEES AND COMPENSATIONS, AND (III) BREACH OF CONFIDENTIALITY, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL EITHER PARTY BE LIABLE TO THE OTHER PARTY FOR ANY LOSS OF PROFIT, LOSS OF DATA, LOSS OF BUSINESS OR GOODWILL OR ANY OTHER INDIRECT, SPECIAL, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE COST, DAMAGES OR EXPENSE OF ANY KIND, HOWSOEVER ARISING UNDER OR IN CONNECTION WITH THIS AGREEMENT.

EXCEPT FOR (I) CASES OF GROSS NEGLIGENCE OR INTENTIONAL MISCONDUCT, (II) LICENSEE'S DUTY TO PAY ALL APPLICABLE LICENSE FEES AND COMPENSATIONS, AND (III) BREACH OF CONFIDENTIALITY, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL EITHER PARTY'S TOTAL AGGREGATE LIABILITY UNDER THIS AGREEMENT EXCEED THE AGGREGATE LICENSE FEES RECEIVED BY THE QT COMPANY FROM LICENSEE DURING THE PERIOD OF TWELVE (12) MONTHS IMMEDIATELY PRECEDING THE EVENT RESULTING IN SUCH LIABILITY.

THE PROVISIONS OF THIS SECTION 7 ALLOCATE THE RISKS UNDER THIS AGREEMENT BETWEEN THE QT COMPANY AND LICENSEE AND THE PARTIES HAVE RELIED UPON THE LIMITATIONS SET FORTH HEREIN IN DETERMINING WHETHER TO ENTER INTO THIS AGREEMENT.

7.2 Licensees Indemnification

Licensee shall indemnify and hold harmless The Qt Company from and against any

claim, injury, judgment, settlement, loss or expense, including attorneys' fees related to: (a) Licensee's misrepresentation in connection with The Qt Company or the Licensed Software or breach of this Agreement, (b) the Application or Device (except where such cause of liability is solely attributable to the Licensed Software).

8. SUPPORT, UPDATES AND ONLINE SERVICES

Licensee will be eligible to receive Support and Updates and to use the Online Services during the Support Term. Unless otherwise decided by The Company at its free and absolute discretion, Upgrades will not be included in the Support but may be available subject to additional fees.

Licenses granted under this Agreement shall include a prepaid Initial Support Term.

Initial Support Term shall be automatically extended to one or more Support Renewal Term(s), unless and until either Party notifies the other Party in writing that it does not wish to continue the Support, such notification to be provided to the other Party no less than ninety (90) days before expiry of the Initial Support Term or respective Support Renewal Term. During any such Support Renewal Term Support shall be available subject to prices and terms agreed between the Parties or, if no advance agreement exists, subject to The Qt Company's standard pricing applicable at the commencement date of any such Support Renewal Term. From time to time The Qt Company may change Support provided within each Support plan; provided that during the respective Initial Support Term or Support Renewal Term (as the case may be), the level of Support provided by The Qt Company may not be reduced without the consent of the Licensee.

Unless otherwise agreed, The Qt Company shall not be responsible for providing any service or support to the Customers.

9. CONFIDENTIALITY

Each Party acknowledges that during the Term of this Agreement each Party may receive information about the other Party's business, business methods, business plans, customers, business relations, technology, and other information, including the terms of this Agreement, that is confidential and of great value to the other Party, and the value of which would be significantly reduced if disclosed to third parties ("Confidential Information"). Accordingly, when a Party (the "Receiving Party") receives Confidential Information from the other Party (the "Disclosing Party"), the Receiving Party shall only disclose such information to employees and Contractors on a need to know basis, and shall cause its employees and employees of its Affiliates to: (i) maintain any and all Confidential Information in confidence; (ii) not disclose the Confidential Information to a third party without the Disclosing Party's prior written approval; and (iii) not, directly or indirectly, use the Confidential

Information for any purpose other than for exercising its rights and fulfilling its responsibilities pursuant to this Agreement. Each Party shall take reasonable measures to protect the Confidential Information of the other Party, which measures shall not be less than the measures taken by such Party to protect its own confidential and proprietary information.

Obligation of confidentiality shall not apply to information that (i) is or becomes generally known to the public through no act or omission of the Receiving Party; (ii) was in the Receiving Party's lawful possession prior to the disclosure hereunder and was not subject to limitations on disclosure or use; (iii) is developed independently by employees or Contractors of the Receiving Party or other persons working for the Receiving Party who have not had access to the Confidential Information of the Disclosing Party, as proven by the written records of the Receiving Party; (iv) is lawfully disclosed to the Receiving Party without restrictions, by a third party not under an obligation of confidentiality; or (v) the Receiving Party is legally compelled to disclose, in which case the Receiving Party shall notify the Disclosing Party of such compelled disclosure and assert the privileged and confidential nature of the information and cooperate fully with the Disclosing Party to limit the scope of disclosure and the dissemination of disclosed Confidential Information to the minimum extent necessary.

The obligations under this Section 9 shall continue to remain in force for a period of five (5) years after the last disclosure, and, with respect to trade secrets, for so long as such trade secrets are protected under applicable trade secret laws.

10. FEES, DELIVERY AND PAYMENT

10.1 License Fees

License Fees are described in The Qt Company's standard price list, quote or Purchase Order confirmation or in an appendix hereto, as the case may be. The License Fees shall not be refunded or claimed as a credit, even on the ground that Distribution Licenses are not used, i.e. Redistributables are not actually distributed corresponding to the Distribution Licenses purchased, or for any other reason.

10.2 Ordering Licenses

Licensee may purchase Development Licenses and Distribution Licenses pursuant to agreed pricing terms or, if no specific pricing terms have been agreed upon, at The Qt Company's standard pricing terms applicable at the time of purchase.

Licensee shall submit all purchase orders for Development Licenses and Distribution Licenses to The Qt Company by email or any other method acceptable to The Qt Company (each such order is referred to herein as a "Purchase Order") for confirmation, whereupon the Purchase Order shall become binding between the

Parties.

10.3 Distribution

License Packs Unless otherwise agreed, the Distribution Licenses are bought by way of Distribution License Packs.

Upon due payment of the ordered Distribution License Pack(s), the Licensee will have an account of Distribution Licenses available for installing, bundling or integrating (all jointly "installing") the Redistributables with the Devices or for otherwise distributing the Redistributables in accordance with this Agreement.

Each time Licensee "installs" or distributes a copy of Redistributables, then one Distribution License is used, and Licensee's account of available Distribution Licenses is decreased accordingly.

Licensee may "install" copies of the Redistributables so long as Licensee has Distribution Licenses remaining on its account.

Redistributables will be deemed to have been "installed" into a Device when one of the following circumstances shall have occurred: a) the Redistributables have been loaded onto the Device and used outside of the Licensee's premises or b) the Device has been fully tested and placed into Licensee's inventory (or sold) for the first time (i.e., Licensee will not be required to use (or pay for) more than one Distribution License for each individual Device, e.g. in a situation where a Device is returned to Licensee's inventory after delivery to a distributor or sale to a Customer). In addition, if Licensee includes a back-up copy of the Redistributables on a CD-ROM or other storage medium along with the product, that backup copy of the Redistributables will not be deemed to have been "installed" and will not require an additional Distribution License.

10.4 Payment Terms

License Fees and any other charges under this Agreement shall be paid by Licensee no later than thirty (30) days from the date of the applicable invoice from The Qt Company.

The Qt Company will submit an invoice to Licensee after the date of this Agreement and/or after The Qt Company receives a Purchase Order from Licensee. A late payment charge of the lower of (a) one percent per month; or (b) the interest rate stipulated by applicable law, shall be charged on any unpaid balances that remain past due.

The Qt Company shall have the right to suspend, terminate or withhold grants of all rights to the Licensed Software hereunder, including but not limited to the Developer License, Distribution License, and Support, should Licensee fail to make payment in a timely fashion.

10.5 Taxes

All License Fees and other charges payable hereunder are gross amounts but exclusive of any value added tax, use tax, sales tax and other taxes, duties or tariffs ("Taxes"). Such applicable Taxes shall be paid by Licensee, or, where applicable, in lieu of payment of such Taxes, Licensee shall provide an exemption certificate to The Qt Company and any applicable authority.

11 RECORD-KEEPING AND REPORTING OBLIGATIONS; AUDIT RIGHTS

11.1 Licensee's Record-keeping

Licensee shall at all times maintain accurate and up-to-date written records of Licensee's activities related to the use of Licensed Software and distribution of Redistributables. The records shall be adequate to determine Licensee's compliance with the provisions of this Agreement and to demonstrate the number of Designated Users and Redistributables distributed by Licensee. The records shall conform to good accounting practices reasonably acceptable to The Qt Company.

Licensee shall, within thirty (30) days from the end of each calendar quarter, deliver to The Qt Company a report detailing the number of Designated Users and copies of Redistributables distributed by Licensee during that calendar quarter, and also detailing the number of undistributed copies of Redistributables made by Licensee and remaining in its account (i.e., undistributed copies for which Distribution Licenses have been or need to be obtained from The Qt Company). Such report shall contain such other information as The Qt Company shall reasonably require from time to time.

11.2. The Qt Company's Audit Rights

The Qt Company or an independent auditor acting on behalf of The Qt Company's, may, upon at least five (5) business days' prior written notice and at its expense, audit Licensee with respect to the use of the Redistributables, but not more frequently than once during each 6-month period. Such audit may be conducted by mail, electronic means or through an in-person visit to Licensee's place of business. Any such in-person audit shall be conducted during regular business hours at Licensee's facilities and shall not unreasonably interfere with Licensee's business activities. The Qt Company or the independent auditor acting on behalf of The Qt Company shall be entitled to inspect Licensee's Records. All such Licensee's Records and use thereof shall be subject to an obligation of confidentiality under this Agreement.

If an audit reveals that Licensee is using the Licensed Software beyond scope of the licenses Licensee has paid for, Licensee agrees to immediately pay The Qt Company any amounts owed for such unauthorized use.

In addition, in the event the audit reveals a material violation of the terms of

this Agreement (underpayment of more than 5% of License Fees shall always be deemed a material violation for purposes of this section), then the Licensee shall pay The Qt Company's reasonable cost of conducting such audit.

12 TERM AND TERMINATION

12.1 Term

This Agreement shall enter into force upon due acceptance by both Parties and remain in force for the Term, unless and until terminated pursuant to the terms of this Section 12.

12.2 Termination by The Qt Company

The Qt Company shall have the right to terminate this Agreement upon thirty (30) days prior written notice if (i) the Licensee is in material breach of any obligation of this Agreement and fails to remedy such breach within such notice period; (ii) or Licensee or any of its Affiliates bring a suit before any court or administrative agency or otherwise assert a claim against The Qt Company's or any of its Affiliates' Intellectual Property Rights or validity thereof.

12.3 Mutual Right to Terminate

Either Party shall have the right to terminate this Agreement immediately upon written notice in the event that the other Party becomes insolvent, files for any form of bankruptcy, makes any assignment for the benefit of creditors, has a receiver, administrative receiver or officer appointed over the whole or a substantial part of its assets, ceases to conduct business, or an act equivalent to any of the above occurs under the laws of the jurisdiction of the other Party.

12.4 Parties Rights and Duties upon Termination

Upon expiry or termination of the Agreement for any reason, Licensee shall, within 30 days after such termination, cease and shall cause all Designated Users (including those of its Affiliates' and Contractors') and Licensee's SDK Contractors to cease using the Licensed Software and distribution of the Redistributables under this Agreement. Notwithstanding the above, in the event the Agreement expires or is terminated for reason other than by The Qt Company pursuant to Section 12.2, the Licensee is entitled, for a period of six (6) months after the effective date of termination, to continue distribution of Devices under the Distribution Licenses paid but unused at such effective date of termination.

Upon any such termination the Licensee shall destroy or return to The Qt Company all copies of the Licensed Software and all related materials and will certify the same to The Qt Company upon its request, provided however that Licensee may retain and exploit such copies of the Licensed Software as it may

reasonably require in providing continued support to Customers.

Expiry or termination of this Agreement for any reason whatsoever shall not relieve Licensee of its obligation to pay any License Fees accrued or payable to The Qt Company prior to the effective date of termination, and Licensee shall immediately pay to The Qt Company all such fees upon the effective date of termination. Termination of this Agreement shall not affect any rights of Customers to continue use of Applications and Devices (and therein incorporated Redistributables).

13. GOVERNING LAW AND LEGAL VENUE

In the event this Agreement is in the name of The Qt Company Inc., a Delaware Corporation, then:

(i) this Agreement shall be construed and interpreted in accordance with the laws of the State of California, USA, excluding its choice of law provisions;

(ii) the United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement; and

(iii) any dispute, claim or controversy arising out of or relating to this Agreement or the breach, termination, enforcement, interpretation or validity thereof, including the determination of the scope or applicability of this Agreement to arbitrate, shall be determined by arbitration in San Francisco, USA, before one arbitrator. The arbitration shall be administered by JAMS pursuant to JAMS' Streamlined Arbitration Rules and Procedures. Judgment on the Award may be entered in any court having jurisdiction. This Section shall not preclude parties from seeking provisional remedies in aid of arbitration from a court of appropriate jurisdiction.

In the event this Agreement is in the name of The Qt Company Ltd., a Finnish Company, then:

(i) this Agreement shall be construed and interpreted in accordance with the laws of Finland, excluding its choice of law provisions;

(ii) the United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement; and

(iii) any disputes, controversy or claim arising out of or relating to this Agreement, or the breach, termination or validity thereof shall be finally settled by arbitration in accordance with the Arbitration Rules of Finland Chamber of Commerce. The arbitration tribunal shall consist of one (1), or if either Party so requires, of three (3), arbitrators. The award shall be final and binding and enforceable in any court of competent jurisdiction. The arbitration shall be held in Helsinki, Finland and the process shall be conducted in the English language. This Section shall not preclude parties from

seeking provisional remedies in aid of arbitration from a court of appropriate jurisdiction.

14. GENERAL PROVISIONS

14.1 No Assignment Licensee

shall not be entitled to assign or transfer all or any of its rights, benefits and obligations under this Agreement without the prior written consent of The Qt Company, which shall not be unreasonably withheld or delayed. The Qt Company shall be entitled to freely assign or transfer any of its rights, benefits or obligations under this Agreement.

14.2 No Third Party Representations

Licensee shall make no representations or warranties concerning the Licensed Software on behalf of The Qt Company. Any representation or warranty Licensee makes or purports to make on The Qt Company's behalf shall be void as to The Qt Company.

14.3 Surviving Sections

Any terms and conditions that by their nature or otherwise reasonably should survive termination of this Agreement shall so be deemed to survive.

14.4 Entire Agreement

This Agreement, the exhibits hereto, the License Certificate and any applicable Purchase Order constitute the complete agreement between the Parties and supersedes all prior or contemporaneous discussions, representations, and proposals, written or oral, with respect to the subject matters discussed herein. In the event of any conflict or inconsistency between this Agreement and any Purchase Order, the terms of this Agreement will prevail over the terms of the Purchase Order with respect to such conflict or inconsistency.

14.5 Modifications

No modification of this Agreement shall be effective unless contained in a writing executed by an authorized representative of each Party. No term or condition contained in Licensee's Purchase Order shall apply unless expressly accepted by The Qt Company in writing.

14.6 Force Majeure

Except for the payment obligations hereunder, neither Party shall be liable to the other for any delay or non-performance of its obligations hereunder in the event and to the extent that such delay or non- performance is due to an event of act of God, terrorist attack or other similar unforeseeable catastrophic

event that prevents either Party for fulfilling its obligations under this Agreement and which such Party cannot avoid or circumvent ("Force Majeure Event"). If the Force Majeure Event results in a delay or non- performance of a Party for a period of three (3) months or longer, then either Party shall have the right to terminate this Agreement with immediate effect without any liability (except for the obligations of payment arising prior to the event of Force Majeure) towards the other Party.

14.7 Notices

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NPM License Checker

=====

[![Build Status](https://www.travis-ci.org/davglass/license-checker.svg?branch=master)](https://www.travis-ci.org/davglass/license-checker)

As of v17.0.0 the `failOn` and `onlyAllow` arguments take semicolons as delimiters instead of commas. Some license names contain commas and it messed with the parsing

Ever needed to see all the license info for a module and its dependencies?

It's this easy:

```
```shell
npm install -g license-checker
```



```
mkdir foo
cd foo
npm install yui-lint
license-checker
...
```

You should see something like this:

```
...
cli@0.4.3
 repository: http://github.com/chriso/cli
 licenses: MIT
glob@3.1.14
 repository: https://github.com/isaacs/node-glob
 licenses: UNKNOWN
graceful-fs@1.1.14
 repository: https://github.com/isaacs/node-graceful-fs
 licenses: UNKNOWN
inherits@1.0.0
 repository: https://github.com/isaacs/inherits
 licenses: UNKNOWN
jshint@0.9.1
 licenses: MIT
lru-cache@1.0.6
 repository: https://github.com/isaacs/node-lru-cache
 licenses: MIT
lru-cache@2.0.4
 repository: https://github.com/isaacs/node-lru-cache
 licenses: MIT
minimatch@0.0.5
 repository: https://github.com/isaacs/minimatch
 licenses: MIT
minimatch@0.2.9
 repository: https://github.com/isaacs/minimatch
 licenses: MIT
sigmund@1.0.0
 repository: https://github.com/isaacs/sigmund
 licenses: UNKNOWN
yui-lint@0.1.1
 licenses: BSD
 repository: http://github.com/yui/yui-lint
...
```

An asterisk next to a license name means that it was deduced from an other file than package.json (README, LICENSE, COPYING, ...)

You could see something like this:

```
...
```



debug@2.0.0  
repository: <https://github.com/visionmedia/debug>  
licenses: MIT\*  
``

## Options

-----

- \* `--production` only show production dependencies.
- \* `--development` only show development dependencies.
- \* `--start [path of the initial json to look for]`
- \* `--unknown` report guessed licenses as unknown licenses.
- \* `--onlyunknown` only list packages with unknown or guessed licenses.
- \* `--json` output in json format.
- \* `--csv` output in csv format.
- \* `--csvComponentPrefix` prefix column for component in csv format.
- \* `--out [filepath]` write the data to a specific file.
- \* `--customPath` to add a custom Format file in JSON
- \* `--exclude [list]` exclude modules which licenses are in the comma-separated list from the output
- \* `--relativeLicensePath` output the location of the license files as relative paths
- \* `--summary` output a summary of the license usage',
- \* `--failOn [list]` fail (exit with code 1) on the first occurrence of the licenses of the semicolon-separated list
- \* `--onlyAllow [list]` fail (exit with code 1) on the first occurrence of the licenses not in the semicolon-separated list
- \* `--packages [list]` restrict output to the packages (package@version) in the semicolon-separated list
- \* `--excludePackages [list]` restrict output to the packages (package@version) not in the semicolon-separated list
- \* `--excludePrivatePackages` restrict output to not include any package marked as private
- \* `--direct` look for direct dependencies only

## Exclusions

-----

A list of licenses is the simplest way to describe what you want to exclude.

You can use valid [SPDX identifiers](<https://spdx.org/licenses/>).

You can use valid SPDX expressions like `'MIT OR X11'`.

You can use non-valid SPDX identifiers, like `'Public Domain'`, since `npm` does support some license strings that are not SPDX identifiers.

## Examples

-----

``

```
license-checker --json > /path/to/licenses.json
license-checker --csv --out /path/to/licenses.csv
license-checker --unknown
license-checker --customPath customFormatExample.json
license-checker --exclude 'MIT, MIT OR X11, BSD, ISC'
license-checker --packages 'react@16.3.0;react-dom@16.3.0;lodash@4.3.1'
license-checker --excludePackages 'internal-1;internal-2'
```



```
license-checker --onlyunknown
```

```
```
```

Custom format

```
-----
```

The `--customPath` option can be used with CSV to specify the columns. Note that the first column, `module_name`, will always be used.

When used with JSON format, it will add the specified items to the usual ones.

The available items are the following:

- name
- version
- description
- repository
- publisher
- email
- url
- licenses
- licenseFile
- licenseText
- licenseModified

You can also give default values for each item.

See an example in `customFormatExample.json`.

Requiring

```
-----
```

```
```js
```

```
var checker = require('license-checker');
```

```
checker.init({
 start: '/path/to/start/looking'
}, function(err, packages) {
 if (err) {
 //Handle error
 } else {
 //The sorted package data
 //as an Object
 }
});
```
```

Debugging

```
-----
```


license-checker uses [debug](https://www.npmjs.com/package/debug) for internal logging. There's two internal markers:

- * `license-checker:error` for errors
- * `license-checker:log` for non-errors

Set the `DEBUG` environment variable to one of these to see debug output:

```
```shell
$ export DEBUG=license-checker*; license-checker
scanning ./yui-lint
cli@0.4.3
 repository: http://github.com/chriso/cli
 licenses: MIT
...
```
```

How Licenses are Found

We walk through the `node_modules` directory with the [read-installed](https://www.npmjs.org/package/read-installed) module. Once we gathered a list of modules we walk through them and look at all of their `package.json`'s. We try to identify the license with the [spdx](https://www.npmjs.com/package/spdx) module to see if it has a valid SPDX license attached. If that fails, we then look into the module for the following files: `LICENSE`, `LICENCE`, `COPYING`, & `README`.

If one of those files are found (in that order) we will attempt to parse the license data from it with a list of known license texts. This will be shown with the `*` next to the name of the license to show that we "guessed" at it. The Mesa header files use the following licenses.

=====

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/*

* \$Id: pa_memorybarrier.h 1240 2007-07-17 13:05:07Z bjornroche \$

* Portable Audio I/O Library

* Memory barrier utilities

*

* Author: Bjorn Roche, XO Audio, LLC

*

* This program uses the PortAudio Portable Audio Library.

* For more information see: <http://www.portaudio.com>

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- * \$Id: pa_ringbuffer.c 1421 2009-11-18 16:09:05Z bjornroche \$
- * Portable Audio I/O Library
- * Ring Buffer utility.
- *
- * Author: Phil Burk, <http://www.softsynth.com>
- * modified for SMP safety on Mac OS X by Bjorn Roche
- * modified for SMP safety on Linux by Leland Lucius
- * also, allowed for const where possible
- * modified for multiple-byte-sized data elements by Sven Fischer
- *
- * Note that this is safe only for a single-thread reader and a
- * single-thread writer.
- *
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- Adapted from Ruby on Rails - <http://dev.rubyonrails.org/browser/spinoffs/prototype/src>
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`cssmin.py` - A Python port of the YUI CSS compressor.

