DHCP and the DOCSIS Configuration File for Cable Modems (DOCSIS 1.0)

Document ID: 10961

Contents

Introduction

Cisco Cable Modem (CM) cards allow you to connect CMs on the Hybrid Fiber Coaxial (HFC) network to a Cisco uBR7200 series in a Cable Television (CATV) headend facility. The CM cards provide the interface between the Cisco uBR7200 series Peripheral Component Interconnect (PCI) bus and the Radio Frequency (RF) signal on the HFC network.

Before You Begin

Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

Prerequisites

Readers of this document should be knowledgeable of the following:

- Dynamic Host Configuration Protocol (DHCP) and Data−over−Cable Service Interface Specifications (DOCSIS) 1.0 protocols.

Components Used

The information in this document is based on the software and hardware versions below.

The components used to create this document are not specific to any particular platform but limited to Cisco DOCSIS compliant CMs and qualified CM Termination System (CMTS).

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

Background Information

Cisco CM cards are compliant with the industry standard DOCSIS.

The following language conventions are used in the items specified in this document:

- MUST: this item is an absolute requirement of the specification.
- MAY: this item is truly optional and may be followed or ignored according to the needs of the implementor.

Configuration data for a specific CM MUST be contained in a file that is downloaded to the CM using Trivial File Transfer Protocol (TFTP), a simplified version of FTP. The configuration file is in the format defined for DHCP vendor extension data, and MUST consist of a number of configuration settings. All CMs, regardless of vendor, require configuration files. There are both standard fields and vendor specific fields within the file. The file format and the standard fields are defined in the DOCSIS specification.

The configuration file in its final form is a binary file, and typically a configuration tool is used to create the file. There are many publicly available tools to assist in the creation of DOCSIS CM configuration files. Please see Cisco's Standalone DOCSIS configuration file editor.

IP Initialization Through DHCP

After a CM completes the ranging adjustment, it establishes IP connectivity through use of a DHCP. A DHCP server provides the IP information necessary for the modem to establish IP connectivity, including its IP address, the IP addresses of the TFTP server for download of the CM configuration file, and other parameters as described below.

DHCP Fields Used by the CM

The following fields MUST be present in the DHCP request from the CM and MUST be set as described below:

- The hardware type (`htype`) MUST be set to 1 (Ethernet).
- The hardware length (`hlen`) MUST be set to 6.
- The client hardware address (`chaddr`) MUST be set to the 48 bit Media Access Control (MAC) address associated with the RF interface of the CM.
- The "client identifier" option MUST be included, with the hardware type set to 1, and the value set to the same 48 bit MAC address as the `chaddr` field.
- The "parameter request list" option MUST be included. The option codes that MUST be included in the list are:
    - Option code 1 (Subnet Mask).
    - Option code 2 (Time Offset).
    - Option code 3 (Router Option).
    - Option