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```
#!/usr/bin/env node
```

```
/*
```

```
Copyright (c) 2013, Yahoo! Inc. All rights reserved.
```

```
Code licensed under the BSD License:
```

```
http://yuilibrary.com/license/
```

```
*/
```

```
var checker = require('../lib/index');
```

```
var args = require('../lib/args').parse();
```

```
var mkdirp = require('mkdirp');
```

```
var path = require('path');
```

```
var chalk = require('chalk');
```

```
var fs = require('fs');
```

```
if (args.help) {
```

```
  console.error('license-checker@' + require('../package.json').version);
```

```
  var usage = [
```

```
    ",
```

```
    ' --production only show production dependencies.',
```

```
    ' --development only show development dependencies.',
```

```
    ' --unknown report guessed licenses as unknown licenses.',
```

```
    ' --start [path of the initial json to look for]',
```

```
    ' --onlyunknown only list packages with unknown or guessed licenses.',
```

```
    ' --json output in json format.',
```

```
    ' --csv output in csv format.',
```

```
    ' --csvComponentPrefix column prefix for components in csv file',
```

```
    ' --out [filepath] write the data to a specific file.',
```

```
    ' --customPath to add a custom Format file in JSON',
```

```
    ' --exclude [list] exclude modules which licenses are in the comma-separated list from the output',
```

```
    ' --relativeLicensePath output the location of the license files as relative paths',
```

```
    ' --summary output a summary of the license usage',
```



```

    ' --failOn [list] fail (exit with code 1) on the first occurrence of the licenses of the semicolon-separated list',
    ' --onlyAllow [list] fail (exit with code 1) on the first occurrence of the licenses not in the semicolon-separated
list',
    ' --direct look for direct dependencies only',
    ' --packages [list] restrict output to the packages (package@version) in the semicolon-separated list',
    ' --excludePackages [list] restrict output to the packages (package@version) not in the semicolon-separated
list',
    ' --excludePrivatePackages restrict output to not include any package marked as private',
    ",
    ' --version The current version',
    ' --help The text you are reading right now :)',
    "
];
console.error(usage.join('\n'), '\n');
process.exit(0);
}

if (args.version) {
    console.error(require('../package.json').version);
    process.exit(1);
}

if (args.failOn && args.onlyAllow) {
    console.error('--failOn and --onlyAllow can not be used at the same time. Choose one or the other. ');
    process.exit(1);
} else {
    var argValue = args.failOn || args.onlyAllow;
    if (argValue && argValue.indexOf(',') >= 0) {
        var argName = args.failOn ? 'failOn' : 'onlyAllow';
        console.warn("Warning: As of v17 the --' + argName + ' argument takes semicolons as delimiters instead of
commas (some license names can contain commas)");
    }
}

checker.init(args, function(err, json) {

    var formattedOutput = "";

    if (!err) {
        console.error('Found error');
        console.error(err);
    }

    if (shouldColorizeOutput(args)) {
        var keys = Object.keys(json);
        keys.forEach(function(key) {
            var keyParts = key.split('@');
            var coloredKey = chalk.blue(keyParts[0]) + chalk.dim('@') + chalk.green(keyParts[1]);

```



```

        json[colorizedKey] = json[key];
        delete json[key];
    });
}

if (args.json) {
    formattedOutput = JSON.stringify(json, null, 2) + '\n';
} else if (args.csv) {
    formattedOutput = checker.asCSV(json, args.customFormat, args.csvComponentPrefix);
} else if (args.markdown){
    formattedOutput = checker.asMarkDown(json, args.customFormat) + '\n';
} else if (args.summary) {
    formattedOutput = checker.asSummary(json);
} else {
    formattedOutput = checker.asTree(json);
}

if (args.files) {
    checker.asFiles(json, args.files);
} else if (args.out) {
    var dir = path.dirname(args.out);
    mkdirp.sync(dir);
    fs.writeFileSync(args.out, formattedOutput, 'utf8');
} else {
    console.log(formattedOutput);
}
});

function shouldColorizeOutput(args) {
    return args.color && !args.out && !(args.csv || args.json || args.markdown);
}

```

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"Term" shall have the meaning set forth in Section 12.

"The Qt Company" shall mean:

- (i) in the event Licensee is an individual residing in the United States or a legal entity incorporated in the United States or having its headquarters in the United States, The Qt Company Inc., a Delaware corporation with its office at 2350 Mission College Blvd., Suite 1020, Santa Clara, CA 95054, USA.; or
- (ii) in the event the Licensee is an individual residing outside of the United States or a legal entity incorporated outside of the United States or having its registered office outside of the United States, The Qt Company Ltd., a Finnish company with its registered office at Bertel Jungin aukio D3A, 02600 Espoo, Finland.

"Third-Party Software" shall have the meaning set forth in Section 4.

"Updates" shall mean a release or version of the Licensed Software containing bug fixes, error corrections and other changes that are generally made available to users of the Licensed Software that have contracted for Support. Updates are generally depicted as a change to the digits following the decimal in the Licensed Software version number. The Qt Company shall make Updates available to the Licensee under the Support. Updates shall be considered as part of the Licensed Software hereunder.

"Upgrades" shall mean a release or version of the Licensed Software containing enhancements and new features and are generally depicted as a change to the first digit of the Licensed Software version number. In the event Upgrades are provided to the Licensee under this Agreement, they shall be considered as part of the Licensed Software hereunder.

2. OWNERSHIP

2.1. Ownership of The Qt Company

The Licensed Software is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The Licensed Software is licensed, not sold.

All of The Qt Company's Intellectual Property Rights are and shall remain the exclusive property of The Qt Company or its licensors respectively.

2.2. Ownership of Licensee

All the Licensee's Intellectual Property Rights are and shall remain the exclusive property of the Licensee or its licensors respectively.

All Intellectual Property Rights to the Modified Software, Applications and Devices shall remain with the Licensee and no rights thereto shall be granted by the Licensee to The Qt Company under this Agreement (except as set forth in Section 2.3 below).

2.3. Modified Software

Licensee may create bug-fixes, error corrections, patches or modifications to the Licensed Software ("Modified Software"). Such Modified Software may break the source or binary compatibility with the Licensed Software (including without limitation through changing the application programming interfaces ("API") or by adding, changing or deleting any variable, method, or class signature in the Licensed Software and/or any inter-process protocols, services or standards in the Licensed Software libraries). To the extent that Licensee's Modified Software so breaks source or binary compatibility with the Licensed Software, Licensee acknowledges that The Qt Company's ability to provide Support may be prevented or limited and Licensee's ability to make use of Updates may be restricted.

Licensee may, at its sole and absolute discretion, choose to submit Modified Software to The Qt Company ("Submitted Modified Software") in connection with Licensee's Support request, service request or otherwise. In the event Licensee does so, then, Licensee hereby grants The Qt Company a sublicensable, assignable, irrevocable, perpetual, worldwide, non-exclusive, royalty-free and fully paid-up license, under all of Licensee's Intellectual Property Rights, to reproduce, adapt, translate, modify, and prepare derivative works of, publicly display, publicly perform, sublicense, make available and distribute such Submitted Modified Software as The Qt Company sees fit at its free and absolute discretion.

3. LICENSES GRANTED

3.1. Development with Licensed Software

Subject to the terms of this Agreement, The Qt Company grants to Licensee a worldwide, non-exclusive, non-transferable license, valid for the License Term, to use, modify and copy the Licensed Software by Designated Users on the Development Platforms for the sole purposes of designing, developing, demonstrating and testing Application(s) and/or Devices, and to provide thereto related support and other related services to end-user Customers. Each Application and/or Device can only include, incorporate or integrate code generated under this Agreement by such Designated Users who are duly licensed for the applicable Development Platform(s) and Deployment Platform(s) (i.e have a valid license for the appropriate Licensed Software product).

Licensee may install copies of the Licensed Software on five (5) computers per Designated User, provided that only the Designated Users who have a valid Development License may use the Licensed Software.

Licensee may at any time designate another Designated User to replace a then-current Designated User by notifying The Qt Company in writing, provided that any Designated User may be replaced only once during any six-month period.

Upon expiry of the initially agreed License Term, the respective License Terms shall be automatically extended to one or more Renewal Term(s), unless and until either Party notifies the other Party in writing that it does not wish to continue the License Term, such notification to be provided to the other Party no less than thirty (30) days before expiry of the respective License Term.

Unless otherwise agreed between the Parties, Renewal Term shall be of equal length with the initial License Term.

Any such Renewal Term shall be subject to License Fees agreed between the Parties or, if no advance agreement exists, subject to The Qt Company's standard pricing applicable at the commencement date of any such Renewal Term.

Any price or other term specified for a Renewal Term shall be valid only for the

specified time.

The Qt Company may request the Licensee to place a purchase order corresponding to a quote by The Qt Company for the relevant Renewal Term.

In the event Licensee does not prevent auto-renewal pursuant the above, but a Renewal Term is nevertheless not duly ordered within 30 days from the date of the respective notification from The Qt Company and/or the respective License Fee paid by due date specified in The Qt Company's respective invoice, The Qt Company shall apply a reinstatement fee equal to ten percent (10 %) of the total value of the License Fees of the Development Licenses for the expired term to be added to the License Fee of the respective Renewal Term.

In the event Licensee chooses not to renew a Development License for a Renewal Term by notifying The Qt Company thereof no less than thirty (30) days before expiry of the respective License Term, Licensee may still reinstate such expired Development Licenses for a Renewal Term subject to applicable renewal Term License Fees until thirty (30) days from the expiry of the initially agreed License Term or preceding Renewal Term. After such thirty (30) day period a Development License shall be subject to applicable License Fees for a new Development License and not any Renewal Term License Fees.

3.2. Distribution of Applications

Subject to the terms of this Agreement, The Qt Company grants to Licensee a worldwide, non-exclusive, non-transferable, revocable (for cause pursuant to this Agreement) right and license, valid for the Term, to

- (i) distribute, by itself or through its Contractors, Redistributables as installed, incorporated or integrated into Applications for execution on the Deployment Platforms, and
- (ii) grant sublicenses to Redistributables, as distributed hereunder, for Customers solely for Customer's internal use and to the extent necessary in order for the Customers to use the Applications for their respective intended purposes.

Right to distribute the Redistributables as part of an Application as provided herein is not royalty-bearing but is conditional upon the Licensee not having any unpaid License Fees for Development Licenses owed to The Qt Company at the time of distribution of any Redistributables to Customers.

3.3. Distribution of Devices

Subject to the terms of this Agreement, The Qt Company grants to Licensee a worldwide, non-exclusive, non-transferable, revocable (for cause pursuant to this Agreement) right and license, valid for the Term, to

- (i) distribute, by itself or through one or more tiers of Contractors, Redistributables as installed, incorporated or integrated, or intended to be installed, incorporated or integrated into Devices for execution on the Deployment Platforms, and
- (ii) grant sublicenses to Redistributables, as distributed hereunder, for

Customers solely for Customer's internal use and to the extent necessary in order for the Customers to use the Devices for their respective intended purposes.

Right to distribute the Redistributables with Devices as provided herein is conditional upon the Licensee (i) not having any unpaid License Fees for Development Licenses owed to The Qt Company, and (ii) having purchased and paid corresponding Distribution Licenses at the time of distribution of any Redistributables to Customers.

3.4. Further Requirements

The licenses granted above in this Section 3 by The Qt Company to Licensee are conditional and subject to Licensee's compliance with the following terms:

- (i) Licensee shall not remove or alter any copyright, trademark or other proprietary rights notice(s) contained in any portion of the Licensed Software;
- (ii) Applications must add primary and substantial functionality to the Licensed Software so as not to compete with the Licensed Software;
- (iii) Applications may not pass on functionality which in any way makes it possible for others to create software with the Licensed Software; provided however that Licensee may use the Licensed Software's scripting and QML ("Qt Quick") functionality solely in order to enable scripting, themes and styles that augment the functionality and appearance of the Application(s) without adding primary and substantial functionality to the Application(s);
- (iv) Licensee shall not use Licensed Software in any manner or for any purpose that infringes, misappropriates or otherwise violates any Intellectual property or right of any third party, or that violates any applicable law;
- (v) Licensee shall not use The Qt Company's or any of its suppliers' names, logos, or trademarks to market Applications, except that Licensee may use "Built with Qt" logo to indicate that Application(s) was developed using the Licensed Software;
- (vi) Licensee shall not distribute, sublicense or disclose source code of Licensed Software to any third party (provided however that Licensee may appoint employee(s) of Contractors as Designated Users to use Licensed Software pursuant to this Agreement). Such right may be available for the Licensee subject to a separate software development kit ("SDK") license agreement to be concluded with The Qt Company;
- (vii) Licensee shall not grant the Customers a right to (i) make copies of the Redistributables except when and to the extent required to use the Applications and/or Devices for their intended purpose, (ii) modify the Redistributables or create derivative works thereof, (iii) decompile, disassemble or otherwise reverse engineer Redistributables, or (iv) redistribute any copy or portion of the Redistributables to any third party, except as part of the onward sale of the Device on which the Redistributables are installed;

- (viii) Licensee shall not and shall cause that its Affiliates or Contractors shall not use Licensed Software in any Prohibited Combination, unless Licensee has received an advance written permission from The Qt Company to do so. Absent such written permission, any and all distribution by the Licensee during the Term of a hardware device or product a) which incorporate or integrate any part of Licensed Software or Open Source Qt; or b) where the main user interface or substantial functionality is provided by software built with Licensed Software or Open Source Qt or otherwise depends on the Licensed Software or Open Source Qt, shall be considered to be Device distribution under this Agreement and shall be dependent on Licensee's compliance thereof (including but not limited to obligation to pay applicable License Fees for such distribution). Notwithstanding what is provided above in this sub-section (viii), Licensee is entitled to use and combine Licensed Software with any Permitted Software;
- (ix) Licensee shall cause all of its Affiliates and Contractors entitled to make use of the licenses granted under this Agreement, to be contractually bound to comply with the relevant terms of this Agreement and not to use the Licensed Software beyond the terms hereof and for any purposes other than operating within the scope of their services for Licensee. Licensee shall be responsible for any and all actions and omissions of its Affiliates and Contractors relating to the Licensed Software and use thereof (including but not limited to payment of all applicable License Fees);
- (x) Except when and to the extent explicitly provided in this Section 3, Licensee shall not transfer, publish, disclose, display or otherwise make available the Licensed Software; and
- (xi) Licensee shall not attempt or enlist a third party to conduct or attempt to conduct any of the above.

Above terms shall not be applicable if and to the extent they conflict with any mandatory provisions of any applicable laws.

Any use of Licensed Software beyond the provisions of this Agreement is strictly prohibited and requires an additional license from The Qt Company.

4. THIRD-PARTY SOFTWARE

The Licensed Software may provide links to third party libraries or code (collectively "Third-Party Software") to implement various functions. Third-Party Software does not comprise part of the Licensed Software. In some cases, access to Third-Party Software may be included with the Licensed Software. Such Third-Party Software will be listed in the ".../src/3rdparty" source tree delivered with the Licensed Software or documented in the Licensed Software, as such may be amended from time to time. Licensee acknowledges that use or distribution of Third-Party Software is in all respects subject to applicable license terms of applicable third-party right holders.

5. PRE-RELEASE CODE

The Licensed Software may contain pre-release code and functionality, or sample code marked or otherwise stated with appropriate designation such as "Technology Preview", "Alpha", "Beta", "Sample" etc. ("Pre-Release Code").

Such Pre-Release Code may be present complimentary for the Licensee, in order to provide experimental support or information for new platforms or preliminary versions of one or more new functionalities or for other similar reasons. The Pre-Release Code may not be at the level of performance and compatibility of a final, generally available, product offering. The Pre-Release Code may not operate correctly, may contain errors and may be substantially modified by The Qt Company prior to the first commercial product release, if any. The Qt Company is under no obligation to make Pre-Release Code commercially available, or provide any Support or Updates relating thereto. The Qt Company assumes no liability whatsoever regarding any Pre-Release Code, but any use thereof is exclusively at Licensee's own risk and expense.

For clarity, unless Licensed Software specifies different license terms for the respective Pre-Release Code, the Licensee is entitled to use such pre-release code pursuant to Section 3, just like other Licensed Software, provided however that in the event Add-on Products are included and available as such Pre-Release Code, Licensee's right to use such Add-on Products is nevertheless subject to and conditional upon conclusion of separate agreement with The Qt Company.

6. LIMITED WARRANTY AND WARRANTY DISCLAIMER

The Qt Company hereby represents and warrants that it has the power and authority to grant the rights and licenses granted to Licensee under this Agreement.

Except as set forth above, the Licensed Software is licensed to Licensee "as is" and Licensee's exclusive remedy and The Qt Company's entire liability for errors in the Licensed Software shall be limited, at The Qt Company's option, to correction of the error, replacement of the Licensed Software or return of the applicable fees paid for the defective Licensed Software for the time period during which the License is not able to utilize the Licensed Software under the terms of this Agreement.

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, THE QT COMPANY ON BEHALF OF ITSELF AND ITS LICENSORS, SUPPLIERS AND AFFILIATES, DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT WITH REGARD TO THE LICENSED SOFTWARE. THE QT COMPANY DOES NOT WARRANT THAT THE LICENSED SOFTWARE WILL SATISFY LICENSEE'S REQUIREMENTS OR THAT IT WILL OPERATE WITHOUT DEFECT OR ERROR OR THAT THE OPERATION THEREOF WILL BE UNINTERRUPTED.

7. INDEMNIFICATION AND LIMITATION OF LIABILITY

7.1. Limitation of Liability

EXCEPT FOR (I) CASES OF GROSS NEGLIGENCE OR INTENTIONAL MISCONDUCT, AND (II) BREACH OF CONFIDENTIALITY, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL EITHER PARTY BE LIABLE TO THE OTHER PARTY FOR ANY LOSS OF PROFIT, LOSS OF DATA, LOSS OF BUSINESS OR GOODWILL OR ANY OTHER INDIRECT, SPECIAL, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE COST, DAMAGES OR EXPENSE OF ANY KIND, HOWSOEVER ARISING UNDER OR IN CONNECTION WITH THIS AGREEMENT.

EXCEPT FOR (I) CASES OF GROSS NEGLIGENCE OR INTENTIONAL MISCONDUCT, AND (II) BREACH OF CONFIDENTIALITY, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL EITHER PARTY'S TOTAL AGGREGATE LIABILITY UNDER THIS AGREEMENT EXCEED THE AGGREGATE LICENSE FEES PAID OR PAYABLE TO THE QT COMPANY FROM LICENSEE DURING THE PERIOD OF TWELVE (12) MONTHS IMMEDIATELY PRECEDING THE EVENT RESULTING IN SUCH LIABILITY.

THE PROVISIONS OF THIS SECTION 7 ALLOCATE THE RISKS UNDER THIS AGREEMENT BETWEEN THE QT COMPANY AND LICENSEE AND THE PARTIES HAVE RELIED UPON THE LIMITATIONS SET FORTH HEREIN IN DETERMINING WHETHER TO ENTER INTO THIS AGREEMENT.

NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS AGREEMENT, LICENSEE SHALL ALWAYS BE LIABLE TO PAY THE APPLICABLE LICENSE FEES CORRESPONDING TO ITS ACTUAL USE OF LICENSED SOFTWARE.

8. SUPPORT, UPDATES AND ONLINE SERVICES

Upon due payment of the agreed License Fees the Licensee will be eligible to receive Support and Updates and to use the Online Services during the License Term, provided, however, that in the event the License Term is longer than 36 months, the initial payment includes Support for only the first 12 months, unless the Parties specifically otherwise agree.

Unless otherwise decided by The Company at its free and absolute discretion, Upgrades will not be included in the Support but may be available subject to additional fees.

From time to time The Qt Company may change the Support terms, provided that during the respective ongoing License Term the level of Support provided by The Qt Company may not be reduced without the consent of the Licensee.

Unless otherwise agreed, The Qt Company shall not be responsible for providing any service or support to Customers.

9. CONFIDENTIALITY

Each Party acknowledges that during the Term of this Agreement each Party may receive information about the other Party's business, business methods, business plans, customers, business relations, technology, and other information, including the terms of this Agreement, that is confidential and of great value to the other Party, and the value of which would be significantly reduced if disclosed to third parties ("Confidential Information"). Accordingly, when a Party (the "Receiving Party") receives Confidential Information from the other Party (the "Disclosing Party"), the Receiving Party shall only disclose such information to employees and Contractors on a need to know basis, and shall cause its employees and employees of its Affiliates to: (i) maintain any and all Confidential Information in confidence; (ii) not disclose the Confidential Information to a third party without the Disclosing Party's prior written approval; and (iii) not, directly or indirectly, use the Confidential Information for any purpose other than for exercising its rights and fulfilling its responsibilities pursuant to this Agreement. Each Party shall take reasonable measures to protect the Confidential Information of the other Party, which measures shall not be less than the measures taken by such Party to protect its own confidential and proprietary information.

Obligation of confidentiality shall not apply to information that (i) is or becomes generally known to the public through no act or omission of the Receiving Party; (ii) was in the Receiving Party's lawful possession prior to the disclosure hereunder and was not subject to limitations on disclosure or use; (iii) is developed independently by employees or Contractors of the Receiving Party or other persons working for the Receiving Party who have not had access to the Confidential Information of the Disclosing Party, as proven by the written records of the Receiving Party; (iv) is lawfully disclosed to the Receiving Party without restrictions, by a third party not under an obligation of confidentiality; or (v) the Receiving Party is legally compelled to disclose, in which case the Receiving Party shall notify the Disclosing Party of such compelled disclosure and assert the privileged and confidential nature of the information and cooperate fully with the Disclosing Party to limit the scope of disclosure and the dissemination of disclosed Confidential Information to the minimum extent necessary.

The obligations under this Section 9 shall continue to remain in force for a period of five (5) years after the last disclosure, and, with respect to trade secrets, for so long as such trade secrets are protected under applicable trade secret laws.

10. FEES, DELIVERY AND PAYMENT

10.1. License Fees

License Fees are described in The Qt Company's standard price list, quote or Purchase Order confirmation or in an appendix hereto, as the case may be.

The License Fees shall not be refunded or claimed as a credit in any event or

for any reason whatsoever.

10.2. Ordering Licenses

Licensee may purchase Development Licenses and Distribution Licenses pursuant to agreed pricing terms or, if no specific pricing terms have been agreed upon, at The Qt Company's standard pricing terms applicable at the time of purchase. Unless specifically otherwise provided, any pricing terms referenced in this Agreement shall be valid for twelve (12) months from the date of this Agreement.

Licensee shall submit all purchase orders for Development Licenses and Distribution Licenses to The Qt Company by email or any other method acceptable to The Qt Company (each such order is referred to herein as a "Purchase Order") for confirmation, whereupon the Purchase Order shall become binding between the Parties.

10.3. Distribution License Packs

Unless otherwise agreed, Distribution Licenses shall be purchased by way of Distribution License Packs.

Upon due payment of the ordered Distribution License Pack(s), the Licensee will have an account of Distribution Licenses available for distributing the Redistributables in accordance with this Agreement.

Each time Licensee distributes a copy of Redistributables, then one Distribution License is used, and Licensee's account of available Distribution Licenses is decreased accordingly.

Licensee may distribute copies of the Redistributables so long as Licensee has Distribution Licenses remaining on its account.

10.4. Payment Terms

License Fees and any other charges under this Agreement shall be paid by Licensee no later than thirty (30) days from the date of the applicable invoice from The Qt Company.

The Qt Company will submit an invoice to Licensee after the date of this Agreement and/or after The Qt Company receives a Purchase Order from Licensee.

A late payment charge of the lower of (a) one percent per month; or (b) the interest rate stipulated by applicable law, shall be charged on any unpaid balances that remain past due.

10.5. Taxes

All License Fees and other charges payable hereunder are gross amounts but exclusive of any value added tax, use tax, sales tax, withholding tax and other taxes, duties or tariffs ("Taxes") levied directly for the sale, delivery or use of Licensed Software hereunder pursuant to any applicable

law. Such applicable Taxes shall be paid by Licensee to The Qt Company, or, where applicable, in lieu of payment of such Taxes to The Qt Company, Licensee shall provide an exemption certificate to The Qt Company and any applicable authority.

11. RECORD-KEEPING AND REPORTING OBLIGATIONS; AUDIT RIGHTS

11.1. Licensee's Record-keeping

Licensee shall at all times during the Term of this Agreement and for a period of seven (7) years thereafter maintain Licensee's Records in an accurate and up-to-date form. Licensee's Records shall be adequate to reasonably enable The Qt Company to determine Licensee's compliance with the provisions of this Agreement. The records shall conform to general good accounting practices.

Licensee shall, within thirty (30) days from receiving The Qt Company's request to that effect, deliver to The Qt Company a report based on Licensee's Records, such report to contain information, in sufficient detail, on (i) number and identity of users working with Licensed Software or Open Source Qt, (ii) copies of Redistributables distributed by Licensee during the most recent calendar quarter and/or any other term specified by The Qt Company, (iii) number of undistributed copies of Redistributables and corresponding number of unused Distribution Licenses remaining on Licensee's account, and (iv) any other information as The Qt Company may reasonably require from time to time.

11.2. The Qt Company's Audit Rights

The Qt Company or an independent auditor acting on behalf of The Qt Company's, may, upon at least five (5) business days' prior written notice and at its expense, audit Licensee with respect to the Licensee's use of the Licensed Software, but not more frequently than once during each 6-month period. Such audit may be conducted by mail, electronic means or through an in-person visit to Licensee's place of business. Any such in-person audit shall be conducted during regular business hours at Licensee's facilities and shall not unreasonably interfere with Licensee's business activities. The Qt Company or the independent auditor acting on behalf of The Qt Company shall be entitled to inspect Licensee's Records and conduct necessary interviews of Licensee's relevant employees and Contractors. All such Licensee's Records and use thereof shall be subject to an obligation of confidentiality under this Agreement.

If an audit reveals that Licensee is using the Licensed Software beyond scope of the licenses Licensee has paid for, Licensee agrees to pay The Qt Company any amounts owed for such unauthorized use within 30 days from receipt of the corresponding invoice from The Qt Company.

In addition, in the event the audit reveals a material violation of the terms of this Agreement (without limitation, either (i) underpayment of

more than 10 % of License Fees or 10,000 euros (whichever is more) or (ii) distribution of products, which include or result from Prohibited Combination, shall be deemed a material violation for purposes of this section), then the Licensee shall pay The Qt Company's reasonable cost of conducting such audit.

12. TERM AND TERMINATION

12.1. Agreement Term

This Agreement shall enter into force upon due acceptance by both Parties and remain in force for as long as there is any Development License(s) purchased under this Agreement in force ("Term"), unless and until terminated pursuant to the terms of this Section 12.

12.2. Termination and suspension of rights

Either Party shall have the right to terminate this Agreement upon thirty (30) days prior written notice if the other Party commits a material breach of any obligation of this Agreement and fails to remedy such breach within such notice period.

Instead of termination, The Qt Company shall have the right to suspend or withhold grants of all rights to the Licensed Software hereunder, including but not limited to the Development Licenses, Distribution License, and Support, should Licensee fail to make payment in timely fashion or otherwise violates or is reasonably suspected to violate its obligations or terms of this Agreement, and where such violation or breach is not cured within five (5) business days following The Qt Company's written notice thereof.

12.3. Mutual Right to Terminate

Either Party shall have the right to terminate this Agreement immediately upon written notice in the event that the other Party becomes insolvent, files for any form of bankruptcy, makes any assignment for the benefit of creditors, has a receiver, administrative receiver or officer appointed over the whole or a substantial part of its assets, ceases to conduct business, or an act equivalent to any of the above occurs under the laws of the jurisdiction of the other Party.

12.4. Parties' Rights and Duties upon Termination

Upon expiry or termination of the Agreement, Licensee shall cease and shall cause all Designated Users (including those of its Affiliates' and Contractors') to cease using the Licensed Software and distribution of the Redistributables under this Agreement.

Notwithstanding the above, in the event the Agreement expires or is terminated:

- (i) as a result of The Qt Company choosing not to renew the Development License(s) as set forth in Section 3.1, then all valid licenses possessed by the Licensee at such date shall be extended to be valid in perpetuity under the terms of this Agreement and Licensee is

entitled to purchase additional licenses as set forth in Section 10.2; or

- (ii) for reason other than by The Qt Company pursuant to item (i) above or pursuant to Section 12.2, then the Licensee is entitled, for a period of six (6) months after the effective date of termination, to continue distribution of Devices under the Distribution Licenses paid but unused at such effective date of termination.

Upon any such termination the Licensee shall destroy or return to The Qt Company all copies of the Licensed Software and all related materials and will certify the same to The Qt Company upon its request, provided however that Licensee may retain and exploit such copies of the Licensed Software as it may reasonably require in providing continued support to Customers.

Expiry or termination of this Agreement for any reason whatsoever shall not relieve Licensee of its obligation to pay any License Fees accrued or payable to The Qt Company prior to the effective date of termination, and Licensee shall immediately pay to The Qt Company all such fees upon the effective date of termination. Termination of this Agreement shall not affect any rights of Customers to continue use of Applications and Devices (and therein incorporated Redistributables).

12.5. Extension in case of bankruptcy

In the event The Qt Company is declared bankrupt under a final, non-cancellable decision by relevant court of law, and this Agreement is not, at the date of expiry of the Development License(s) pursuant to Section 3.1, assigned to party, who has assumed The Qt Company's position as a legitimate licensor of Licensed Software under this Agreement, then all valid licenses possessed by the Licensee at such date of expiry, and which the Licensee has not notified for expiry, shall be extended to be valid in perpetuity under the terms of this Agreement.

13. GOVERNING LAW AND LEGAL VENUE

In the event this Agreement is in the name of The Qt Company Inc., a Delaware Corporation, then:

- (i) this Agreement shall be construed and interpreted in accordance with the laws of the State of California, USA, excluding its choice of law provisions;
- (ii) the United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement; and
- (iii) any dispute, claim or controversy arising out of or relating to this Agreement or the breach, termination, enforcement, interpretation or validity thereof, including the determination of the scope or applicability of this Agreement to arbitrate, shall be determined by arbitration in San Francisco, USA, before one arbitrator. The arbitration shall be administered by JAMS pursuant to JAMS' Streamlined Arbitration Rules and Procedures. Judgment on the Award

may be entered in any court having jurisdiction. This Section shall not preclude parties from seeking provisional remedies in aid of arbitration from a court of appropriate jurisdiction.

In the event this Agreement is in the name of The Qt Company Ltd., a Finnish Company, then:

- (i) this Agreement shall be construed and interpreted in accordance with the laws of Finland, excluding its choice of law provisions;
- (ii) the United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement; and
- (iii) any disputes, controversy or claim arising out of or relating to this Agreement, or the breach, termination or validity thereof shall be finally settled by arbitration in accordance with the Arbitration Rules of Finland Chamber of Commerce. The arbitration tribunal shall consist of one (1), or if either Party so requires, of three (3), arbitrators. The award shall be final and binding and enforceable in any court of competent jurisdiction. The arbitration shall be held in Helsinki, Finland and the process shall be conducted in the English language. This Section shall not preclude parties from seeking provisional remedies in aid of arbitration from a court of appropriate jurisdiction.

14. GENERAL PROVISIONS

14.1. No Assignment

Except in the case of a merger or sale of substantially all of its corporate assets, Licensee shall not be entitled to assign or transfer all or any of its rights, benefits and obligations under this Agreement without the prior written consent of The Qt Company, which shall not be unreasonably withheld or delayed. The Qt Company shall be entitled to freely assign or transfer any of its rights, benefits or obligations under this Agreement.

14.2. No Third-Party Representations

Licensee shall make no representations or warranties concerning the Licensed Software on behalf of The Qt Company. Any representation or warranty Licensee makes or purports to make on The Qt Company's behalf shall be void as to The Qt Company.

14.3. Surviving Sections

Any terms and conditions that by their nature or otherwise reasonably should survive termination of this Agreement shall so be deemed to survive. Such sections include especially the following: 1, 2, 6, 7, 9, 11, 12.4, 13 and 14.

14.4. Entire Agreement

This Agreement, the exhibits hereto, the License Certificate and any applicable Purchase Order accepted by The Qt Company constitute the complete agreement between the Parties and supersedes all prior or contemporaneous discussions, representations, and proposals, written or oral, with respect

to the subject matters discussed herein.

In the event of any conflict or inconsistency between this Agreement and any Purchase Order, the terms of this Agreement will prevail over the terms of the Purchase Order with respect to such conflict or inconsistency.

Parties specifically acknowledge and agree that this Agreement prevails over any click-to-accept or similar agreements the Designated Users may need to accept online upon download of the Licensed Software, as may be required by The Qt Company's applicable processes relating to Licensed Software.

14.5. Modifications

No modification of this Agreement shall be effective unless contained in a writing executed by an authorized representative of each Party. No term or condition contained in Licensee's Purchase Order ("Deviating Terms") shall apply unless The Qt Company has expressly agreed such Deviating Terms in writing. Unless and to the extent expressly agreed by The Qt Company, any such Deviating Terms shall be deemed void and with no legal effect. For clarity, delivery of the Licensed Software following the receipt of the Purchase Order including Deviating Terms shall not constitute acceptance of such Deviating Terms."

14.6. Force Majeure

Except for the payment obligations hereunder, neither Party shall be liable to the other for any delay or non-performance of its obligations hereunder in the event and to the extent that such delay or non-performance is due to an event of act of God, terrorist attack or other similar unforeseeable catastrophic event that prevents either Party for fulfilling its obligations under this Agreement and which such Party cannot avoid or circumvent ("Force Majeure Event"). If the Force Majeure Event results in a delay or non-performance of a Party for a period of three (3) months or longer, then either Party shall have the right to terminate this Agreement with immediate effect without any liability (except for the obligations of payment arising prior to the event of Force Majeure) towards the other Party.

14.7. Notices

Any notice given by one Party to the other shall be deemed properly given and deemed received if specifically acknowledged by the receiving Party in writing or when successfully delivered to the recipient by hand, fax, or special courier during normal business hours on a business day to the addresses specified for each Party on the signature page. Each communication and document made or delivered by one Party to the other Party pursuant to this Agreement shall be in the English language.

14.8. Export Control

Licensee acknowledges that the Redistributables, as incorporated in

Applications or Devices, may be subject to export control restrictions under the applicable laws of respective countries. Licensee shall fully comply with all applicable export license restrictions and requirements as well as with all laws and regulations relating to the Redistributables and exercise of licenses hereunder and shall procure all necessary governmental authorizations, including without limitation, all necessary licenses, approvals, permissions or consents, where necessary for the re-exportation of the Redistributables, Applications and/or Devices.

14.9. No Implied License

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APPENDICES

The Agreement includes Appendix 1, and possibly one or more of the appendices 3-5, depending on the product(s) purchased by the Licensee, what is stated in the quote or invoice, and/or what is stated in the Licensee's License Certificate.

APPENDIX 1

The modules and/or tools that are included in the respective product - Qt for Application Development (QtAD), Qt for Device Creation (QtDC), Qt for MCUs (QtMCU), Qt 3D Studio (Qt3DS) and Qt Design Studio (QtDS) - are marked with 'X' in the below table.

Parts of the product that are permitted for distribution in object-code form only ("Redistributables") are marked with 'R' in the below table.

| Modules / Tools | QtAD | QtDC | QtMCU | Qt3DS | QtDS |
|-----------------------|------|------|-------|-------|------|
| Qt Core | X, R | X, R | | | |
| Qt GUI | X, R | X, R | | | |
| Qt Multimedia | X, R | X, R | | | |
| Qt Multimedia Widgets | X, R | X, R | | | |
| Qt Network | X, R | X, R | | | |
| Qt QML | X, R | X, R | | | |
| Qt Quick | X, R | X, R | | | |
| Qt Quick Controls 2 | X, R | X, R | | | |
| Qt Quick Dialogs | X, R | X, R | | | |
| Qt Quick Layouts | X, R | X, R | | | |
| Qt Quick Test | X, R | X, R | | | |
| Qt SQL | X, R | X, R | | | |
| Qt Test | X, R | X, R | | | |
| Qt Widgets | X, R | X, R | | | |
| Active Qt | X, R | X, R | | | |
| Qt 3D | X, R | X, R | | | |
| Qt Android Extras | X, R | X, R | | | |
| Qt Bluetooth | X, R | X, R | | | |

| | | | | | | |
|--------------------------|------|------|--|--|--|--|
| Qt Canvas 3D | X, R | X, R | | | | |
| Qt Concurrent | X, R | X, R | | | | |
| Qt D-Bus | X, R | X, R | | | | |
| Qt Gamepad | X, R | X, R | | | | |
| Qt Graphical Effects | X, R | X, R | | | | |
| Qt Help | X, R | X, R | | | | |
| Qt Image Formats | X, R | X, R | | | | |
| Qt Location | X, R | X, R | | | | |
| Qt Mac Extras | X, R | X, R | | | | |
| Qt Network Authorization | X, R | X, R | | | | |
| Qt NFC | X, R | X, R | | | | |
| Qt Platform Headers | X, R | X, R | | | | |
| Qt Positioning | X, R | X, R | | | | |
| Qt Print Support | X, R | X, R | | | | |
| Qt Purchasing | X, R | X, R | | | | |
| Qt for Python | X, R | X, R | | | | |
| Qt Quick Controls | X, R | X, R | | | | |
| Qt Quick Extras | X, R | X, R | | | | |
| Qt Quick Widgets | X, R | X, R | | | | |
| Qt SCXML | X, R | X, R | | | | |
| Qt Sensors | X, R | X, R | | | | |
| Qt Serial Bus | X, R | X, R | | | | |
| Qt Serial Port | X, R | X, R | | | | |
| Qt Speech | X, R | X, R | | | | |

| | | | | | | | | |
|---------------------------------------|---|---|---|---|---|--|--|--|
| Qt SVG | X | R | X | R | | | | |
| Qt UI Tools | X | R | X | R | | | | |
| Qt WebChannel | X | R | X | R | | | | |
| Qt WebEngine | X | R | X | R | | | | |
| Qt WebSockets | X | R | X | R | | | | |
| Qt WebView | X | R | X | R | | | | |
| Qt Windows Extras | X | R | X | R | | | | |
| Qt X11 Extras | X | R | X | R | | | | |
| Qt XML | X | R | X | R | | | | |
| Qt XML Patterns | X | R | X | R | | | | |
| Qt Wayland Compositor | X | R | X | R | | | | |
| Qt Charts | X | R | X | R | | | | |
| Qt Data visualization | X | R | X | R | | | | |
| Qt Virtual Keyboard | X | R | X | R | | | | |
| Boot 2 Qt stack | | X | R | | | | | |
| Qt OTA | | X | R | | | | | |
| Device Utilities | | X | R | | | | | |
| Qt Debugging Bridge (QDB) Daemon | | X | R | | | | | |
| Qt Quick Ultralite Controls | | | X | R | | | | |
| Qt Quick Ultralite | | | X | R | | | | |
| Qt Creator | X | | X | | X | | | |
| Qt Designer (Qt Widget Designer) | X | | X | | | | | |
| Qt Quick Designer (Qt Creator plugin) | X | | X | | X | | | |

| | | | | | | |
|--------------------------------|---|---|---|------|---|--|
| Qt Linguist | X | X | X | | | |
| +-----+ | | | | | | |
| Qt Assistant | X | X | X | | | |
| +-----+ | | | | | | |
| Lupdate | X | X | X | | | |
| +-----+ | | | | | | |
| Lrelease | X | X | X | | | |
| +-----+ | | | | | | |
| Qmake | X | X | | | | |
| +-----+ | | | | | | |
| Uic | X | X | | | | |
| +-----+ | | | | | | |
| Rcc | X | X | | | | |
| +-----+ | | | | | | |
| Qlallr | X | X | | | | |
| +-----+ | | | | | | |
| Qdoc | X | X | | | | |
| +-----+ | | | | | | |
| Qmlscene | X | X | | | | |
| +-----+ | | | | | | |
| Qmlviewer | X | X | | | | |
| +-----+ | | | | | | |
| Target toolchains | | X | X | | | |
| +-----+ | | | | | | |
| Qt Debugging Bridge (QDB) Host | | X | | | | |
| Tools | | | | | | |
| +-----+ | | | | | | |
| qtconfig-gui | | X | | | | |
| +-----+ | | | | | | |
| Qt Emulator | | X | | | | |
| +-----+ | | | | | | |
| Qmlinterfacegenerator | | | X | | | |
| +-----+ | | | | | | |
| Qmltoccpp | | | X | | | |
| +-----+ | | | | | | |
| qulfontcompiler | | | X | | | |
| +-----+ | | | | | | |
| Qt53DStudioRuntime2 | | | | X, R | | |
| +-----+ | | | | | | |
| Qt 3D Studio | | | | X | | |
| +-----+ | | | | | | |
| Qt Design Studio | | | | | X | |
| +-----+ | | | | | | |

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|--|-------------------|---------------------|------------------|------------------------|-------------|---------------|-------------|
| Modules / Tools of Licensed Software | Qt for Automation | Qt Automotive Suite | Qt Safe Renderer | Qt Application Manager | Qt GammaRay | Qt Deployment | Qt Platform |
| Protocols | | | | | Package | | |
| Qt MQTT | X, R | | | | | | |
| Qt KNX | X, R | | | | | | |
| Qt OPC UA | X, R | | | | | | |
| Qt CoAP | X, R | | | | | | |
| Qt Safe Renderer | | X, R | X, R | | | | |
| Qt Application Manager | | X, R | | X, R | | | |
| Qt IVI | | X, R | | | | | |
| Reference UI | | X, R | | | | | |
| Qt GENIVI Extras | | X, R | | | | | |
| QML Live | | X | | | | | |
| Qt Creator | | X | | | | | |
| Deployment | | | | | | | |
| Qt Creator Plugin for Qt Application Manager | | X | | X | | | |
| Qt Automotive Suite | | X | | | | | |
| Deployment Server | | | | | | | |

| | | | | | | | |
|----------------------|--|---|--|--|---|---|--|
| Qt Design Studio | | X | | | | | |
| Qt 3D Studio | | X | | | | | |
| GammaRay | | X | | | X | | |
| Platform adaptations | | | | | | X | |
| for specified | | | | | | | |
| Deployment Platforms | | | | | | | |
| Qt for Device | | X | | | | | |
| Creation | | | | | | | |

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^tools/utls/qtcreator/

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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Change Log

v25.0.1 (2019/01/10 19:29 +00:00)

- [f1c835b](https://github.com/davglass/license-checker/commit/f1c835b991b65dc928eafe64c29b73df9e703169) Updated readme with new args (@davglass)
- [ada667f](https://github.com/davglass/license-checker/commit/ada667f28e8ef4e96b5b6059fe05541d05ca936c) changelog (@davglass)
- [7813f0d](https://github.com/davglass/license-checker/commit/7813f0db3b51f7cc4cd37d8e7b4670f9005fed06) contrib (@davglass)

v25.0.0 (2019/01/10 15:09 +00:00)

- [cdb77d9](https://github.com/davglass/license-checker/commit/cdb77d9a2b36cd87503f32265a0ee388b25c24ae) 25.0.0 (@davglass)
- [b897345](https://github.com/davglass/license-checker/commit/b89734549bc05fb5e143083fdf6d3959d87eb2b8) [Fixes #136] Document --start option and add the depth option for looking into root dependencies or infinitely (@davglass)
- [#185](https://github.com/davglass/license-checker/pull/185) Merge pull request #185 from theboolean/fix/exclude-packages-and-private (@theboolean)
- [#184](https://github.com/davglass/license-checker/pull/184) Merge pull request #184 from theboolean/docs/fix-typo (@theboolean)
- [987a60f](https://github.com/davglass/license-checker/commit/987a60fbb58052cf36d5a80e6252e81136bb1dd8) changes 24.1.0 (@davglass)

v24.1.0 (2018/12/14 20:54 +00:00)

- [18ab8a1](https://github.com/davglass/license-checker/commit/18ab8a1eb478d1354429ca4318c1df3de3e4cbb1) 24.1.0 (@davglass)
- [1dca0f6](https://github.com/davglass/license-checker/commit/1dca0f616aebdef2d398c130a2a4f86c2b4e88c8) Changelog (@davglass)
- [#188](https://github.com/davglass/license-checker/pull/188) Fix for #153: remove deprecated package 'spdx' (#188) (@rogierschouten)
- [d1d34b1](https://github.com/davglass/license-checker/commit/d1d34b1a8894987807419c093c3ec10b4f06db3d) Fix typo in package.json description (@theboolean)
- [f5c9008](https://github.com/davglass/license-checker/commit/f5c9008a6d20b503e21c0d8130e52be526a5bfe8) Fix: Allow excluding packages and private packages together (@theboolean)
- [98c4dc6](https://github.com/davglass/license-checker/commit/98c4dc670fdebb6e58b62b38ebcb12302e5b1db5) changes (@davglass)

v24.0.1 (2018/10/11 16:40 +00:00)

- [d72eae8](https://github.com/davglass/license-checker/commit/d72eae8bcb80d8582e6d12c5e2664e9c19135709) 24.0.1 (@davglass)
- [9433e64](https://github.com/davglass/license-checker/commit/9433e640ea9f629aad5f00c224a9f61026b8116d) [Fixes #181] - Removed extra line break with --cvs (@davglass)
- [65baa28](https://github.com/davglass/license-checker/commit/65baa28f532f87ebb75a32578c7ac5837806d12f) contrib and changes (@davglass)

v24.0.0 (2018/10/09 21:12 +00:00)

- [84d64a2](https://github.com/davglass/license-checker/commit/84d64a28fa971c3bfb20b9e9de27cafbe6e8481b) 24.0.0 (@davglass)
- [#180](https://github.com/davglass/license-checker/pull/180) Feature: Exclude Private Packages (#180) (Jonny Reeves)
- [#179](https://github.com/davglass/license-checker/pull/179) Merge pull request #179 from jonny-

improbable/fix/fix-strict-checks (@jonny-improbable)
- [179077d](https://github.com/davglass/license-checker/commit/179077d079acbcd0183aa6691cfe5c2ec0f93f07)
Fixes 176, Packages are not ignored when using --onlyAllow and --excludePackages. (@jonny-improbable)
- [890ca17](https://github.com/davglass/license-checker/commit/890ca17d179bc43a6cb7cff962d69d1521dc9ac2)
changelog (@davglass)

v23.0.0 (2018/10/09 14:37 +00:00)
- [f243287](https://github.com/davglass/license-checker/commit/f243287fbce6da33838a226ddfe8c412535390d4)
23.0.0 (@davglass)
- [#178](https://github.com/davglass/license-checker/pull/178) Merge pull request #178 from jonny-improbable/fix/filtering (@jonny-improbable)
- [#175](https://github.com/davglass/license-checker/pull/175) Merge pull request #175 from jonny-improbable/patch-1 (@jonny-improbable)
- [f2c6611](https://github.com/davglass/license-checker/commit/f2c6611d6c68e50b2b6f56260026837e7167f44a)
Fixes #177, --packages and --excludePackages filtering (@jonny-improbable)
- [0a598df](https://github.com/davglass/license-checker/commit/0a598df55c3ec33803ef33be07cc47a910eee961)
Improve --onlyAllow violation Error
- [ee723af](https://github.com/davglass/license-checker/commit/ee723af79889a4d98ed067494a58f6aa41a44ac7)
changes (@davglass)

v22.0.0 (2018/10/08 19:00 +00:00)
- [bd398c3](https://github.com/davglass/license-checker/commit/bd398c3bce0279699c9aad1dc4b592f398a75766)
22.0.0 (@davglass)
- [#172](https://github.com/davglass/license-checker/pull/172) Merge pull request #172 from fzaninotto/exclude-packages (@fzaninotto)
- [014fd96](https://github.com/davglass/license-checker/commit/014fd9613fe5460e0b7a0fc118a659a337e25e2c)
added changes (@davglass)

v21.0.0 (2018/10/06 13:24 +00:00)
- [d75fe43](https://github.com/davglass/license-checker/commit/d75fe43d61a9d5b6696d71a663e25a53fd3d44f7)
21.0.0 (@davglass)
- [05cb221](https://github.com/davglass/license-checker/commit/05cb221359de4ffe1039f586cd9e8fb7cb9d6398)
[Fixes #174] - Moved private and unknown detection above filtering (@davglass)
- [b1d5700](https://github.com/davglass/license-checker/commit/b1d570088236dfb90253bdac27763523b2e74ffb)
Add an excludePackages option (@fzaninotto)
- [231bd3f](https://github.com/davglass/license-checker/commit/231bd3f2412507be1d702ad100b23c1b1fe93602)
updated readme (@davglass)
- [6c61a7b](https://github.com/davglass/license-checker/commit/6c61a7bd102466c702065d42706392c11717cc1d)
changelog (@davglass)

v20.2.0 (2018/07/30 13:49 +00:00)
- [28dc521](https://github.com/davglass/license-checker/commit/28dc5218dec3340778bd801593275ad1b222e53f)
20.2.0 (@davglass)
- [#169](https://github.com/davglass/license-checker/pull/169) Merge pull request #169 from codepunkt/restrict_packages (@codepunkt)
- [5e4b274](https://github.com/davglass/license-checker/commit/5e4b274e955485fb2aba37e65fec913b8042f38d)
refactor: restore previous code style (@codepunkt)
- [ed25d68](https://github.com/davglass/license-checker/commit/ed25d6829602793e13233d3da2d97b92ee2044c6)

test: add test for --packages flag (@codepunkt)

- [0f53922](https://github.com/davglass/license-checker/commit/0f53922088be0b0dfd4f8db7ea884b53d0137e45)

feat: allow restricting output to specified packages (@codepunkt)

- [5f63f87](https://github.com/davglass/license-checker/commit/5f63f8766a17e589b57db99bda4eb54d91b85b77)

changes and contrib (@davglass)

v20.1.0 (2018/06/07 14:33 +00:00)

- [970882a](https://github.com/davglass/license-checker/commit/970882a09b345c7f32496431e5ca4c069ad7e320)

20.1.0 (@davglass)

- [#165](https://github.com/davglass/license-checker/pull/165) Merge pull request #165 from santiagocanti/fix-exclude-not-adding-custom-licenses (@santiagocanti)
- [89e48a9](https://github.com/davglass/license-checker/commit/89e48a9d3d0c9f2e48bfcee0dc3563ce4b652e22)

Fix exclude not including custom licenses (@santiagocanti)

v20.0.0 (2018/05/17 14:14 +00:00)

- [0e89310](https://github.com/davglass/license-checker/commit/0e8931021df777cb401d9a332fa2a8c9a2c49eb2)

20.0.0 (@davglass)

- [c36a5c9](https://github.com/davglass/license-checker/commit/c36a5c99bb4f68816e4e19cad5090ba3c7ba67a4)

changes (@davglass)

- [ccb66f3](https://github.com/davglass/license-checker/commit/ccb66f3410a4589e6f2b7cf1c3aefb1446bab460)

contributors (@davglass)

- [#156](https://github.com/davglass/license-checker/pull/156) Merge pull request #156 from zodiac403/z4/copyright (@zodiac403)
- [56414b4](https://github.com/davglass/license-checker/commit/56414b4a67cbb25bcc8eb8cc05b0ac712b677dc2)

Add unit test for Copyright statement. (@zodiac403)

- [3eafe24](https://github.com/davglass/license-checker/commit/3eafe249ad662af727a9b7472f7ad6c1b9a73ade)

fixing test coverage with switch to nyc from istanbul (@davglass)

v19.0.0 (2018/04/30 14:51 +00:00)

- [7e83a06](https://github.com/davglass/license-checker/commit/7e83a069d23c104c3cd8257eb64666704ecca465)

19.0.0 (@davglass)

- [e5eb49b](https://github.com/davglass/license-checker/commit/e5eb49bcb5546dbc681f736f159d63908cd39ce9)

upgrading packages (@davglass)

- [442aee6](https://github.com/davglass/license-checker/commit/442aee69b5d44e47bfd2e441c4e1f86d387e49c6)

Changelog (@davglass)

v18.1.0 (2018/04/30 14:16 +00:00)

- [82ec91b](https://github.com/davglass/license-checker/commit/82ec91bb02e6bf998164b62b4aa827198156ad4c)

18.1.0 (@davglass)

- [4b546d3](https://github.com/davglass/license-checker/commit/4b546d38ce91bcbe8d21e7bc53e44635b0447fc2)

contrib (@davglass)

- [#155](https://github.com/davglass/license-checker/pull/155) Merge pull request #155 from ktmouk/supress-path-property (@ktmouk)
- [#160](https://github.com/davglass/license-checker/pull/160) Merge pull request #160 from helio-frota/pr (@helio-frota)
- [8b068f2](https://github.com/davglass/license-checker/commit/8b068f25fe910d087c06e29312bc250b49aba4c7)

fix: Updating debug dependency to fix a security warning (@helio-frota)

- [040dd94](https://github.com/davglass/license-checker/commit/040dd9468261966c5c40e4a418aa9ba8f716c3a2)

Copyright statement: Handle multi-line stagements (@zodiac403)

- [0480750](https://github.com/davglass/license-checker/commit/04807506d61aa1d704e8b51da3a289baa025b510) Fix layout issue. (@zodiac403)
- [9cb45f2](https://github.com/davglass/license-checker/commit/9cb45f2b9ce2c1142c0d1f556f01f7d754737a4c) Link with customFormat (@zodiac403)
- [f83aaae](https://github.com/davglass/license-checker/commit/f83aaae85ad4cc2e9880802951dfacbc86dc2d7f) Merge branch 'z4/copyright' of https://github.com/zodiac403/license-checker into z4/copyright (@zodiac403)
- [7536af9](https://github.com/davglass/license-checker/commit/7536af935d91078657f0e169ed82383f099607f6) Trim output. (@zodiac403)
- [8716845](https://github.com/davglass/license-checker/commit/87168456cae35263882bd2b6d6d0081f228b6b66) Suppress path property (@ktmouk)
- [be57ee8](https://github.com/davglass/license-checker/commit/be57ee8f76c8aada0d227913b7d0e12aca0dc640) Add example for (c) statement. (@zodiac403)
- [fe17f7c](https://github.com/davglass/license-checker/commit/fe17f7c76dbdae0cbf689a0cd260a746698f3281) Parse (c) statements from LICENSE file. (@zodiac403)
- [#149](https://github.com/davglass/license-checker/pull/149) Merge pull request #149 from honzajavorek/patch-1 (@honzajavorek)
- [955bbf6](https://github.com/davglass/license-checker/commit/955bbf6070ffcd9f0d01ef37bb84ffbacc65e007b) remove the old status badge (@honzajavorek)

v18.0.0 (2018/03/20 12:30 +00:00)

- [315de0b](https://github.com/davglass/license-checker/commit/315de0b1a881cf8737c3c0131c217c4820df13a8) 18.0.0 (@davglass)
- [76655d5](https://github.com/davglass/license-checker/commit/76655d59bad95c2e52724aaa3a0cf036f0e60bd6) changelog (@davglass)
- [c8aa823](https://github.com/davglass/license-checker/commit/c8aa823342b7a250d510582c8a03dd76af50bd9c) added contributors (@davglass)
- [#147](https://github.com/davglass/license-checker/pull/147) Merge pull request #147 from honzajavorek/honzajavorek/license-files (@honzajavorek)
- [#148](https://github.com/davglass/license-checker/pull/148) Merge pull request #148 from honzajavorek/honzajavorek/use-stderr (@honzajavorek)
- [#146](https://github.com/davglass/license-checker/pull/146) Merge pull request #146 from honzajavorek/honzajavorek/fix-e2e-test (@honzajavorek)
- [#145](https://github.com/davglass/license-checker/pull/145) Merge pull request #145 from honzajavorek/honzajavorek/drop-4-add-8 (@honzajavorek)
- [0105f7d](https://github.com/davglass/license-checker/commit/0105f7dcf01a67b8f7c34371d95a1d76b191d5ed) use stderr where applicable (@honzajavorek)
- [0ff8d91](https://github.com/davglass/license-checker/commit/0ff8d917c659446256074c0940ae43dd84930233) add support for LICENSE-MIT and similar (@honzajavorek)
- [f02589e](https://github.com/davglass/license-checker/commit/f02589e62c0ba8221081b8b1799d561c3ff20500) isolate and test the license file detection (@honzajavorek)
- [f0da0fe](https://github.com/davglass/license-checker/commit/f0da0fe2ab28f1658e4ed504bb034fb1536b9ff8) add warning about commas and test it (@honzajavorek)
- [3db0b6f](https://github.com/davglass/license-checker/commit/3db0b6f05a68ccfff4181503ca87edce4ef10cd7) fix e2e test (transition from comma delimiter to semicolon) (@honzajavorek)
- [cec3b73](https://github.com/davglass/license-checker/commit/cec3b73505ac40a2dca211e78427624d009585dc) let Travis CI to cache node_modules (@honzajavorek)
- [8cea3dc](https://github.com/davglass/license-checker/commit/8cea3dccf1d185dc3ae3f37f44a82d7e123a1988)

add Travis CI badge to the README (@honzajavorek)

- [8f59c3b](https://github.com/davglass/license-checker/commit/8f59c3b494f69b1d51535bcff80c0e006d0ef6bb)

drop support for node 4, add support for node 8 (@honzajavorek)

v17.0.0 (2018/03/19 13:26 +00:00)

- [cd5fdd8](https://github.com/davglass/license-checker/commit/cd5fdd8e94267d7d8f29e86dd9cbf8b694c037f1)

17.0.0 (@davglass)

- [13c11ee](https://github.com/davglass/license-checker/commit/13c11eeea1b1a3e012de62536100fce91c355c8b)

updated readme and help text (@davglass)

- [#144](https://github.com/davglass/license-checker/pull/144) Merge pull request #144 from creising/parser-fixes (@creising)

- [d2ab8df](https://github.com/davglass/license-checker/commit/d2ab8df30bc3e6b38b321a1e12a70cf477a69eb0)

added support for lic with commas and spaces (@creising)

- [2075208](https://github.com/davglass/license-checker/commit/20752083c6029823fb389a30a1ed4d7d90fa9297)

contrib and changelog (@davglass)

- [6c5274c](https://github.com/davglass/license-checker/commit/6c5274c6064d318844cf36185dea395e0893ff08)

[fixes #132] - Fixed issue with asFiles and path issues (@davglass)

- [a46c448](https://github.com/davglass/license-checker/commit/a46c4483f872c3db9498a65b7ae3dc6d8164de0a)

16.0.0 (@davglass)

- [38d63e2](https://github.com/davglass/license-checker/commit/38d63e2c2c3fd6c11012fb69b1470b2ba06d5554)

[fixes #128] - Added --onlyAllow option (@davglass)

v16.0.0 (2018/01/18 15:02 +00:00)

- [#131](https://github.com/davglass/license-checker/pull/131) Merge pull request #131 from mischah/patch-1

(@mischah)

- [e341d17](https://github.com/davglass/license-checker/commit/e341d1701092be87309ec4b51fa6eb23f7e9a589)

Fix typo in Readme (@mischah)

- [cc38a20](https://github.com/davglass/license-checker/commit/cc38a2047bf41b6fe25266114a13a9bf54133e04)

updated license text (@davglass)

v15.0.0 (2017/10/19 14:24 +00:00)

- [a9bd001](https://github.com/davglass/license-checker/commit/a9bd001b649bfa186bae5598bb8c67ff56383599)

15.0.0 (@davglass)

- [db621fa](https://github.com/davglass/license-checker/commit/db621fa6beeff870699c33be484bf49816ab7866)

changelog (@davglass)

- [#124](https://github.com/davglass/license-checker/pull/124) Merge pull request #124 from

neverendingqs/app/stricterguesses (@neverendingqs)

- [#126](https://github.com/davglass/license-checker/pull/126) app - output now includes path to dependency.

(#126) (@neverendingqs)

- [9f68b29](https://github.com/davglass/license-checker/commit/9f68b29bbfa73278cdab92e221be6ccbab191932)

app - strengthening license guessing; resolves #123. (@neverendingqs)

- [3061c87](https://github.com/davglass/license-checker/commit/3061c87363f3416d86ca6c2ba7b2bfa77def0e73)

changes (@davglass)

v14.0.0 (2017/08/28 13:22 +00:00)

- [b2a4403](https://github.com/davglass/license-checker/commit/b2a440309c1537c52e5c5a2106f11e72d5b784ec)

14.0.0 (@davglass)

- [#122](https://github.com/davglass/license-checker/pull/122) Added --failOn [list] mode (#122) (@tobilg)

v13.1.0 (2017/08/25 15:00 +00:00)

- [ee25265](https://github.com/davglass/license-checker/commit/ee25265f92fe0d3b603da6b8c88d175e0d1f2fa5) 13.1.0 (@davglass)
- [5bb9a17](https://github.com/davglass/license-checker/commit/5bb9a17f89d7e180b3a9d929ebc073135262bd2f) changes (@davglass)
- [b1e0392](https://github.com/davglass/license-checker/commit/b1e0392afa4b511b7c532125cd3165a828d3d4e3) added contrib (@davglass)
- [#121](https://github.com/davglass/license-checker/pull/121) Add `--summary` mode to show a summary with counts of the used licenses (#121) (@tobilg)
- [#119](https://github.com/davglass/license-checker/pull/119) Fix minor spelling mistakes (#119) (@tobiasbueschel)
- [#118](https://github.com/davglass/license-checker/pull/118) Minor readme text improvements (#118) (@peteruithoven)
- [d2bc5ea](https://github.com/davglass/license-checker/commit/d2bc5ea91ab50becea91d5f0f050955fe9a6ac59) added license parsing info to README (@davglass)
- [3e9d320](https://github.com/davglass/license-checker/commit/3e9d320acb2e9f14297d6a4355680f34a9b0609d) changes (@davglass)

v13.0.3 (2017/08/04 17:15 +00:00)

- [2caf76b](https://github.com/davglass/license-checker/commit/2caf76be7f2849e153ee28410f3b7a41df3283b5) 13.0.3 (@davglass)
- [fadddc8](https://github.com/davglass/license-checker/commit/fadddc895ef9c6f182e2283c5605a8c1d8fa8a25) [fixes #117] fixed minor URL parsing (@davglass)
- [e58a868](https://github.com/davglass/license-checker/commit/e58a868268aefd97d735b364bd87d03140d76482) changes (@davglass)

v13.0.2 (2017/07/18 16:24 +00:00)

- [2c712b7](https://github.com/davglass/license-checker/commit/2c712b7c7e6efe916d60f3ef3125f7f019c46d59) 13.0.2 (@davglass)
- [ef812c1](https://github.com/davglass/license-checker/commit/ef812c1168901d08b97dbd450a64ca03bb7062ad) [fixes #114] - Custom URL/File parsing skipped if file found on disk (@davglass)

v13.0.1 (2017/07/17 12:48 +00:00)

- [a1bf8f1](https://github.com/davglass/license-checker/commit/a1bf8f152b100d81b44757b3b7e141df6a971c44) 13.0.1 (@davglass)
- [e6d0c89](https://github.com/davglass/license-checker/commit/e6d0c893b8a86e12493f7a5c22fd74ef26267994) contrib & changes (@davglass)
- [#113](https://github.com/davglass/license-checker/pull/113) Use LICENSE file in preference to README (#113) (@ibeucaly)
- [6b7f79f](https://github.com/davglass/license-checker/commit/6b7f79f654e21903ea37e4391fba3601ece32e90) changes (@davglass)

v13.0.0 (2017/07/14 12:49 +00:00)

- [dd9e880](https://github.com/davglass/license-checker/commit/dd9e880abd234d683d8c1e57e7a5f889c9156de4) 13.0.0 (@davglass)
- [051b20b](https://github.com/davglass/license-checker/commit/051b20b0c4b35f223f724705a0025dafc809373f) cleaned up some tests (@davglass)

- [#110](https://github.com/davglass/license-checker/pull/110) FEATURE: Recognise some custom licenses by file or url (#110) (@dancrumb)
- [#111](https://github.com/davglass/license-checker/pull/111) Resolves #60 (#111) Adding support for GPL and LGPL (@dancrumb)
- [#109](https://github.com/davglass/license-checker/pull/109) FEATURE: Improve license exclusion (#109) (@dancrumb)
- [#108](https://github.com/davglass/license-checker/pull/108) FEATURE: Detect private modules and report them as UNLICENSED (#108) (@dancrumb)

v12.1.0 (2017/07/12 16:48 +00:00)

- [dc944e5](https://github.com/davglass/license-checker/commit/dc944e54d55d77b0ef6b6321d9abee847662ccb8) 12.1.0 (@davglass)
- [d415c58](https://github.com/davglass/license-checker/commit/d415c580b04bc5eefa592dc9f9a0a31b244c1bd3) updated contrib and changes (@davglass)
- [#107](https://github.com/davglass/license-checker/pull/107) Merge pull request #107 from dancrumb/feature/support-for-public-domain-licenses (@dancrumb)
- [0c55770](https://github.com/davglass/license-checker/commit/0c55770294167161c48b79cc82a15a6545154a87) FEATURE: Add support for Public Domain licenses (@dancrumb)

v12.0.0 (2017/07/05 13:33 +00:00)

- [8b74fa1](https://github.com/davglass/license-checker/commit/8b74fa1fe3b5edb0d217aa3ce86f4662eb024621) 12.0.0 (@davglass)
- [4f3367c](https://github.com/davglass/license-checker/commit/4f3367c2bf2e9713a6cccd11341f7f4fa70ed400) changes & contrib (@davglass)
- [#106](https://github.com/davglass/license-checker/pull/106) Merge pull request #106 from helio-frota/licensefile-readme (@helio-frota)
- [a229507](https://github.com/davglass/license-checker/commit/a2295073d0178dca1b88e85ea8f52c21d35e52fc) src: the README is added as licenseFile (@helio-frota)
- [b59d90d](https://github.com/davglass/license-checker/commit/b59d90d8705f6f728c817b89936f95097d26857b) changes & contrib (@davglass)

v11.0.0 (2017/05/30 13:33 +00:00)

- [258df10](https://github.com/davglass/license-checker/commit/258df102da484943088da8e0b6160b80c0e703cd) 11.0.0 (@davglass)
- [#102](https://github.com/davglass/license-checker/pull/102) Merge pull request #102 from xswordsx/multiple-licenses (@xswordsx)
- [c5c8b0f](https://github.com/davglass/license-checker/commit/c5c8b0f408f2a26259a7b1109f7cc135ed5bf9c4) Check for SPDX-compatible licenses (@xswordsx)

v10.1.0 (2017/05/25 16:16 +00:00)

- [b52a16d](https://github.com/davglass/license-checker/commit/b52a16d0ba414e7287f82325dd65619cd76afdd1) 10.1.0 (@davglass)
- [f911a99](https://github.com/davglass/license-checker/commit/f911a9919033254945ecbbf69362cb171436688e) contrib & changes (@davglass)
- [#100](https://github.com/davglass/license-checker/pull/100) Suppress JSON properties with custom format (#100) (@tbbstny)
- [ed5b3ab](https://github.com/davglass/license-checker/commit/ed5b3ab50825f0be032958f8233dd3000ee98e85) changelog (@davglass)

v10.0.0 (2017/05/17 13:51 +00:00)

- [b2c2283](https://github.com/davglass/license-checker/commit/b2c2283cf5a937e64a07ab200ec2379e481903b6) 10.0.0 (@davglass)
- [a0406ac](https://github.com/davglass/license-checker/commit/a0406ac2c7a0b1037ca31b47e36d316b9c088938) [fixes #96] - do not replace newline, etc in licenses for exporting to json/markdown (@davglass)
- [98a03fa](https://github.com/davglass/license-checker/commit/98a03fa700ef6d038cc2f9104ea5cf17c82a10ad) [fixes #97] - Added a newline to the output file (@davglass)
- [#98](https://github.com/davglass/license-checker/pull/98) Merge pull request #98 from davglass/eslint (@davglass)
- [10fe441](https://github.com/davglass/license-checker/commit/10fe441a2e70e549e57f7da99d2287fc55355500) moved to eslint (@davglass)
- [f82b535](https://github.com/davglass/license-checker/commit/f82b535d3b7f152fa00bb4680e94af18d1c1421d) changelog (@davglass)

v9.0.3 (2017/04/10 13:42 +00:00)

- [a0fd60f](https://github.com/davglass/license-checker/commit/a0fd60f972b7c84a32117b3dfc1f95bfa2282f27) 9.0.3 (@davglass)
- [#95](https://github.com/davglass/license-checker/pull/95) Merge pull request #95 from abtris/prefix-component (@abtris)
- [3b80272](https://github.com/davglass/license-checker/commit/3b80272a217687c2f0cd7a0c1e98775064d820ff) test: add test for csvComponentPrefix (@abtris)
- [d593554](https://github.com/davglass/license-checker/commit/d593554c1a6b4f7e004e4a23fca88cb7294f8351) feat: add support for csvComponentPrefix (@abtris)
- [5b2eea1](https://github.com/davglass/license-checker/commit/5b2eea12d8c54068a01a2cf1fd9bdeca8c1f0fa2) added contrib (@davglass)

v9.0.2 (2017/04/05 14:55 +00:00)

- [f24833b](https://github.com/davglass/license-checker/commit/f24833bce846f608ec3d8c327d335da56c42b895) 9.0.2 (@davglass)
- [#94](https://github.com/davglass/license-checker/pull/94) Merge pull request #94 from timbru31/fix-comma-exclude (@timbru31)
- [2d08a77](https://github.com/davglass/license-checker/commit/2d08a77030362c7ab03ac1235dd524c0be47eee) contrib & changelog (@davglass)

v9.0.1 (2017/04/05 13:09 +00:00)

- [9f1a1f3](https://github.com/davglass/license-checker/commit/9f1a1f32194a9bb312858f624e303af1ad4f61ca) 9.0.1 (@davglass)
- [c99f612](https://github.com/davglass/license-checker/commit/c99f612fee22d9eb03db0ad41e7918fbaf6e8ed9) added test for licenseText (@davglass)
- [#93](https://github.com/davglass/license-checker/pull/93) Merge pull request #93 from abtris/licenseText-just-in-customFormat (@abtris)
- [8d7fb2f](https://github.com/davglass/license-checker/commit/8d7fb2f85fc585d8e75ab1459e0b0cef43993ba4) fix: allow escaped commas in exclude string (@timbru31)
- [da4d73c](https://github.com/davglass/license-checker/commit/da4d73c0feb22f50ddbce54364eef5b7bcc7f1a4) test: fix test, remove check from non custom format (@abtris)
- [dcd3b59](https://github.com/davglass/license-checker/commit/dcd3b59bb9457df354fa3095189235b6e030df1a) feat: add licenseText only for customFormat

- [4e02eca](https://github.com/davglass/license-checker/commit/4e02eca6e8bd332ff6d90e5039cacb50f0df1bf3)
updated contribs and changelog (@davglass)

v9.0.0 (2017/04/04 12:26 +00:00)

- [267c80e](https://github.com/davglass/license-checker/commit/267c80efac89eef70c71a12b8f12b3dc8e6d58dd)
9.0.0 (@davglass)

- [057af47](https://github.com/davglass/license-checker/commit/057af47bc52ac526f646ba21496f338689801809)
added licenseFile assertion to tests (@davglass)

- [#92](https://github.com/davglass/license-checker/pull/92) Merge pull request #92 from abtris/includeFileContent
(@abtris)

- [1cda118](https://github.com/davglass/license-checker/commit/1cda118e1aa18cc391ba2765dcca89172943a0f)
fix: replace problematic chars for easy import to Excel (@abtris)

- [dd6ecab](https://github.com/davglass/license-checker/commit/dd6ecab1a7b1354c4d1d001491f58dbe0f5e3e63)
feat: add licenseText (@abtris)

- [6395498](https://github.com/davglass/license-checker/commit/639549890c54a12043244579ad0c0d5972309fb2)
changes and contrib (@davglass)

v8.0.4 (2017/02/15 16:21 +00:00)

- [28d379a](https://github.com/davglass/license-checker/commit/28d379aca51da7a47af324bc6feb63736ea02295)
8.0.4 (@davglass)

- [#89](https://github.com/davglass/license-checker/pull/89) Merge pull request #89 from Pawamoy/master
(@Pawamoy)

- [#90](https://github.com/davglass/license-checker/pull/90) Merge pull request #90 from drewfish/bsd-source-code
(@drewfish)

- [b704bc1](https://github.com/davglass/license-checker/commit/b704bc18a43de246302b8ff6933f8fe5f96ee3a6)
guess BSD-Source-Code license (@drewfish)

- [8d31eab](https://github.com/davglass/license-checker/commit/8d31eabfb671d32e6f3e63215d6530d7fb4acc59)
Add docs about customFormat option (@pawamoy)

- [2529d31](https://github.com/davglass/license-checker/commit/2529d3118dfae53f1e01056ec99f5c542cb8d63e)
changes (@davglass)

v8.0.3 (2016/11/10 17:04 +00:00)

- [66fd7b5](https://github.com/davglass/license-checker/commit/66fd7b5ad5577cc2c85668a7c6607365c86a2c85)
8.0.3 (@davglass)

- [#87](https://github.com/davglass/license-checker/pull/87) Merge pull request #87 from drewfish/guess-cc0
(@drewfish)

- [668bbd3](https://github.com/davglass/license-checker/commit/668bbd38fd5148f99c5263f4e0506e04d5e3f8a0)
guess CC0-1.0, upgraded jshint (@drewfish)

v8.0.2 (2016/11/09 21:57 +00:00)

- [0bdedd8](https://github.com/davglass/license-checker/commit/0bdedd8cb990e1f5ffacde1c12cc708185a5b866)
8.0.2 (@davglass)

- [ef67bb4](https://github.com/davglass/license-checker/commit/ef67bb454373352343faa49d4dc978a295bd1544)
updated semver (@davglass)

- [14b5c85](https://github.com/davglass/license-checker/commit/14b5c8551ccbb5c5ce8aa76fb5367857c891d013)
Changelog (@davglass)

v8.0.1 (2016/11/09 21:51 +00:00)

- [594871d](https://github.com/davglass/license-checker/commit/594871d6197a030121f940500495e6ca7d82f02c) 8.0.1 (@davglass)
- [c243663](https://github.com/davglass/license-checker/commit/c243663b0ab8a0126251292a57b2c47369a51ebf) added contrib (@davglass)
- [#86](https://github.com/davglass/license-checker/pull/86) Merge pull request #86 from drewfish/copying (@drewfish)
- [380aa26](https://github.com/davglass/license-checker/commit/380aa26799cb527739907484e69c6dae26d5f17a) also support COPYING file (@drewfish)
- [329c367](https://github.com/davglass/license-checker/commit/329c3676d0cd5c5947a53fd205ff23b767b7f882) handling undefined@undefined error better (@davglass)
- [1f93a07](https://github.com/davglass/license-checker/commit/1f93a072632aad0660b63f61c56c3bd2fe109474) changelog (@davglass)

v8.0.0 (2016/09/09 13:23 +00:00)

- [44c2c48](https://github.com/davglass/license-checker/commit/44c2c48ae177915523fdf89a74474fe0953408bf) 8.0.0 (@davglass)
- [b5f5c6a](https://github.com/davglass/license-checker/commit/b5f5c6ae03a8c60c52fdd308f1721744a4baaa99) [fixes #78] - include notice file if found (@davglass)
- [dfcbd6f](https://github.com/davglass/license-checker/commit/dfcbd6f4966adc74e065f71e45cbd08ba8fe62ab) changelog (@davglass)
- [99976d0](https://github.com/davglass/license-checker/commit/99976d07980e241384be10341d0305d08de9cea5) 7.1.1 (@davglass)
- [ef857b7](https://github.com/davglass/license-checker/commit/ef857b7e9bab706299a1cc565ec5d144893af424) [fixes #77] fixed readme file name parsing, made it more strict (@davglass)

v7.1.1 (2016/09/07 19:16 +00:00)

- [28be6d4](https://github.com/davglass/license-checker/commit/28be6d4128a3625cf8ed37ba149e79ed3a41b4fa) changelog (@davglass)

v7.1.0 (2016/09/07 15:12 +00:00)

- [9f8b7f1](https://github.com/davglass/license-checker/commit/9f8b7f1c367dfe86342ee5f5cc97171bf97281aa) 7.1.0 (@davglass)
- [60fce1a](https://github.com/davglass/license-checker/commit/60fce1a24a4ef5add98a08dd8c8a85870db3f4a6) Fixed order of operations for parsing (@davglass)
- [9d4db11](https://github.com/davglass/license-checker/commit/9d4db112794b8110a1bfe0abfe2d3e63bc812299) Updated changelog (@davglass)

v7.0.0 (2016/09/06 14:50 +00:00)

- [a3a08da](https://github.com/davglass/license-checker/commit/a3a08da70b680d724045f655e107f36b16b45fea) 7.0.0 (@davglass)
- [b993399](https://github.com/davglass/license-checker/commit/b9933994472162cc9c4292cb42f2900e17a5167f) added contrib (@davglass)
- [d783029](https://github.com/davglass/license-checker/commit/d7830297b053496e45b7145b3cfa5809ac8ab1d1) Fixes #76 - If readme data not found, look for it on disk (@davglass)
- [#75](https://github.com/davglass/license-checker/pull/75) Merge pull request #75 from revov/master (@revov)
- [6204a24](https://github.com/davglass/license-checker/commit/6204a244ee71ae0329b4f2c1ca6cf37713741f32) Fix incorrect example in README (@revov)
- [90e24ac](https://github.com/davglass/license-checker/commit/90e24ac9ad20591d5ac166cc2974034fb997b30a)

Added changelog (@davglass)
- [dd768c6](https://github.com/davglass/license-checker/commit/dd768c6c8cbc39b596881a2eca582ad4bb816879)
Added contributors (@davglass)

v6.0.0 (2016/08/26 19:46 +00:00)
- [4bca140](https://github.com/davglass/license-checker/commit/4bca140db752b7b98ad1e261e5ee965d84995741)
6.0.0 (@davglass)
- [889ff17](https://github.com/davglass/license-checker/commit/889ff171aeb01a2180f4c9100ca9ea528a264d81)
updating tests (@davglass)
- [ed18801](https://github.com/davglass/license-checker/commit/ed188010351c4afb44db0d32dfa1025de53bf10f)
Merge branch 'nodeback' of git://github.com/bengl/license-checker into bengl-nodeback (@davglass)
- [34bb266](https://github.com/davglass/license-checker/commit/34bb26677cd0e25500fa545d4f1e8aef216b8cc7)
dropping node 0.10 and adding node 6.0 to travis (@davglass)
- [1d30667](https://github.com/davglass/license-checker/commit/1d306674a7fface2cad31f2bd76d7584c7922bbc)
updating tests (@davglass)
- [65d7c73](https://github.com/davglass/license-checker/commit/65d7c73f967111003fcc71ae24a4a5391bd48046)
Cleaned up some code (@davglass)
- [f753998](https://github.com/davglass/license-checker/commit/f753998a06cbb5fd9fff6430b3588a3b3cf81339)
Merge branch 'master' of git://github.com/amittkSharma/license-checker into amittkSharma-master (@davglass)
- [28e4462](https://github.com/davglass/license-checker/commit/28e4462543724685080c1623dc2dbd57cabb1c30)
Added tests and cleaned up linting (@davglass)
- [153857a](https://github.com/davglass/license-checker/commit/153857a251a97d14c883f6479579844b2980b5aa)
Publisher Information incorporated.
- [1265cb3](https://github.com/davglass/license-checker/commit/1265cb38d186ab1609dbdfa4124f237f8aa15846)
Added ability to output individual license files (@aweber1)
- [49e11d0](https://github.com/davglass/license-checker/commit/49e11d049645d565b7ef6d3c778af54eb13af888)
fix tests (@bengl)
- [26ffc6f](https://github.com/davglass/license-checker/commit/26ffc6f63d43c372c9a18f9c0c137608b3d5e4fa) use
nodeback/errback (@bengl)

v5.1.2 (2016/05/04 18:32 +00:00)
- [7101c77](https://github.com/davglass/license-checker/commit/7101c77667ad134fe01f02c298e7df2a4080e311)
5.1.2 (@davglass)
- [#67](https://github.com/davglass/license-checker/pull/67) Merge pull request #67 from graingert/patch-2
(@graingert)
- [a6ee290](https://github.com/davglass/license-checker/commit/a6ee2904eb7fcced220dcfe8548f80ec74fde3a2)
Upgrade read-installed (@graingert)
- [42e29c6](https://github.com/davglass/license-checker/commit/42e29c637940959121842762d74921bece5e8d93)
migrating tests from vows to mocha (@davglass)

v5.1.1 (2016/04/14 13:20 +00:00)
- [6ae0334](https://github.com/davglass/license-checker/commit/6ae03348ca8e5835ac732028afdab664a381cfc4)
5.1.1 (@davglass)
- [0720a46](https://github.com/davglass/license-checker/commit/0720a46569f3e12eb398165526944f307e08aad6)
Fixes #64 - Turn off color for --json/markdown/csv options (@davglass)

v5.1.0 (2016/03/09 15:50 +00:00)
- [86772d2](https://github.com/davglass/license-checker/commit/86772d202b63d4a4c6729b9a774193ca6ef5cb3f)

5.1.0 (@davglass)

- [#61](https://github.com/davglass/license-checker/pull/61) Merge pull request #61 from sgtcdck/master (@sgtdck)
- [6547ac1](https://github.com/davglass/license-checker/commit/6547ac1ded58560c7c4abdfc68fa69d17b81fe1e) Removed obsolete d[key].name assignment from tests (@sgtdck)
- [00b18a6](https://github.com/davglass/license-checker/commit/00b18a6012387e1a4a8284c07bf2d08740e03ddd) Added a --relativeLicensePath option to display the license file relatively to the current path. (@sgtdck)
- [629da20](https://github.com/davglass/license-checker/commit/629da201e0d1170057fd9efe05efcb293d2f1bda) Added latest contributors (@davglass)

v5.0.1 (2016/02/08 15:57 +00:00)

- [33731fc](https://github.com/davglass/license-checker/commit/33731fca482936a7a18fffe3fca2f3cd41e3a625)

5.0.1 (@davglass)

- [fe06eae](https://github.com/davglass/license-checker/commit/fe06eae8844d050ad0f80d576a221dd605131de) Fixed replace (@davglass)
 - [997914f](https://github.com/davglass/license-checker/commit/997914fd6f94030452d4d9bf549eb156ae8ef7c0) fix git+https URLs (@graingert)
 - [#57](https://github.com/davglass/license-checker/pull/57) Merge pull request #57 from Damien-Larmine/doc-license-asterisk (@Damien-Larmine)
 - [2adff2d](https://github.com/davglass/license-checker/commit/2adff2da98a5af79479a162e4998eb5892ab31c3) Explicit the asterisk in license report (@Damien-Larmine)
 - [b2fc9cf](https://github.com/davglass/license-checker/commit/b2fc9cf2a8eaa008c7593037d046f245a7ce7f25)
- #### 5.0.0 (@davglass)
- [7f71c53](https://github.com/davglass/license-checker/commit/7f71c53833cf1318ffe84215fcb1291f9ce4fbd5) updated contributors (@davglass)

v5.0.0 (2016/01/22 15:31 +00:00)

- [#55](https://github.com/davglass/license-checker/pull/55) Merge pull request #55 from davglass/devflag (@davglass)
- [ff1d8f2](https://github.com/davglass/license-checker/commit/ff1d8f20d5d7248a4f61e2fc9279fdfea91a6ec6) supporting --production and --development flags (@davglass)
- [#53](https://github.com/davglass/license-checker/pull/53) Merge pull request #53 from swashcap/enhancement/#46-verbose-output (@swashcap)
- [#54](https://github.com/davglass/license-checker/pull/54) Merge pull request #54 from davglass/travis-updates (@davglass)
- [2c80d9d](https://github.com/davglass/license-checker/commit/2c80d9d2dcc59340698630144256096a91e23f22) fixing tests in other node versions (@davglass)
- [78820ac](https://github.com/davglass/license-checker/commit/78820ac33ab8aed74809c8a5f8847705c8b2848e) travis config updates (@davglass)
- [f94263b](https://github.com/davglass/license-checker/commit/f94263b203046e2f53d64997b0261498010eb38d) Update documentation for debug use. (@swashcap)
- [429e44d](https://github.com/davglass/license-checker/commit/429e44d697527221ef22bb03af9d67820015446f) Change `console.error` call to use debug module. (@swashcap)
- [7312daf](https://github.com/davglass/license-checker/commit/7312daf7af195a1b9d1b1f290fae15963fbb2ab4) Add debug to project. (@swashcap)

v4.2.0 (2015/10/20 13:44 +00:00)

- [3583d92](https://github.com/davglass/license-checker/commit/3583d925e96fc9f63b3bbf0110b11c8448aed0e7)

4.2.0 (@davglass)

- [981eeda](https://github.com/davglass/license-checker/commit/981eeda898084dea88d54ea29c5bda93c5313fb6)
Fixes #49: Default to unknown if licenses null and added ISC support (@davglass)

v4.1.2 (2015/09/29 13:46 +00:00)

- [ba946dd](https://github.com/davglass/license-checker/commit/ba946dd1065e762c36b27dcecd9bb7389ad18d4)
4.1.2 (@davglass)
- [#48](https://github.com/davglass/license-checker/pull/48) Merge pull request #48 from CantemoInternal/master (@CantemoInternal)
- [e314a6d](https://github.com/davglass/license-checker/commit/e314a6d1f505d19478c33871640a763fabff6abd)
Fix json, csv and markdown output for license-checker (@mattiasa)

v4.1.1 (2015/09/12 14:39 +00:00)

- [c918314](https://github.com/davglass/license-checker/commit/c918314bfc687b647d1d288bb5857dd1caac1393)
4.1.1 (@davglass)
- [#47](https://github.com/davglass/license-checker/pull/47) Merge pull request #47 from tmpvar/ensure-bin-runs (@tmpvar)
- [a842eca](https://github.com/davglass/license-checker/commit/a842ecae4f008c07df3039dcaacd4641d7273625)
add missing } (@tmpvar)
- [1d513bb](https://github.com/davglass/license-checker/commit/1d513bb673d726f34286061446f965e46d96170e)
ensure bin/license-checker works at a high-level (@tmpvar)

v4.1.0 (2015/09/09 14:52 +00:00)

- [a4bb437](https://github.com/davglass/license-checker/commit/a4bb437ffa806c0832f877da2de7a107863d0a1f)
4.1.0 (@davglass)
- [ddd317a](https://github.com/davglass/license-checker/commit/ddd317a5a09344f0021812b8dee2f39bbbf07a0)
fixed all of the windows line endings (@davglass)
- [11e6487](https://github.com/davglass/license-checker/commit/11e64870484435e1e6f8efb9b0f13e6b2f737a6b)
Fix issues caused by merge (@ptusch)
- [313a7ed](https://github.com/davglass/license-checker/commit/313a7edc3dbdf8d50e43ba8da89306d3c89326bc)
Merge remote-tracking branch 'remotes/upstream/master' into ft_custom_format (@ptusch)
- [1f5e326](https://github.com/davglass/license-checker/commit/1f5e326dbca91fc8a396b9e02efe3eac9fd82a82)
added contributors to package.json (@davglass)
- [#45](https://github.com/davglass/license-checker/pull/45) Merge pull request #45 from hufsm/ft_error_handling (@hufsm)
- [c806034](https://github.com/davglass/license-checker/commit/c806034ab6feaef297d0c23afb536b290ba8c81)
Remove unused var statement (@ptusch)
- [778b1fa](https://github.com/davglass/license-checker/commit/778b1fa1a9c1be0c816545165020522d2dbf17ef)
More tests to fulfill the required % (@ptusch)
- [22257d9](https://github.com/davglass/license-checker/commit/22257d95490765db816578cc48c2b5b62699f1aa)
Add tests for licenses (WTFPL) (@ptusch)
- [0fe7561](https://github.com/davglass/license-checker/commit/0fe75611a73970fe9e9e0aab2d4bdee5250435b2)
Remove unused filter option (never used) (@ptusch)
- [83caa10](https://github.com/davglass/license-checker/commit/83caa10493a5a05ffba6c0e80b5c03f9cd4f65d6)
Change license shortcut for WTFPL (@ptusch)
- [3e348db](https://github.com/davglass/license-checker/commit/3e348dbe5feeb7bd356ebef3cd34e69329dbc8c1)
More tests for the custom formatter (@ptusch)
- [96c2d6f](https://github.com/davglass/license-checker/commit/96c2d6f24c509df2bf3f6bd8b83a613fea8d9ecc)
Add tests for customFormatter (@ptusch)

- [c9948c4](https://github.com/davglass/license-checker/commit/c9948c4b7b2cccd053ba63f4fd2a6a6d0a46493)
Add test configs (@ptusch)
- [4b2dea0](https://github.com/davglass/license-checker/commit/4b2dea0c124f6aba63abd2129625825c3b5a6570)
Fix merge issues - semicolon slipped through (@ptusch)
- [cc7662a](https://github.com/davglass/license-checker/commit/cc7662a46719c97745410e3ac2b782f937dc54ef)
Merge branch 'master' into ft_error_handling (@ptusch)
- [04a2294](https://github.com/davglass/license-checker/commit/04a2294b82a8227cccb83d76f73cbd7cf62af533)
Add additional test (@ptusch)
- [52fa91c](https://github.com/davglass/license-checker/commit/52fa91c5cbc345736ebe6e97f400a27a773502d2)
Add parseJson test (@ptusch)
- [d846c5e](https://github.com/davglass/license-checker/commit/d846c5e6970737dd3085688e7b601e9ea4546417)
Fix tests after merge conflict (@ptusch)
- [7eac458](https://github.com/davglass/license-checker/commit/7eac4583f8003b5bda4ef966768bbb457fe8dc44)
Merge branch 'master' into ft_custom_format (@ptusch)
- [4aa7065](https://github.com/davglass/license-checker/commit/4aa7065c5eef88d49c3684369b2edd9802c3f374)
Add tests for customFormat (@ptusch)

v4.0.0 (2015/09/04 13:40 +00:00)

- [3fba5b](https://github.com/davglass/license-checker/commit/3fba5bd5a489ea8c17328eabf71c4d5e9beb17e)
4.0.0 (@davglass)
- [ce8d661](https://github.com/davglass/license-checker/commit/ce8d66108a49af7855c16231ce675c567a2ffe7f)
tests: added 100% coverage for license file (@davglass)
- [#42](https://github.com/davglass/license-checker/pull/42) Merge pull request #42 from ptusch/ft_onlyunknown
(@ptusch)
- [8929e90](https://github.com/davglass/license-checker/commit/8929e90413be0362f19e755048e9218c372abf68)
Add tests for the error generation (@ptusch)
- [1a93a41](https://github.com/davglass/license-checker/commit/1a93a41569a53a1580c94c2c903a5bc127ad2692)
Add error handling (@ptusch)
- [6b79145](https://github.com/davglass/license-checker/commit/6b791457463dca71b22b09eecff16bbf982db682)
Add additional check to negate the test (@ptusch)
- [559e72c](https://github.com/davglass/license-checker/commit/559e72ccab2420bc42bf28b498702dad13ef967a)
Add test for the first function call. (@ptusch)
- [faf8ffd](https://github.com/davglass/license-checker/commit/faf8ffd69fd8ae475484a9b47b57a7b6ea738856)
Remove trivial UNKNOWN check (@ptusch)
- [6fa44ef](https://github.com/davglass/license-checker/commit/6fa44ef8c045ab2b0a1291b45990edf52adfc0e2)
Merge branch 'master' into ft_custom_format (@ptusch)
- [efe23d9](https://github.com/davglass/license-checker/commit/efe23d991cfc40dc6980fbf13461408da822b1f)
Merge branch 'master' into ft_onlyunknown (@ptusch)
- [c287959](https://github.com/davglass/license-checker/commit/c2879592858805d7ecd0304a39c5cf079efe6a7c)
Add option to only show unknown licenses (@ptusch)
- [#43](https://github.com/davglass/license-checker/pull/43) Merge pull request #43 from senotrusov/master
(@senotrusov)
- [d7a663f](https://github.com/davglass/license-checker/commit/d7a663f9deeb4d7a648a6d2cb9db84d5667ee540)
Add test for exclude option. (@senotrusov)
- [45a27de](https://github.com/davglass/license-checker/commit/45a27de02a3c1d57a86e3f8e14b6e335788c23ba)
Add option to exclude from the output modules which licenses are in the comma-separated list (@senotrusov)
- [#41](https://github.com/davglass/license-checker/pull/41) Merge pull request #41 from
ptusch/ft_path_to_unknown_dependency (@ptusch)

- [1ff5f22](https://github.com/davglass/license-checker/commit/1ff5f225fd2ba97edfd3ef3f6462981832740c19) Add option to see the path of a dependency if unknown (@ptusch)
- [ea4d629](https://github.com/davglass/license-checker/commit/ea4d6297de32d94201bb4786da7ba824d928c8f2) Add additional 'undefined' checks (@ptusch)
- [af043a2](https://github.com/davglass/license-checker/commit/af043a2c11af45d28bfe71914cd10672855b3297) Merge branch 'master' into ft_custom_format (@ptusch)
- [2d94a19](https://github.com/davglass/license-checker/commit/2d94a19ece177836345a4227893a82d956141b2e) updating the docs for --unknown to make it clear (@davglass)
- [38a2bd2](https://github.com/davglass/license-checker/commit/38a2bd28a9597fdb06d844258f1070054b38bbcf) Fix codestyle and whitespaces (@ptusch)
- [dd173ba](https://github.com/davglass/license-checker/commit/dd173badc65368dc6140476ffe5ae3768fbf9618) Add --customPath in README.md (@ptusch)
- [911fc1c](https://github.com/davglass/license-checker/commit/911fc1c6b5cc27a32aac60bb409c08be138bc707) Finalize the customFormat (markdown) (@ptusch)
- [8102091](https://github.com/davglass/license-checker/commit/8102091f7949fa8b73cfc803e4ae3624b81148) Add functionality to add a custom format (@ptusch)

v3.1.0 (2015/06/29 14:25 +00:00)

- [59e1e58](https://github.com/davglass/license-checker/commit/59e1e58ca0bea1cd38e3da1712fe7ca624d860b0) 3.1.0 (@davglass)
- [0e33f7a](https://github.com/davglass/license-checker/commit/0e33f7a2cb9fa69d13d1e2b5c69f70f885e09e08) reformatted code, fixed lint issues and added tests (@davglass)
- [83a7f09](https://github.com/davglass/license-checker/commit/83a7f0933d1cc1f331279e53fcce13e4efface91) Merge branch 'asMarkdown' of git://github.com/ptusch/license-checker into ptusch-asMarkdown (@davglass)
- [703ad47](https://github.com/davglass/license-checker/commit/703ad4714173559e05267e8fd24c74e5b9d3aee0) fixing tests (@davglass)
- [2d9fffd](https://github.com/davglass/license-checker/commit/2d9fffd75192e9812692c9099481d23e265bb493) Added Markdown Option (@ptusch)
- [67dca36](https://github.com/davglass/license-checker/commit/67dca365b941a7265e4a98d2de533b22c761b169) Remove color tags (@ptusch)

v3.0.3 (2015/06/03 13:35 +00:00)

- [7475c12](https://github.com/davglass/license-checker/commit/7475c129bf291289e4616d9692a962ae537401e8) 3.0.3 (@davglass)
- [c7dae0f](https://github.com/davglass/license-checker/commit/c7dae0fe5317a17b3aef61e8c118fafc6bb43a56) spdx license (@davglass)

v3.0.2 (2015/05/12 20:29 +00:00)

- [01f3b53](https://github.com/davglass/license-checker/commit/01f3b5384998be6243d38e0d95a4478e5fe3cfa5) 3.0.2 (@davglass)
- [fc0c083](https://github.com/davglass/license-checker/commit/fc0c0832ee291c55e53efe6b37a7b9d89f191bc7) defensive code, fixes #34 (@davglass)

v3.0.1 (2015/05/04 12:28 +00:00)

- [0479570](https://github.com/davglass/license-checker/commit/0479570faf87eccc9b37fbb25afae7faec6636) 3.0.1 (@davglass)
- [d85e355](https://github.com/davglass/license-checker/commit/d85e355b55998952facf202eabf8d374fec69a7e) Checking for valid path first (@davglass)

v3.0.0 (2015/04/24 14:38 +00:00)

- [e22b61d](https://github.com/davglass/license-checker/commit/e22b61d5d32fef7ffb18627f55a97e1863a78096) 3.0.0 (@davglass)
- [fde9635](https://github.com/davglass/license-checker/commit/fde963583dd207eca4badffb3e0d033a038f17b5) always try to find and log the license file (@davglass)

v2.0.2 (2015/01/26 18:18 +00:00)

- [490f31d](https://github.com/davglass/license-checker/commit/490f31d6820f068814cfe27adf3af1ac6d58f733) 2.0.2 (@davglass)
- [a3fefdb](https://github.com/davglass/license-checker/commit/a3fefdb8fafd7ec64714defb793d757a9e8ad065) fixes #30 (@davglass)

v2.0.1 (2015/01/12 18:34 +00:00)

- [898fbd5](https://github.com/davglass/license-checker/commit/898fbd53fa289338cf8a9a1735eea440c2a6c525) 2.0.1 (@davglass)
- [2da23db](https://github.com/davglass/license-checker/commit/2da23db2f240e7e73efdf93cc554e4d7783af225) cleaned up spacing and moved vars around (@davglass)
- [d47dbe4](https://github.com/davglass/license-checker/commit/d47dbe45c992dbbdb15bfb45e8af7f18ee0ca737) fixes #29 (@davglass)

v2.0.0 (2014/12/04 16:34 +00:00)

- [f94edfe](https://github.com/davglass/license-checker/commit/f94edfec7a9914b4a36f455e8bffc6230d6f7a5e) 2.0.0 (@davglass)
- [f4c7b1a](https://github.com/davglass/license-checker/commit/f4c7b1a3d4e9c0e4753a9b267e51714fe7f7051e) syntax cleanup (@davglass)
- [d189623](https://github.com/davglass/license-checker/commit/d1896234a5649621ee57ff9a901877d769217194) Document CLI options in Readme. (@timoxley)
- [11e204c](https://github.com/davglass/license-checker/commit/11e204c5c078eae1f165fa010da229d2a9fb4b5) Default to --no-colour for json, csv & file output. (@timoxley)
- [7e80d50](https://github.com/davglass/license-checker/commit/7e80d50c733f8ee42c7b4a79dc3344b3dd330cff) Add --out flag for writing an output file. (@timoxley)
- [47bffc9](https://github.com/davglass/license-checker/commit/47bffc9e0e249b2847c8ed4f3eaadb0dcdd731b9) Always print to stdout, don't write files. (@timoxley)
- [b725080](https://github.com/davglass/license-checker/commit/b725080d2dbdfddbf0994867577d4c5e3dc0ee2a) Don't print info messages to stdout. (@timoxley)

v1.0.1 (2014/11/27 15:23 +00:00)

- [e60f792](https://github.com/davglass/license-checker/commit/e60f792159351aa7ccff1f7af73e289afee261a5) 1.0.1 (@davglass)
- [3f74178](https://github.com/davglass/license-checker/commit/3f7417822dc8804978d1bae4ed84190d327df15c) Merge branch 'fixinfiniterecursion' of github.com:yzapuchlak/license-checker into yzapuchlak-fixinfiniterecursion (@davglass)
- [dc78ea0](https://github.com/davglass/license-checker/commit/dc78ea0dca546283440c89fec2dc6818dc4cc1c1) sticking vows 0.8.0 for testing (@davglass)
- [bd549b3](https://github.com/davglass/license-checker/commit/bd549b3b68e74fddd0e08dac10d5f88a8bb51ca6) Fixed issue where circular dependencies in dependency tree would cause the flatten function to infinitely recurse. If the current key is found to be already in the data object (which means it was already processed), we stop processing

that key and return the data object. (@yzapuchlak)

v1.0.0 (2014/11/21 13:56 +00:00)

- [917193d](https://github.com/davglass/license-checker/commit/917193dab27147534976b71307a77f48198ca322)
1.0.0 (@davglass)
- [63e5f9c](https://github.com/davglass/license-checker/commit/63e5f9c77e348720b3867171bcc67541e846d088)
added options.filter to checker.init (@davglass)

v0.1.2 (2014/11/20 15:48 +00:00)

- [8e5f5f0](https://github.com/davglass/license-checker/commit/8e5f5f0e7f83252e4039f6c7d16cc266acc1a33a)
0.1.2 (@davglass)
- [3d7a74e](https://github.com/davglass/license-checker/commit/3d7a74e90122f908057b2008ab29d8bd49011291)
fixed lint issue (@davglass)

v0.1.1 (2014/11/20 15:47 +00:00)

- [750d507](https://github.com/davglass/license-checker/commit/750d5079d32b44ecc984ff7ed672498d1b197235)
0.1.1 (@davglass)
- [94522e0](https://github.com/davglass/license-checker/commit/94522e099434dfdf163c3f2c5cacb3e6aa196cf8)
fixed merge issues (@davglass)

v0.1.0 (2014/11/20 15:41 +00:00)

- [8127f5e](https://github.com/davglass/license-checker/commit/8127f5e79eeceb7dfd86cd5f694080e4183dcb11)
0.1.0 (@davglass)
- [76c71ac](https://github.com/davglass/license-checker/commit/76c71ac46baeca8c349fe5892dcb659e859b9608)
Updated to newer read-installed (@davglass)

v0.0.10 (2014/08/12 12:48 +00:00)

- [807507d](https://github.com/davglass/license-checker/commit/807507df1a293bc0360adffd725a9f911331ff2b)
0.0.10 (@davglass)
- [e39ad9b](https://github.com/davglass/license-checker/commit/e39ad9bce6bcd545772c241e2e7aba8f40d5bbbbb)
Added checking that the license file is a normal file, because otherwise an appropriately named directory crashes the license-checker through EISDIR, illegal operation on a directory.
- [40ca4da](https://github.com/davglass/license-checker/commit/40ca4dadbc163ca774c87b1de249bd295952faa9)
colorize (@couchand)

v0.0.9 (2014/07/29 01:48 +00:00)

- [c14ef79](https://github.com/davglass/license-checker/commit/c14ef79f10f950ff0985e7e0b3138147b98ab1ec)
0.0.9 (@davglass)
- [ba1b66b](https://github.com/davglass/license-checker/commit/ba1b66b6172a2f9f8dbcdc56f40206820bc0916b)
Fixes #12 - Using some nicer regexes (@davglass)
- [bce94d5](https://github.com/davglass/license-checker/commit/bce94d5a8ab2f146356851776b2543df65fbf750)
case insensitive check (@davglass)
- [87c3406](https://github.com/davglass/license-checker/commit/87c3406aee2507eaf1d00d592f6dcb59a16e7c48)
Allow for LICENCE (@gdw2)

v0.0.8 (2014/07/07 20:10 +00:00)

- [6ad6ee2](https://github.com/davglass/license-checker/commit/6ad6ee21813e698e7f995e98dcadafbd961f6a33)
0.0.8 (@davglass)

- [b8c5815](https://github.com/davglass/license-checker/commit/b8c58151135f57d91fb0d1cfb194d034c012073f) added tests and refactored the code a little (@davglass)
- [275f276](https://github.com/davglass/license-checker/commit/275f276dc6e6d5635f9cb5b7e9a978e286f2d174) Added --csv option to readme file
- [d91eb72](https://github.com/davglass/license-checker/commit/d91eb7289466853ae6e88448b953b4d3d98ebab5) Apparently abbrev is now at version 1.0.5 which caused the unit test to fail.
- [40b4a42](https://github.com/davglass/license-checker/commit/40b4a420e520c2008b9395d1a8fdf38b56f846f5) Modified changes based on lshint output during Travis build
- [54e2390](https://github.com/davglass/license-checker/commit/54e2390cefd1dc664a15cd3a84347227f889f48b) Added csv output option similar to the existing JSON output option. Requires an output filename.

v0.0.7 (2014/02/26 04:52 +00:00)

- [1ce6d42](https://github.com/davglass/license-checker/commit/1ce6d42147b2d0237870818e8059003b331816cf) 0.0.7 (@davglass)
- [7d04195](https://github.com/davglass/license-checker/commit/7d041959450c68b3c5f427007c43cd6c73c6adfb) Added not check and a proper test (@davglass)
- [40d6e25](https://github.com/davglass/license-checker/commit/40d6e2580946c3cee1d408ebe28ff523852e8eb2) Undefined handling (@garrows)
- [90217d0](https://github.com/davglass/license-checker/commit/90217d070fd62cf76eb4e7b1610ed5eef6ae840d) travis Stuff (@davglass)
- [2bd76c8](https://github.com/davglass/license-checker/commit/2bd76c894f740cd83f6246e0e7341832c6432d8b) 0.0.6 (@davglass)
- [6f390ff](https://github.com/davglass/license-checker/commit/6f390fff60b31a07939e6d325796bdcfbefb5907) Added some better tests (@davglass)
- [2dbcac3](https://github.com/davglass/license-checker/commit/2dbcac37b5795ceb6db53452d0e41d1c4bc3153f) Looking for WTFPL as well as the string (@davglass)
- [5d91a07](https://github.com/davglass/license-checker/commit/5d91a073a8b76ec9a497c1e3b83198ce97e144fd) Flattened array of one (@davglass)
- [e95da82](https://github.com/davglass/license-checker/commit/e95da820c63e0d56c4567f1cfad07142d3110eca) Fixed extra var (@davglass)
- [fe8f2f7](https://github.com/davglass/license-checker/commit/fe8f2f7d39d520c0c4d87d34c9d4f55d59f4222d) Removing unnecessary log statement (@paulmand3l)
- [72a6f24](https://github.com/davglass/license-checker/commit/72a6f2403de43ecf5ec07bb504cb931c0e53f6a3) Adding license checks in the LICENSE file (and variations) (@paulmand3l)
- [#7](https://github.com/davglass/license-checker/pull/7) Merge pull request #7 from jamesbloomer/master (@jamesbloomer)
- [a81eee0](https://github.com/davglass/license-checker/commit/a81eee0a27f580688e371cc15015e848f591bb92) Fixed missing "install" in npm -g (@jamesbloomer)
- [416b012](https://github.com/davglass/license-checker/commit/416b01219e07a8274e05cd883ec050376902adeb) Updated Version (@davglass)
- [6d9bd1e](https://github.com/davglass/license-checker/commit/6d9bd1e195202c871693d4b1e9bac8c055683e8b) Fixed lint issue and added a test placeholder. Will add more tests soon (@davglass)
- [655a316](https://github.com/davglass/license-checker/commit/655a316f6448daf3c449f8b88e8878a95a8b153e) Added Travis test file (@davglass)
- [99895df](https://github.com/davglass/license-checker/commit/99895df6d3ac0f9ae4e8c935311fb1b3f88a688e) Version Bump (@davglass)
- [#4](https://github.com/davglass/license-checker/pull/4) Merge pull request #4 from badunk/refactor (@badunk)
- [1123a1b](https://github.com/davglass/license-checker/commit/1123a1baefc1975f8c36cb59952254cd66c31017)

Merge branch 'master' of <https://github.com/davglass/license-checker> (@badunk)
- [191612e](<https://github.com/davglass/license-checker/commit/191612e5c21a01bd453368299a14cc5ff1c6fb13>)
Version Bump (@davglass)
- [#2](<https://github.com/davglass/license-checker/pull/2>) Merge pull request #2 from badunk/circular (@badunk)
- [9b5a117](<https://github.com/davglass/license-checker/commit/9b5a1175892254e96d72f3d8dc793dcc4e2bde37>)
fixed special case when an empty array is passed to license/licenses (@badunk)
- [025668b](<https://github.com/davglass/license-checker/commit/025668b0a62b0d5b58662ce6aeed91de909a6fef>)
fixed bug with multiple licenses objects not showing (@badunk)
- [e6bdf52](<https://github.com/davglass/license-checker/commit/e6bdf52a8e5f9ebed29982014fa4d4586f63d06a>)
cleaned up the code (@badunk)
- [efb62f2](<https://github.com/davglass/license-checker/commit/efb62f2f52a29e9a37a7f387b280fc17ab0a5f19>)
added check for circular dependencies (@badunk)
- [825b40c](<https://github.com/davglass/license-checker/commit/825b40cb61fee36dd60751daa9d44e28853587ac>)
Version Bump (@davglass)
- [#1](<https://github.com/davglass/license-checker/pull/1>) Merge pull request #1 from mwilliamson/master
(@mwilliamson)
- [2f24319](<https://github.com/davglass/license-checker/commit/2f24319dd8dd212a1f78ad91af7fee21d50ab762>)
Don't ignore license field if it's a string (@mwilliamson)
- [7b8c34f](<https://github.com/davglass/license-checker/commit/7b8c34f75b04a7541bf23d596bbaae5447492c53>)
Initial Commit (@davglass)
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/*

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*/

// Original can be found at:

// <https://bitbucket.org/lindenlab/llsd>

// Modifications by Joshua Bell inexorabletash@gmail.com

// <https://github.com/inexorabletash/polyfill>

// ES3/ES5 implementation of the Khronos Typed Array Specification

// Ref: <http://www.khronos.org/registry/arraybuffer/specs/latest/>

// Date: 2011-02-01

//

// Variations:

// * Allows typed_array.get/set() as alias for subscripts (typed_array[])

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source: <https://github.com/johan/world.geo.json>

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v4.0.1 (2016-12-14)

WHOOPS

* [[fb9b1ce`](https://github.com/npm/nopt/commit/fb9b1ce57b3c69b4f7819015be87719204f77ef6)](https://github.com/npm/nopt/commit/fb9b1ce57b3c69b4f7819015be87719204f77ef6)
Merged so many patches at once that the code fencing
([@adius](https://github.com/adius)) added got broken. Sorry,
([@adius](https://github.com/adius))!
([@othiym23](https://github.com/othiym23))

v4.0.0 (2016-12-13)

BREAKING CHANGES

* [[651d447`](https://github.com/npm/nopt/commit/651d4473946096d341a480bbe56793de3fc706aa)](https://github.com/npm/nopt/commit/651d4473946096d341a480bbe56793de3fc706aa)
When parsing String-typed arguments, if the next value is `""`, don't simply swallow it. ([@samjonester](https://github.com/samjonester))

PERFORMANCE TWEAKS

* [[3370ce8`](https://github.com/npm/nopt/commit/3370ce87a7618ba228883861db84ddbcdff252a9)](https://github.com/npm/nopt/commit/3370ce87a7618ba228883861db84ddbcdff252a9)
Simplify initialization. ([@elidoran](https://github.com/elidoran))
* [[356e58e`](https://github.com/npm/nopt/commit/356e58e3b3b431a4b1af7fd7bdee44c2c0526a09)](https://github.com/npm/nopt/commit/356e58e3b3b431a4b1af7fd7bdee44c2c0526a09)
Store `Array.isArray(types[arg])` for reuse.
([@elidoran](https://github.com/elidoran))
* [[0d95e90`](https://github.com/npm/nopt/commit/0d95e90515844f266015b56d2c80b94e5d14a07e)](https://github.com/npm/nopt/commit/0d95e90515844f266015b56d2c80b94e5d14a07e)
Interpret single-item type arrays as a single type.
([@samjonester](https://github.com/samjonester))
* [[07c69d3`](https://github.com/npm/nopt/commit/07c69d38b5186450941fbb505550becb78a0e925)](https://github.com/npm/nopt/commit/07c69d38b5186450941fbb505550becb78a0e925)
Simplify key-value extraction. ([@elidoran](https://github.com/elidoran))
* [[39b6e5c`](https://github.com/npm/nopt/commit/39b6e5c65ac47f60cd43a1fbeece5cd4c834c254)](https://github.com/npm/nopt/commit/39b6e5c65ac47f60cd43a1fbeece5cd4c834c254)
Only call `Date.parse(val)` once. ([@elidoran](https://github.com/elidoran))
* [[934943d`](https://github.com/npm/nopt/commit/934943dffe5123a2b15959fe2a359319a5dbd)](https://github.com/npm/nopt/commit/934943dffe5123a2b15959fe2a359319a5dbd)
Use `osenv.home()` to find a user's home directory instead of assuming it's always `\$HOME`. ([@othiym23](https://github.com/othiym23))

TEST & CI IMPROVEMENTS

* [[326fff`](https://github.com/npm/nopt/commit/326fff7f78a00bcd316adecf69075f8a8093619)](https://github.com/npm/nopt/commit/326fff7f78a00bcd316adecf69075f8a8093619)

Fix `tmp` test to work on Windows.

([@elidoran](https://github.com/elidoran))

* [c89d31a`](https://github.com/npm/nopt/commit/c89d31a49d14f2238bc6672db08da697bbc57f1b)

Only run Windows tests on Windows, only run Unix tests on a Unix.

([@elidoran](https://github.com/elidoran))

* [affd3d1`](https://github.com/npm/nopt/commit/affd3d1d0addffa93006397b2013b18447339366)

Refresh Travis to run the tests against the currently-supported batch of npm

versions. ([@helio](https://github.com/helio)-frota)

* [55f9449`](https://github.com/npm/nopt/commit/55f94497d163ed4d16dd55fd6c4fb95cc440e66d)

`tap@8.0.1` ([@othiym23](https://github.com/othiym23))

DOC TWEAKS

* [5271229`](https://github.com/npm/nopt/commit/5271229ee7c810217dd51616c086f5d9ab224581)

Use JavaScript code block for syntax highlighting.

([@adius](https://github.com/adius))

* [c0d156f`](https://github.com/npm/nopt/commit/c0d156f229f9994c5dfcec4a8886eaceff7a07682)

The code sample in the README had `many2: [oneThing]`, and now it has

`many2: [two, things]`. ([@silkentrance](https://github.com/silkentrance))

version 1.2.11, January 15th, 2017

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Julian Seward, jseward@bzip.org
bzip2/libbzip2 version 1.0.6 of 6 September 2010

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TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, THE QT COMPANY ON BEHALF OF ITSELF AND ITS LICENSORS, SUPPLIERS AND AFFILIATES, DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT WITH REGARD TO THE LICENSED SOFTWARE. THE QT COMPANY DOES NOT WARRANT THAT THE LICENSED SOFTWARE WILL SATISFY LICENSEE'S REQUIREMENTS OR THAT IT WILL OPERATE WITHOUT DEFECT OR ERROR OR THAT THE OPERATION THEREOF WILL BE UNINTERRUPTED.

7. INDEMNIFICATION AND LIMITATION OF LIABILITY

7.1. Limitation of Liability

EXCEPT FOR (I) CASES OF GROSS NEGLIGENCE OR INTENTIONAL MISCONDUCT, AND (II) BREACH OF CONFIDENTIALITY, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL EITHER PARTY BE LIABLE TO THE OTHER PARTY FOR ANY LOSS OF PROFIT, LOSS OF DATA, LOSS OF BUSINESS OR GOODWILL OR ANY OTHER INDIRECT, SPECIAL, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE COST, DAMAGES OR EXPENSE OF ANY KIND,

HOWSOEVER ARISING UNDER OR IN CONNECTION WITH THIS AGREEMENT.

EXCEPT FOR (I) CASES OF GROSS NEGLIGENCE OR INTENTIONAL MISCONDUCT, AND (II) BREACH OF CONFIDENTIALITY, AND TO THE EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL EITHER PARTY'S TOTAL AGGREGATE LIABILITY UNDER THIS AGREEMENT EXCEED THE AGGREGATE LICENSE FEES PAID OR PAYABLE TO THE QT COMPANY FROM LICENSEE DURING THE PERIOD OF TWELVE (12) MONTHS IMMEDIATELY PRECEDING THE EVENT RESULTING IN SUCH LIABILITY.

THE PROVISIONS OF THIS SECTION 7 ALLOCATE THE RISKS UNDER THIS AGREEMENT BETWEEN THE QT COMPANY AND LICENSEE AND THE PARTIES HAVE RELIED UPON THE LIMITATIONS SET FORTH HEREIN IN DETERMINING WHETHER TO ENTER INTO THIS AGREEMENT.

NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS AGREEMENT, LICENSEE SHALL ALWAYS BE LIABLE TO PAY THE APPLICABLE LICENSE FEES CORRESPONDING TO ITS ACTUAL USE OF LICENSED SOFTWARE.

8. SUPPORT, UPDATES AND ONLINE SERVICES

Upon due payment of the agreed License Fees the Licensee will be eligible to receive Support and Updates and to use the Online Services during the License Term, provided, however, that in the event the License Term is longer than 36 months, the initial payment includes Support for only the first 12 months, unless the Parties specifically otherwise agree.

Unless otherwise decided by The Company at its free and absolute discretion, Upgrades will not be included in the Support but may be available subject to additional fees.

From time to time The Qt Company may change the Support terms, provided that during the respective ongoing License Term the level of Support provided by The Qt Company may not be reduced without the consent of the Licensee.

Unless otherwise agreed, The Qt Company shall not be responsible for providing any service or support to Customers.

9. CONFIDENTIALITY

Each Party acknowledges that during the Term of this Agreement each Party may receive information about the other Party's business, business methods, business plans, customers, business relations, technology, and other information, including the terms of this Agreement, that is confidential and of great value to the other Party, and the value of which would be significantly reduced if disclosed to third parties ("Confidential Information").

Accordingly, when a Party (the "Receiving Party") receives Confidential Information from the other Party (the "Disclosing Party"), the Receiving Party shall only disclose such information to employees and Contractors on a need to know basis, and shall cause its employees and employees of its Affiliates to:

(i) maintain any and all Confidential Information in confidence; (ii) not

disclose the Confidential Information to a third party without the Disclosing Party's prior written approval; and (iii) not, directly or indirectly, use the Confidential Information for any purpose other than for exercising its rights and fulfilling its responsibilities pursuant to this Agreement. Each Party shall take reasonable measures to protect the Confidential Information of the other Party, which measures shall not be less than the measures taken by such Party to protect its own confidential and proprietary information.

Obligation of confidentiality shall not apply to information that (i) is or becomes generally known to the public through no act or omission of the Receiving Party; (ii) was in the Receiving Party's lawful possession prior to the disclosure hereunder and was not subject to limitations on disclosure or use; (iii) is developed independently by employees or Contractors of the Receiving Party or other persons working for the Receiving Party who have not had access to the Confidential Information of the Disclosing Party, as proven by the written records of the Receiving Party; (iv) is lawfully disclosed to the Receiving Party without restrictions, by a third party not under an obligation of confidentiality; or (v) the Receiving Party is legally compelled to disclose, in which case the Receiving Party shall notify the Disclosing Party of such compelled disclosure and assert the privileged and confidential nature of the information and cooperate fully with the Disclosing Party to limit the scope of disclosure and the dissemination of disclosed Confidential Information to the minimum extent necessary.

The obligations under this Section 9 shall continue to remain in force for a period of five (5) years after the last disclosure, and, with respect to trade secrets, for so long as such trade secrets are protected under applicable trade secret laws.

10. FEES, DELIVERY AND PAYMENT

10.1. License Fees

License Fees are described in The Qt Company's standard price list, quote or Purchase Order confirmation or in an appendix hereto, as the case may be.

The License Fees shall not be refunded or claimed as a credit in any event or for any reason whatsoever.

10.2. Ordering Licenses

Licensee may purchase Development Licenses and Distribution Licenses pursuant to agreed pricing terms or, if no specific pricing terms have been agreed upon, at The Qt Company's standard pricing terms applicable at the time of purchase. Unless specifically otherwise provided, any pricing terms referenced in this Agreement shall be valid for twelve (12) months from the date of this Agreement.

Licensee shall submit all purchase orders for Development Licenses and Distribution Licenses to The Qt Company by email or any other method acceptable to The Qt Company (each such order is referred to herein as a "Purchase Order") for confirmation, whereupon the Purchase Order shall become binding between the

Parties.

10.3. Distribution License Packs

Unless otherwise agreed, Distribution Licenses shall be purchased by way of Distribution License Packs.

Upon due payment of the ordered Distribution License Pack(s), the Licensee will have an account of Distribution Licenses available for distributing the Redistributables in accordance with this Agreement.

Each time Licensee distributes a copy of Redistributables, then one Distribution License is used, and Licensee's account of available Distribution Licenses is decreased accordingly. Licensee may distribute copies of the Redistributables so long as Licensee has Distribution Licenses remaining on its account.

10.4. Payment Terms

License Fees and any other charges under this Agreement shall be paid by Licensee no later than thirty (30) days from the date of the applicable invoice from The Qt Company.

The Qt Company will submit an invoice to Licensee after the date of this Agreement and/or after The Qt Company receives a Purchase Order from Licensee.

A late payment charge of the lower of (a) one percent per month; or (b) the interest rate stipulated by applicable law, shall be charged on any unpaid balances that remain past due.

10.5. Taxes

All License Fees and other charges payable hereunder are gross amounts but exclusive of any value added tax, use tax, sales tax, withholding tax and other taxes, duties or tariffs ("Taxes") levied directly for the sale, delivery or use of Licensed Software hereunder pursuant to any applicable law. Such applicable Taxes shall be paid by Licensee to The Qt Company, or, where applicable, in lieu of payment of such Taxes to The Qt Company, Licensee shall provide an exemption certificate to The Qt Company and any applicable authority.

11. RECORD-KEEPING AND REPORTING OBLIGATIONS; AUDIT RIGHTS

11.1. Licensee's Record-keeping

Licensee shall at all times during the Term of this Agreement and for a period of seven (7) years thereafter maintain Licensee's Records in an accurate and up-to-date form. Licensee's Records shall be adequate to reasonably enable The Qt Company to determine Licensee's compliance with the provisions of this Agreement. The records shall conform to general good accounting practices.

Licensee shall, within thirty (30) days from receiving The Qt Company's request to that effect, deliver to The Qt Company a report based on Licensee's Records, such report to contain information, in sufficient detail, on (i) number and

identity of users working with Licensed Software or Open Source Qt, (ii) copies of Redistributables distributed by Licensee during the most recent calendar quarter and/or any other term specified by The Qt Company, (iii) number of undistributed copies of Redistributables and corresponding number of unused Distribution Licenses remaining on Licensee's account, and (iv) any other information as The Qt Company may reasonably require from time to time.

11.2. The Qt Company's Audit Rights

The Qt Company or an independent auditor acting on behalf of The Qt Company's, may, upon at least five (5) business days' prior written notice and at its expense, audit Licensee with respect to the Licensee's use of the Licensed Software, but not more frequently than once during each 6-month period. Such audit may be conducted by mail, electronic means or through an in-person visit to Licensee's place of business. Any such in-person audit shall be conducted during regular business hours at Licensee's facilities and shall not unreasonably interfere with Licensee's business activities. The Qt Company or the independent auditor acting on behalf of The Qt Company shall be entitled to inspect Licensee's Records and conduct necessary interviews of Licensee's relevant employees and Contractors. All such Licensee's Records and use thereof shall be subject to an obligation of confidentiality under this Agreement.

If an audit reveals that Licensee is using the Licensed Software beyond scope of the licenses Licensee has paid for, Licensee agrees to pay The Qt Company any amounts owed for such unauthorized use within 30 days from receipt of the corresponding invoice from The Qt Company. In addition, in the event the audit reveals a material violation of the terms of this Agreement (without limitation, either (i) underpayment of more than 10 % of License Fees or 10,000 euros (whichever is more) or (ii) distribution of products, which include or result from Prohibited Combination, shall be deemed a material violation for purposes of this section), then the Licensee shall pay The Qt Company's reasonable cost of conducting such audit.

12. TERM AND TERMINATION

12.1. Agreement Term

This Agreement shall enter into force upon due acceptance by both Parties and remain in force for as long as there is any Development License(s) purchased under this Agreement in force ("Term"), unless and until terminated pursuant to the terms of this Section 12.

12.2. Termination and suspension of rights

Either Party shall have the right to terminate this Agreement upon thirty (30) days prior written notice if the other Party commits a material breach of any obligation of this Agreement and fails to remedy such breach within such notice period.

Instead of termination, The Qt Company shall have the right to suspend or withhold grants of all rights to the Licensed Software hereunder, including but not limited to the Development Licenses, Distribution License, and Support,

should Licensee fail to make payment in timely fashion or otherwise violates or is reasonably suspected to violate its obligations or terms of this Agreement, and where such violation or breach is not cured within five (5) business days following The Qt Company's written notice thereof.

12.3. Mutual Right to Terminate

Either Party shall have the right to terminate this Agreement immediately upon written notice in the event that the other Party becomes insolvent, files for any form of bankruptcy, makes any assignment for the benefit of creditors, has a receiver, administrative receiver or officer appointed over the whole or a substantial part of its assets, ceases to conduct business, or an act equivalent to any of the above occurs under the laws of the jurisdiction of the other Party.

12.4. Parties Rights and Duties upon Termination

Upon expiry or termination of the Agreement, Licensee shall cease and shall cause all Designated Users (including those of its Affiliates' and Contractors') to cease using the Licensed Software and distribution of the Redistributables under this Agreement.

Notwithstanding the above, in the event the Agreement expires or is terminated:

- (i) as a result of The Qt Company choosing not to renew the Development License(s) as set forth in Section 3.1, then all valid licenses possessed by the Licensee at such date shall be extended to be valid in perpetuity under the terms of this Agreement and Licensee is entitled to purchase additional licenses as set forth in Section 10.2; or
- (ii) for reason other than by The Qt Company pursuant to item (i) above or pursuant to Section 12.2, then the Licensee is entitled, for a period of six (6) months after the effective date of termination, to continue distribution of Devices under the Distribution Licenses paid but unused at such effective date of termination.

Upon any such termination the Licensee shall destroy or return to The Qt Company all copies of the Licensed Software and all related materials and will certify the same to The Qt Company upon its request, provided however that Licensee may retain and exploit such copies of the Licensed Software as it may reasonably require in providing continued support to Customers.

Expiry or termination of this Agreement for any reason whatsoever shall not relieve Licensee of its obligation to pay any License Fees accrued or payable to The Qt Company prior to the effective date of termination, and Licensee shall immediately pay to The Qt Company all such fees upon the effective date of termination. Termination of this Agreement shall not affect any rights of Customers to continue use of Applications and Devices (and therein incorporated Redistributables).

12.5. Extension in case of bankruptcy

In the event The Qt Company is declared bankrupt under a final, non-cancellable decision by relevant court of law, and this Agreement is not, at the date of expiry of the Development License(s) pursuant to Section 3.1, assigned to party, who has assumed The Qt Company's position as a legitimate licensor of Licensed Software under this Agreement, then all valid licenses possessed by the Licensee at such date of expiry, and which the Licensee has not notified for expiry, shall be extended to be valid in perpetuity under the terms of this Agreement.

13. GOVERNING LAW AND LEGAL VENUE

In the event this Agreement is in the name of The Qt Company Inc., a Delaware Corporation, then:

- (i) this Agreement shall be construed and interpreted in accordance with the laws of the State of California, USA, excluding its choice of law provisions;
- (ii) the United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement; and
- (iii) any dispute, claim or controversy arising out of or relating to this Agreement or the breach, termination, enforcement, interpretation or validity thereof, including the determination of the scope or applicability of this Agreement to arbitrate, shall be determined by arbitration in San Francisco, USA, before one arbitrator. The arbitration shall be administered by JAMS pursuant to JAMS' Streamlined Arbitration Rules and Procedures. Judgment on the Award may be entered in any court having jurisdiction. This Section shall not preclude parties from seeking provisional remedies in aid of arbitration from a court of appropriate jurisdiction.

In the event this Agreement is in the name of The Qt Company Ltd., a Finnish Company, then:

- (i) this Agreement shall be construed and interpreted in accordance with the laws of Finland, excluding its choice of law provisions;
- (ii) the United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement; and
- (iii) any disputes, controversy or claim arising out of or relating to this Agreement, or the breach, termination or validity thereof shall be finally settled by arbitration in accordance with the Arbitration Rules of Finland Chamber of Commerce. The arbitration tribunal shall consist of one (1), or if either Party so requires, of three (3), arbitrators. The award shall be final and binding and enforceable in any court of competent jurisdiction. The arbitration shall be held in Helsinki, Finland and the process shall be conducted in the English language. This Section shall not preclude parties from seeking provisional remedies in aid of arbitration from a court of appropriate jurisdiction.

14. GENERAL PROVISIONS

14.1. No Assignment

Except in the case of a merger or sale of substantially all of its corporate assets, Licensee shall not be entitled to assign or transfer all or any of its rights, benefits and obligations under this Agreement without the prior written consent of The Qt Company, which shall not be unreasonably withheld or delayed. The Qt Company shall be entitled to freely assign or transfer any of its rights, benefits or obligations under this Agreement.

14.2. No Third-Party Representations

Licensee shall make no representations or warranties concerning the Licensed Software on behalf of The Qt Company. Any representation or warranty Licensee makes or purports to make on The Qt Company's behalf shall be void as to The Qt Company.

14.3. Surviving Sections

Any terms and conditions that by their nature or otherwise reasonably should survive termination of this Agreement shall so be deemed to survive. Such sections include especially the following: 1, 2, 6, 7, 9, 11, 12.4, 13 and 14.

14.4. Entire Agreement

This Agreement, the exhibits hereto, the License Certificate and any applicable Purchase Order accepted by The Qt Company constitute the complete agreement between the Parties and supersedes all prior or contemporaneous discussions, representations, and proposals, written or oral, with respect to the subject matters discussed herein.

In the event of any conflict or inconsistency between this Agreement and any Purchase Order, the terms of this Agreement will prevail over the terms of the Purchase Order with respect to such conflict or inconsistency.

Parties specifically acknowledge and agree that this Agreement prevails over any click-to-accept or similar agreements the Designated Users may need to accept online upon download of the Licensed Software, as may be required by The Qt Company's applicable processes relating to Licensed Software.

14.5. Modifications

No modification of this Agreement shall be effective unless contained in a writing executed by an authorized representative of each Party. No term or condition contained in Licensee's Purchase Order ("Deviating Terms") shall apply unless The Qt Company has expressly agreed such Deviating Terms in writing. Unless and to the extent expressly agreed by The Qt Company, any such Deviating Terms shall be deemed void and with no legal effect. For clarity, delivery of the Licensed Software following the receipt of the Purchase Order including Deviating Terms shall not constitute acceptance of such Deviating Terms."

14.6. Force Majeure

Except for the payment obligations hereunder, neither Party shall be liable to

the other for any delay or non-performance of its obligations hereunder in the event and to the extent that such delay or non-performance is due to an event of act of God, terrorist attack or other similar unforeseeable catastrophic event that prevents either Party for fulfilling its obligations under this Agreement and which such Party cannot avoid or circumvent ("Force Majeure Event"). If the Force Majeure Event results in a delay or non-performance of a Party for a period of three (3) months or longer, then either Party shall have the right to terminate this Agreement with immediate effect without any liability (except for the obligations of payment arising prior to the event of Force Majeure) towards the other Party.

14.7. Notices

Any notice given by one Party to the other shall be deemed properly given and deemed received if specifically acknowledged by the receiving Party in writing or when successfully delivered to the recipient by hand, fax, or special courier during normal business hours on a business day to the addresses specified for each Party on the signature page. Each communication and document made or delivered by one Party to the other Party pursuant to this Agreement shall be in the English language.

14.8. Export Control

Licensee acknowledges that the Redistributables, as incorporated in Applications or Devices, may be subject to export control restrictions under the applicable laws of respective countries. Licensee shall fully comply with all applicable export license restrictions and requirements as well as with all laws and regulations relating to the Redistributables and exercise of licenses hereunder and shall procure all necessary governmental authorizations, including without limitation, all necessary licenses, approvals, permissions or consents, where necessary for the re-exportation of the Redistributables, Applications and/or Devices.

14.9. No Implied License

There are no implied licenses or other implied rights granted under this Agreement, and all rights, save for those expressly granted hereunder, shall remain with The Qt Company and its licensors. In addition, no licenses or immunities are granted to the combination of the Licensed Software with any other software or hardware not delivered by The Qt Company under this Agreement.

14.10. Attorney Fees

The prevailing Party in any action to enforce this Agreement shall be entitled to recover its attorney's fees and costs in connection with such action.

14.11. Privacy

Licensee acknowledges and agrees that for the purpose of this Agreement, The Qt Company may collect, use, transfer and disclose personal data pertaining to Designated Users as well as any other employees and directors of the Licensee and its Contractors relevant for carrying out the intent of this Agreement. Such personal data may be collected from the Licensee or directly from the

relevant individuals. The Parties acknowledge that with regard to such personal data processed hereunder, The Qt Company shall be regarded as the Data Controller under the applicable Data Protection Legislation. The Qt Company shall process any such personal data in accordance with its privacy policies and practices, which will comply with all applicable requirements of the Data Protection Legislation.

14.12. Severability

If any provision of this Agreement shall be adjudged by any court of competent jurisdiction to be unenforceable or invalid, that provision shall be limited or eliminated to the minimum extent necessary so that this Agreement shall otherwise remain in full force and effect and enforceable.

APPENDICES

The Agreement includes Appendix 1, and possibly one or more of the appendices 3-5, depending on the product(s) purchased by the Licensee, what is stated in the quote or invoice, and/or what is stated in the Licensee's License Certificate.

APPENDIX 1

The modules and/or tools that are included in the respective product - Qt for Application Development (QtAD), Qt for Device Creation (QtDC), Qt for MCUs (QtMCU), Qt 3D Studio (Qt3DS) and Qt Design Studio (QtDS) - are marked with 'X' in the below table.

Parts of the product that are permitted for distribution in object-code form only ("Redistributables") are marked with 'R' in the below table.

| Modules/Tools | QtAD | QtDC | QtMCU | Qt3DS | QtDS |
|-----------------------|------|------|-------|-------|------|
| Qt Core | X,R | X,R | | | |
| Qt GUI | X,R | X,R | | | |
| Qt Multimedia | X,R | X,R | | | |
| Qt Multimedia Widgets | X,R | X,R | | | |
| Qt Network | X,R | X,R | | | |
| Qt QML | X,R | X,R | | | |
| Qt Quick | X,R | X,R | | | |
| Qt Quick Controls 2 | X,R | X,R | | | |

| | | | |
|--------------------------|-----------|--|--|
| Qt Quick Dialogs | X,R X,R | | |
| Qt Quick Layouts | X,R X,R | | |
| Qt Quick Test | X,R X,R | | |
| Qt SQL | X,R X,R | | |
| Qt Test | X,R X,R | | |
| Qt Widgets | X,R X,R | | |
| Active Qt | X,R X,R | | |
| Qt 3D | X,R X,R | | |
| Qt Android Extras | X,R X,R | | |
| Qt Bluetooth | X,R X,R | | |
| Qt Canvas 3D | X,R X,R | | |
| Qt Concurrent | X,R X,R | | |
| Qt D-Bus | X,R X,R | | |
| Qt Gamepad | X,R X,R | | |
| Qt Graphical Effects | X,R X,R | | |
| Qt Help | X,R X,R | | |
| Qt Image Formats | X,R X,R | | |
| Qt Location | X,R X,R | | |
| Qt Mac Extras | X,R X,R | | |
| Qt Network Authorization | X,R X,R | | |
| Qt NFC | X,R X,R | | |
| Qt Platform Headers | X,R X,R | | |
| Qt Positioning | X,R X,R | | |
| Qt Print Support | X,R X,R | | |

| | | | |
|-----------------------|-----------|--|--|
| Qt Purchasing | X,R X,R | | |
| Qt for Python | X,R X,R | | |
| Qt Quick Controls | X,R X,R | | |
| Qt Quick Extras | X,R X,R | | |
| Qt Quick Widgets | X,R X,R | | |
| Qt SCXML | X,R X,R | | |
| Qt Sensors | X,R X,R | | |
| Qt Serial Bus | X,R X,R | | |
| Qt Serial Port | X,R X,R | | |
| Qt Speech | X,R X,R | | |
| Qt SVG | X,R X,R | | |
| Qt UI Tools | X,R X,R | | |
| Qt WebChannel | X,R X,R | | |
| Qt WebEngine | X,R X,R | | |
| Qt WebSockets | X,R X,R | | |
| Qt WebView | X,R X,R | | |
| Qt Windows Extras | X,R X,R | | |
| Qt X11 Extras | X,R X,R | | |
| Qt XML | X,R X,R | | |
| Qt XML Patterns | X,R X,R | | |
| Qt Wayland Compositor | X,R X,R | | |
| Qt Charts | X,R X,R | | |
| Qt Data Visualization | X,R X,R | | |
| Qt Virtual Keyboard | X,R X,R | | |

| | | | | | | |
|-----------------------|--|--|---|-----|--|---|
| qmlinterfacegenerator | | | | X | | |
| qmltocpp | | | X | | | |
| qulfontcompiler | | | X | | | |
| Qt53DStudioRuntime2 | | | | X,R | | |
| Qt 3D Studio | | | | X | | |
| Qt Design Studio | | | | | | X |

APPENDIX 3: ADDITIONS TO LICENSED SOFTWARE

In addition to what is provided under the definition of the Licensed Software, Parties agree that Licensed Software shall also include the Add-On Products of The Qt Company, as mentioned in this Appendix, if included in the quote / invoice.

The Modules and/or Tools of the Licensed Software that are included with each Add-On Product respectively are marked with 'X' in the below table. Parts of the respective Add-On Product that are permitted for distribution in object-code form only ("Redistributables") are marked with 'R' in the below table.

| | Add-On Product(s) | | | | | |
|--------------------------------------|-------------------|---------------------|------------------|------------------------|----------------------|-----------------------|
| Modules / Tools of Licensed Software | Qt for Automation | Qt Automotive Suite | Qt Safe Renderer | Qt Application Manager | Qt Gammaray Platform | Qt Deployment Package |
| Qt MQTT | X,R | | | | | |
| Qt KNX | X,R | | | | | |
| Qt OPC UA | X,R | | | | | |
| Qt CoAP | X,R | | | | | |
| Qt Safe Renderer | | X,R | X,R | | | |
| Qt Application | | X,R | | X,R | | |

| | | | | | | | | | |
|--------------|--|--|--|-----|--|--|--|---|---|
| Manager | | | | | | | | | |
| ----- | | | | | | | | | |
| Qt IVI | | | | X,R | | | | | |
| ----- | | | | | | | | | |
| Reference UI | | | | X,R | | | | | |
| ----- | | | | | | | | | |
| Qt GENIVI | | | | X,R | | | | | |
| Extras | | | | | | | | | |
| ----- | | | | | | | | | |
| QML Live | | | | X | | | | | |
| ----- | | | | | | | | | |
| Qt Creator | | | | X | | | | | |
| Deployment | | | | | | | | | |
| ----- | | | | | | | | | |
| Qt Creator | | | | | | | | | |
| Plugin for | | | | | | | | | |
| Qt | | | | X | | | | X | |
| Application | | | | | | | | | |
| Manager | | | | | | | | | |
| ----- | | | | | | | | | |
| Qt | | | | | | | | | |
| Automotive | | | | | | | | | |
| Suite | | | | X | | | | | |
| Deployment | | | | | | | | | |
| Server | | | | | | | | | |
| ----- | | | | | | | | | |
| Qt Design | | | | X | | | | | |
| Studio | | | | | | | | | |
| ----- | | | | | | | | | |
| Qt 3D Studio | | | | X | | | | | |
| ----- | | | | | | | | | |
| GammaRay | | | | X | | | | X | |
| ----- | | | | | | | | | |
| Platform | | | | | | | | | |
| adaptations | | | | | | | | | |
| for | | | | | | | | | X |
| specified | | | | | | | | | |
| Deployment | | | | | | | | | |
| Platforms | | | | | | | | | |
| ----- | | | | | | | | | |
| Qt for | | | | | | | | | |
| Device | | | | X | | | | | |
| Creation | | | | | | | | | |
| ----- | | | | | | | | | |

All the above Redistributables are subject to applicable provisions and limitations including but not limited to what is defined in section 3 of the Agreement.

APPENDIX 4: SMALL BUSINESS AND STARTUP

The provisions of this Appendix 4 are applicable for Start-up Companies and for the Evaluation Term. For the purpose of this Appendix 4, the following additional definitions shall be applicable:

"Trial Term" shall mean a period of twelve (12) months.

"Start-up Company" means a company with a maximum annual revenue, including funding, equivalent to 100,000 USD (in applicable currency) during a respective calendar year, as evidenced by duly audited records of the Licensee and approved by The Qt Company.

During the Trial Term, Section 3 shall apply with following modifications ("Trial Term Modifications"):

- (i) Licenses granted under Sections 3.1 and 3.2 shall be free of any charge. For clarity, License for distribution of Devices pursuant to Section 3.3 is subject to applicable License Fee for necessary Distribution Licenses;
- (ii) Development License under Section 3.1 is limited to a maximum of three (3) Designated Users; and
- (iii) Support is available subject to availability, as judged by The Qt Company at its free and absolute discretion, provided that support will be limited to a maximum of ten (10) tickets during the Trial Term.

Upon expiry of the Trial Term:

- (a) This Appendix 4 is terminated, Trial Term Modifications cease to remain in force, Licensee's Development Licenses shall be automatically converted into licenses subject to a License Fee (in the amount specified in the quote or in Appendix 2 and payable with a 30-day payment term) and Licensee's rights and obligations under this Agreement shall continue to remain in force under the standard provisions of the Agreement, unless the Licensee notifies The Qt Company in writing no less than ninety (90) days before such expiry date that Licensee does not agree to such continuance, in which event the Agreement, and all rights of the Licensee thereunder, shall expire; provided however that
- (b) in the event the Licensee still qualifies as a Start-up Company, the Licensee has an option ("Option"), instead of what is stated in item a) above, to renew the Trial Term. Renewal is limited to one time, and the total duration of Trial Term is thus 24 months after the effective date. Licensee shall notify The Qt Company in writing, no less than ninety (90) days before the expiry date, if Licensee wish to exercise the Option.

APPENDIX 5: NON-COMMERCIAL USE

The provisions of this Appendix 5 are applicable for non-commercial use of the Licensed Software by the Licensee.

For the purpose of this Appendix 5, the following additional definitions (replacing the relevant definition of the Agreement, where applicable) shall be applicable:

"Demo Units" shall mean (i) hardware development platform, which incorporates the Licensed Software along with Licensee's software and/or hardware, and (ii) prototype versions of Applications or Devices.

"Designated User(s)" shall mean the employees and students of the Licensee.

"Licensee Products" shall mean Applications and/or Devices.

"Permitted Purpose" shall mean (i) Licensee's internal evaluation and testing of Licensed Software, (ii) building Demo Units as well as (iii) educational use.

"Term" shall mean a period of twelve (12) months or any such other period as may be agreed between the Parties.

For the purpose of this Appendix 5, the following changes shall be agreed with respect to relevant Sections of the Agreement:

I. Recital (A) shall be replaced in its entirety to read as follows:

"(A) Licensee wishes to use the Licensed Software for the Permitted Purpose."

II. Section 3.1 shall be replaced in its entirety to read as follows:

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^ expected errors | v input

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/*---

esid: sec-assignment-operators-static-semantics-early-errors

description: Minimal test

---*/

void 0;

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spdx-license-ids

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Installation

[Download JSON directly](https://raw.githubusercontent.com/shinnn/spdx-license-ids/master/index.json), or
[use](https://docs.npmjs.com/cli/install) [npm](https://docs.npmjs.com/about-npm/):

npm install spdx-license-ids

[Node.js](https://nodejs.org/) API

require('spdx-license-ids')

Type: `string[]`

All license IDs except for the currently deprecated ones.

```
```javascript
const ids = require('spdx-license-ids');
//=> ['0BSD', 'AAL', 'ADSL', 'AFL-1.1', 'AFL-1.2', 'AFL-2.0', 'AFL-2.1', 'AFL-3.0', 'AGPL-1.0-only', ...]

ids.includes('BSD-3-Clause'); //=> true
ids.includes('CC-BY-1.0'); //=> true

ids.includes('GPL-3.0'); //=> false
```
```

```
### require('spdx-license-ids/deprecated')
```

Type: `string[]`

Deprecated license IDs.

```
```javascript
const deprecatedIds = require('spdx-license-ids/deprecated');
//=> ['AGPL-1.0', 'AGPL-3.0', 'GFDL-1.1', 'GFDL-1.2', 'GFDL-1.3', 'GPL-1.0', 'GPL-2.0', ...]

deprecatedIds.includes('BSD-3-Clause'); //=> false
deprecatedIds.includes('CC-BY-1.0'); //=> false

deprecatedIds.includes('GPL-3.0'); //=> true
```
```

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Version 3, 29 June 2007

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Included here to compliment the Pthreads-win32 license header in wtf/ThreadingWin.cpp file. WebKit is using derived sources of ThreadCondition code from Pthreads-win32.

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Port to Digital Mars compiler.

Gottlob Frege gottlobfrege at gmail dot com
re-implemented pthread_once (version 2)
(pthread_once cancellation added by rpj).

Vladimir Kliatchko vladimir at kliatchko dot com
reimplemented pthread_once with the same form
as described by A.Terekhov (later version 2);
implementation of MCS (Mellor-Crummey/Scott) locks.

A. HISTORY OF THE SOFTWARE

=====

Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization

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| 2.0 | 1.6 | 2000 | BeOpen.com | no |
| 1.6.1 | 1.6 | 2001 | CNRI | yes (2) |
| 2.1 | 2.0+1.6.1 | 2001 | PSF | no |
| 2.0.1 | 2.0+1.6.1 | 2001 | PSF | yes |
| 2.1.1 | 2.1+2.0.1 | 2001 | PSF | yes |
| 2.1.2 | 2.1.1 | 2002 | PSF | yes |
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The code in this library is an extension of Bala Vatti's clipping algorithm:
"A generic solution to polygon clipping"
Communications of the ACM, Vol 35, Issue 7 (July 1992) pp 56-63.
<http://portal.acm.org/citation.cfm?id=129906>

Computer graphics and geometric modeling: implementation and algorithms

By Max K. Agoston
Springer; 1 edition (January 4, 2005)
<http://books.google.com/books?q=vatti+clipping+agoston>

See also:

"Polygon Offsetting by Computing Winding Numbers"
Paper no. DETC2005-85513 pp. 565-575
ASME 2005 International Design Engineering Technical Conferences
and Computers and Information in Engineering Conference (IDETC/CIE2005)
September 24-28, 2005 , Long Beach, California, USA
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C++ port by Konstantin Kfer <mail@kkaefer.com>, 2014.

<https://github.com/deanm/css-color-parser-js>
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node-http-proxy

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- * Added @Override annotation to generated Java code where appropriate.

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- * Solaris 10 + Sun Studio fixes.

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- * Slicing support for repeated scalar fields for the Python API.

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- * MS Visual Studio error format option.
- * Detect unordered_map in stl_hash.m4.

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- * gzip/zlib I/O support.

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- * Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).
- * Added generation of field number constants.

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- * Fixed initialization ordering problem in logging code.

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- * Small patch improving performance of in Python serialization.

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- * Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

Scott Stafford <scott.stafford@gmail.com>

- * Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

Alexander Melnikov <alm@sibmail.ru>

- * HPUX support.

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- * Detect whether zlib is new enough in configure script.
- * Fixes for Solaris 10 32/64-bit confusion.

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- * Optimize Java serialization code when writing a small message to a stream.
- * Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
- * Clean up some Java warnings.
- * Fix bug with permanent callbacks that delete themselves when run.

Michael Kucharski <m.kucharski@gmail.com>

- * Added CodedInputStream.getTotalBytesRead().

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- * Fixed m4/acx_pthread.m4 problem for some Linux distributions.

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- * Fixed detection of sched_yield on Solaris.
- * Added atomicops for Solaris

Andrew Paprocki <andrew@ishiboo.com>

- * Fixed minor IBM xLC compiler build issues
- * Added atomicops for AIX (POWER)

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- * The implementation was written so as to conform with Netscapes SSL.
- *
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*

* From: Wilco Dijkstra <Wilco.Dijkstra@ntlworld.com>

* Date: Fri, Jun 24, 2011 at 3:20 AM

* Subject: Re: sqrt routine

* To: Kevin Ma <kma@google.com>

* Hi Kevin,

* Thanks for asking. Those routines are public domain (originally posted to
* comp.sys.arm a long time ago), so you can use them freely for any purpose.

* Cheers,

* Wilco

*

* ----- Original Message -----

* From: "Kevin Ma" <kma@google.com>

* To: <Wilco.Dijkstra@ntlworld.com>

* Sent: Thursday, June 23, 2011 11:44 PM

* Subject: Fwd: sqrt routine

* Hi Wilco,

* I saw your sqrt routine from several web sites, including

* <http://www.finesse.demon.co.uk/steven/sqrt.html>.

* Just wonder if there's any copyright information with your Successive

* approximation routines, or if I can freely use it for any purpose.

* Thanks.

* Kevin

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'zlib' general purpose compression library
version 1.2.3, July 18th, 2005

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ESLint

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If you want to write an option parser, and have it be good, there are two ways to do it. The Right Way, and the Wrong Way.

The Wrong Way is to sit down and write an option parser. We've all done that.

The Right Way is to write some complex configurable program with so many options that you hit the limit of your frustration just trying to

manage them all, and defer it with duct-tape solutions until you see exactly to the core of the problem, and finally snap and write an awesome option parser.

If you want to write an option parser, don't write an option parser. Write a package manager, or a source control system, or a service restarter, or an operating system. You probably won't end up with a good one of those, but if you don't give up, and you are relentless and diligent enough in your procrastination, you may just end up with a very nice option parser.

USAGE

```
```javascript
// my-program.js
var nopt = require("nopt")
, Stream = require("stream").Stream
, path = require("path")
, knownOpts = { "foo" : [String, null]
, "bar" : [Stream, Number]
, "baz" : path
, "bloo" : ["big", "medium", "small"]
, "flag" : Boolean
, "pick" : Boolean
, "many1" : [String, Array]
, "many2" : [path, Array]
}
, shortHands = { "foofoo" : ["--foo", "Mr. Foo"]
, "b7" : ["--bar", "7"]
, "m" : ["--bloo", "medium"]
, "p" : ["--pick"]
, "f" : ["--flag"]
}
// everything is optional.
// knownOpts and shorthands default to { }
// arg list defaults to process.argv
// slice defaults to 2
, parsed = nopt(knownOpts, shortHands, process.argv, 2)
console.log(parsed)
```
```

This would give you support for any of the following:

```
```console
$ node my-program.js --foo "blerp" --no-flag
{ "foo" : "blerp", "flag" : false }

$ node my-program.js ---bar 7 --foo "Mr. Hand" --flag
```



```

{ bar: 7, foo: "Mr. Hand", flag: true }

$ node my-program.js --foo "blerp" -f -----p
{ foo: "blerp", flag: true, pick: true }

$ node my-program.js -fp --foofoo
{ foo: "Mr. Foo", flag: true, pick: true }

$ node my-program.js --foofoo -- -fp # -- stops the flag parsing.
{ foo: "Mr. Foo", argv: { remain: ["-fp"] } }

$ node my-program.js --blatzk -fp # unknown opts are ok.
{ blatzk: true, flag: true, pick: true }

$ node my-program.js --blatzk=1000 -fp # but you need to use = if they have a value
{ blatzk: 1000, flag: true, pick: true }

$ node my-program.js --no-blatzk -fp # unless they start with "no-"
{ blatzk: false, flag: true, pick: true }

$ node my-program.js --baz b/a/z # known paths are resolved.
{ baz: "/Users/isaacs/b/a/z" }

if Array is one of the types, then it can take many
values, and will always be an array. The other types provided
specify what types are allowed in the list.

$ node my-program.js --many1 5 --many1 null --many1 foo
{ many1: ["5", "null", "foo"] }

$ node my-program.js --many2 foo --many2 bar
{ many2: ["/path/to/foo", "path/to/bar"] }
```

```

Read the tests at the bottom of `lib/nopt.js` for more examples of what this puppy can do.

Types

The following types are supported, and defined on `nopt.typeDefs`

- * String: A normal string. No parsing is done.
- * path: A file system path. Gets resolved against cwd if not absolute.
- * url: A url. If it doesn't parse, it isn't accepted.
- * Number: Must be numeric.
- * Date: Must parse as a date. If it does, and `Date` is one of the options, then it will return a Date object, not a string.
- * Boolean: Must be either `true` or `false`. If an option is a boolean,

then it does not need a value, and its presence will imply `true` as the value. To negate boolean flags, do `--no-whatever` or `--whatever` `false`

* NaN: Means that the option is strictly not allowed. Any value will fail.

* Stream: An object matching the "Stream" class in node. Valuable for use when validating programmatically. (npm uses this to let you supply any WriteStream on the `outfd` and `logfd` config options.)

* Array: If `Array` is specified as one of the types, then the value will be parsed as a list of options. This means that multiple values can be specified, and that the value will always be an array.

If a type is an array of values not on this list, then those are considered valid values. For instance, in the example above, the `--bloo` option can only be one of `"big"`, `"medium"`, or `"small"`, and any other value will be rejected.

When parsing unknown fields, `"true"`, `"false"`, and `"null"` will be interpreted as their JavaScript equivalents.

You can also mix types and values, or multiple types, in a list. For instance `{ blah: [Number, null] }` would allow a value to be set to either a Number or null. When types are ordered, this implies a preference, and the first type that can be used to properly interpret the value will be used.

To define a new type, add it to `nopt.typeDefs`. Each item in that hash is an object with a `type` member and a `validate` method. The `type` member is an object that matches what goes in the type list. The `validate` method is a function that gets called with `validate(data, key, val)`. Validate methods should assign `data[key]` to the valid value of `val` if it can be handled properly, or return boolean `false` if it cannot.

You can also call `nopt.clean(data, types, typeDefs)` to clean up a config object and remove its invalid properties.

Error Handling

By default, nopt outputs a warning to standard error when invalid values for known options are found. You can change this behavior by assigning a method to `nopt.invalidHandler`. This method will be called with the offending `nopt.invalidHandler(key, val, types)`.

If no `nopt.invalidHandler` is assigned, then it will console.error its whining. If it is assigned to boolean `false` then the warning is suppressed.

Abbreviations

Yes, they are supported. If you define options like this:

```
```javascript
{ "foolhardyelephants" : Boolean
, "pileofmonkeys" : Boolean }
```
```

Then this will work:

```
```bash
node program.js --foolhar --pil
node program.js --no-f --pileofmon
etc.
```
```

Shorthands

Shorthands are a hash of shorter option names to a snippet of args that they expand to.

If multiple one-character shorthands are all combined, and the combination does not unambiguously match any other option or shorthand, then they will be broken up into their constituent parts. For example:

```
```json
{ "s" : ["--loglevel", "silent"]
, "g" : "--global"
, "f" : "--force"
, "p" : "--parseable"
, "l" : "--long"
}
```
```

```
```bash
npm ls -sgflp
just like doing this:
npm ls --loglevel silent --global --force --long --parseable
```
```

The Rest of the args

The config object returned by nopt is given a special member called ``argv``, which is an object with the following fields:

- * ``remain``: The remaining args after all the parsing has occurred.
- * ``original``: The args as they originally appeared.

* ``cooked``: The args after flags and shorthands are expanded.

Slicing

Node programs are called with more or less the exact argv as it appears in C land, after the v8 and node-specific options have been plucked off. As such, ``argv[0]`` is always ``node`` and ``argv[1]`` is always the JavaScript program being run.

That's usually not very useful to you. So they're sliced off by default. If you want them, then you can pass in ``0`` as the last argument, or any other number that you'd like to slice off the start of the list.

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- topographic model from Elevation model 2 m (U4421B, U4421D, U4422A and U4422C) 08/2014

- map image extracted from Topographic map raster 1:50 000 (U442) 08/2014

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```

```
// clang-format off
```

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#####

BezierEasing - use bezier curve for transition easing function
by Gatan Renaudeau 2014 - 2015 MIT License

Credits: is based on Firefox's nsSMILKeySpline.cpp

Usage:

```
var spline = BezierEasing([ 0.25, 0.1, 0.25, 1.0 ])
```

spline.get(x) => returns the easing value | x must be in [0, 1] range

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reporting:

reports:

- lcov
- text
- text-summary

check:

global:

statements: 95
lines: 95
branches: 90
functions: 100

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raytrace.js contains code from the the Prototype JavaScript framework, version 1.5.0:

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```

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## Commands to generate dependency files
GEN_DEPS.c= $(CC) -E -MM $(DEFS) $(CPPFLAGS)
GEN_DEPS.cc= $(CXX) -E -MM $(DEFS) $(CPPFLAGS)

## Flags for position independent code
SHAREDLIBCFLAGS = -fPIC
SHAREDLIBCXXFLAGS = -fPIC
SHAREDLIBCPPFLAGS = -DPIC

## Additional flags when building libraries and with threads
THREADSCPPFLAGS = -D_REENTRANT
LIBCPPFLAGS =

## Compiler switch to embed a runtime search path
LD_RPATH=
LD_RPATH_PRE= -Wl,-rpath,

## Compiler switch to embed a library name
LD_SONAME = -Wl,-soname -Wl,$(notdir $(MIDDLE_SO_TARGET))

## Shared library options
LD_SOOPTIONS= -Wl,-Bsymbolic

## Shared object suffix
SO = so

## Non-shared intermediate object suffix
STATIC_O = ao

## Compilation rules
%. $(STATIC_O): $(srcdir)/%.c
$(COMPILE.c) $(STATICCPPFLAGS) $(STATICCFLAGS) -o $@ $<
%.o: $(srcdir)/%.c
$(COMPILE.c) $(DYNAMICCPPFLAGS) $(DYNAMICCFLAGS) -o $@ $<

%. $(STATIC_O): $(srcdir)/%.cpp
$(COMPILE.cc) $(STATICCPPFLAGS) $(STATICCXXFLAGS) -o $@ $<
%.o: $(srcdir)/%.cpp
$(COMPILE.cc) $(DYNAMICCPPFLAGS) $(DYNAMICCXXFLAGS) -o $@ $<

## Dependency rules

```



```

%.d: $(srcdir)/%.c
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.c) $< \
| sed "s/($*)\.o[ :]*/1.o $@ : /g"' > $@; \
[ -s $@ ] || rm -f $@

%.d: $(srcdir)/%.cpp
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.cc) $< \
| sed "s/($*)\.o[ :]*/1.o $@ : /g"' > $@; \
[ -s $@ ] || rm -f $@

## Versioned libraries rules

%.${SO}.${SO_TARGET_VERSION_MAJOR}: %.${SO}.${SO_TARGET_VERSION}
$(RM) $@ && ln -s ${<F} $@
%.${SO}: %.${SO}.${SO_TARGET_VERSION_MAJOR}
$(RM) $@ && ln -s ${*F}.${SO}.${SO_TARGET_VERSION} $@

## Bind internal references

# LDflags that pkgdata will use
BIR_LDFLAGS= -Wl,-Bsymbolic

# Dependencies [i.e. map files] for the final library
BIR_DEPS=

## Remove shared library 's'
STATIC_PREFIX_WHEN_USED =
STATIC_PREFIX =

## End BSD-specific setup
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Author: Nicolas Roussel (nicolas.roussel@inria.fr)

```

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```
#!/usr/bin/env node  
var nopt = require("../lib/nopt")  
, path = require("path")  
, types = { num: Number  
  , bool: Boolean  
  , help: Boolean  
  , list: Array  
  , "num-list": [Number, Array]  
  , "str-list": [String, Array]  
  , "bool-list": [Boolean, Array]  
  , str: String  
  , clear: Boolean  
  , config: Boolean  
  , length: Number
```



```

    , file: path
  }
  , shorthands = { s: [ "--str", "astring" ]
    , b: [ "--bool" ]
    , nb: [ "--no-bool" ]
    , tft: [ "--bool-list", "--no-bool-list", "--bool-list", "true" ]
    , "?": [ "--help" ]
    , h: [ "--help" ]
    , H: [ "--help" ]
    , n: [ "--num", "125" ]
    , c: [ "--config" ]
    , l: [ "--length" ]
    , f: [ "--file" ]
  }
  , parsed = nopt( types
    , shorthands
    , process.argv
    , 2 )

```

```

console.log("parsed", parsed)

```

```

if (parsed.help) {
  console.log("")
  console.log("nopt cli tester")
  console.log("")
  console.log("types")
  console.log(Object.keys(types).map(function M (t) {
    var type = types[t]
    if (Array.isArray(type)) {
      return [t, type.map(function (type) { return type.name })]
    }
    return [t, type && type.name]
  })).reduce(function (s, i) {
    s[i[0]] = i[1]
    return s
  }, {})
  console.log("")
  console.log("shorthands")
  console.log(shorthands)
}

```

The "Clarified Artistic License"

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C++ Big Integer Library  
(see ChangeLog for version)

<http://mattmccutchen.net/bigint/>

Written and maintained by Matt McCutchen <matt@mattmccutchen.net>

You can use this library in a C++ program to do arithmetic on integers of size limited only by your computer's memory. The library provides `BigUnsigned` and `BigInteger` classes that represent nonnegative integers and signed integers, respectively. Most of the C++ arithmetic operators are overloaded for these classes, so big-integer calculations are as easy as:

```
#include "BigIntegerLibrary.hh"
```

```
BigInteger a = 65536;  
cout << (a * a * a * a * a * a * a * a * a * a);
```

(prints 340282366920938463463374607431768211456)

The code in ``sample.cc'` demonstrates the most important features of the library. To get started quickly, read the code and explanations in that file and run it. If you want more detail or a feature not shown in ``sample.cc'`, consult the actual header and source files, which are thoroughly commented.

This library emphasizes ease of use and clarity of implementation over speed; some users will prefer GMP (<http://swox.com/gmp/>), which is faster. The code is intended to be reasonably portable across computers and modern C++ compilers; in particular, it uses whatever word size the computer provides (32-bit, 64-bit, or otherwise).

Compiling programs that use the library



-----  
The library consists of a folder full of C++ header files (`.hh`) and source files (`.cc`). Your own programs should `#include` the necessary header files and link with the source files. A makefile that builds the sample program (`.sample.cc`) is included; you can adapt it to replace the sample with your own program.

Alternatively, you can use your own build system or IDE. In that case, you must put the library header files where the compiler will find them and arrange to have your program linked with the library source files; otherwise, you will get errors about missing header files or "undefined references". To learn how to do this, consult the documentation for the build system or IDE; don't bother asking me. Adding all the library files to your project will work in many IDEs but may not be the most desirable approach.

#### Resources

-----  
The library's Web site (above) provides links to released versions, the current development version, and a mailing list for release announcements, questions, bug reports, and other discussion of the library. I would be delighted to hear from you if you like this library and/or find a good use for it.

#### Bugs and enhancements

-----  
The library has been tested by me and others but is by no means bug-free. If you find a bug, please report it, whether it comes in the form of compiling trouble, a mathematically inaccurate result, or a memory-management blooper (since I use Java, these are altogether too common in my C++). I generally fix all reported bugs. You are also welcome to request enhancements, but I am unlikely to do substantial amounts of work on enhancements at this point.

#### Legal

-----  
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~~~~~

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#

Don't put empty lines into this file!

#

.gitignore

#

builds/unix/pkg.m4

docs/FTL.TXT
docs/GPLv2.TXT

include/freetype/internal/fthash.h

src/base/fthash.c
src/base/md5.c
src/base/md5.h

src/bdf/bdf.c
src/bdf/bdf.h
src/bdf/bdfdrivr.c
src/bdf/bdfdrivr.h
src/bdf/bdferror.h
src/bdf/bdflib.c
src/bdf/module.mk
src/bdf/README
src/bdf/rules.mk

src/pcf/module.mk
src/pcf/pcf.c
src/pcf/pcf.h
src/pcf/pcfdrivr.c
src/pcf/pcfdrivr.h
src/pcf/pcferror.h
src/pcf/pcfread.c
src/pcf/pcfread.h
src/pcf/pcfutil.c
src/pcf/pcfutil.h
src/pcf/README
src/pcf/rules.mk

src/gzip/adler32.c
src/gzip/infblock.c
src/gzip/infblock.h
src/gzip/infcodes.c
src/gzip/infcodes.h
src/gzip/inffixed.h
src/gzip/inflate.c
src/gzip/inftrees.c
src/gzip/inftrees.h
src/gzip/infutil.c
src/gzip/infutil.h
src/gzip/zconf.h
src/gzip/zlib.h
src/gzip/zutil.c


```
src/gzip/zutil.h
#
src/tools/apinames.c
src/tools/ftrandom/ftrandom.c
#
# EOF
The MIT License (MIT)
```

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//
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By: Adrian Heine

Repository: <https://github.com/adrianheine/acorn-import-meta>

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acorn-walk

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By: Marijn Haverbeke, Ingvar Stepanyan, Adrian Heine

Repository: <https://github.com/acornjs/acorn.git>

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braces

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By: Jon Schlinkert, Brian Woodward, Elan Shanker, Eugene Sharygin, hemanth.hm

Repository: [micromatch/braces](https://github.com/micromatch/braces)

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minimalistic-assert

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minimalist

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By: James Halliday

Repository: <git://github.com/substack/minimist.git>

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By: Jon Schlinkert
Repository: micromatch/picomatch

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Repository: sindresorhus/pretty-bytes

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require-relative
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By: Valerio Proietti
Repository: [git://github.com/kamicane/require-relative.git](https://github.com/kamicane/require-relative.git)

rollup-pluginutils
License: MIT
By: Rich Harris
Repository: rollup/rollup-pluginutils

signal-exit
License: ISC
By: Ben Coe
Repository: <https://github.com/tapjs/signal-exit.git>

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License: MIT

By: Rich Harris

Repository: <https://github.com/Rich-Harris/sourcemap-codec>

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time-zone

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By: Sindre Sorhus

Repository: [sindresorhus/time-zone](https://github.com/sindresorhus/time-zone)

to-regex-range

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By: Jon Schlinkert, Rouven Weling

Repository: micromatch/to-regex-range

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By: Microsoft Corp.

Repository: <https://github.com/Microsoft/tslib.git>

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turbocolor

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By: Jorge Bucaran

Repository: jorgebucaran/turbocolor

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language: node_js

node_js:

- '0.12'
- '4'
- '6'
- '7'

before_install:

- npm install -g npm@latest

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validate-npm-package-license
=====
```

Give me a string and I'll tell you if it's a valid npm package license string.

```
```javascript
var valid = require('validate-npm-package-license');
```
```

SPDX license identifiers are valid license strings:

```
```javascript

var assert = require('assert');
var validSPDXExpression = {
 validForNewPackages: true,
 validForOldPackages: true,
 spdx: true
};

assert.deepEqual(valid('MIT'), validSPDXExpression);
assert.deepEqual(valid('BSD-2-Clause'), validSPDXExpression);
assert.deepEqual(valid('Apache-2.0'), validSPDXExpression);
assert.deepEqual(valid('ISC'), validSPDXExpression);
```
```

The function will return a warning and suggestion for nearly-correct license identifiers:

```
```javascript
assert.deepEqual(
 valid('Apache 2.0'),
 {
 validForOldPackages: false,
 validForNewPackages: false,
 warnings: [
 'license should be ' +

```



```

 'a valid SPDX license expression (without "LicenseRef"), ' +
 "'UNLICENSED', or ' +
 "'SEE LICENSE IN <filename>'",
 'license is similar to the valid expression "Apache-2.0"'
]
}
);
```

```

SPDX expressions are valid, too ...

```

```javascript
// Simple SPDX license expression for dual licensing
assert.deepEqual(
 valid('(GPL-3.0-only OR BSD-2-Clause)'),
 validSPDXExpression
);
```

```

... except if they contain `LicenseRef`:

```

```javascript
var warningAboutLicenseRef = {
 validForOldPackages: false,
 validForNewPackages: false,
 spdx: true,
 warnings: [
 'license should be ' +
 'a valid SPDX license expression (without "LicenseRef"), ' +
 "'UNLICENSED', or ' +
 "'SEE LICENSE IN <filename>'",
]
};

assert.deepEqual(
 valid('LicenseRef-Made-Up'),
 warningAboutLicenseRef
);

assert.deepEqual(
 valid('(MIT OR LicenseRef-Made-Up)'),
 warningAboutLicenseRef
);
```

```

If you can't describe your licensing terms with standardized SPDX identifiers, put the terms in a file in the package and point users there:


```

```javascript
assert.deepEqual(
 valid('SEE LICENSE IN LICENSE.txt'),
 {
 validForNewPackages: true,
 validForOldPackages: true,
 inFile: 'LICENSE.txt'
 }
);

assert.deepEqual(
 valid('SEE LICENSE IN license.md'),
 {
 validForNewPackages: true,
 validForOldPackages: true,
 inFile: 'license.md'
 }
);
```

```

If there aren't any licensing terms, use `UNLICENSED`:

```

```javascript
var unlicensed = {
 validForNewPackages: true,
 validForOldPackages: true,
 unlicensed: true
};
assert.deepEqual(valid('UNLICENSED'), unlicensed);
assert.deepEqual(valid('UNLICENSED'), unlicensed);
```

```

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Version 2.0 - August 6, 2003

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1.38 protobuf 3.7.1

1.39 libjpeg-turbo 2.0.6

1.39.1 Available under license :

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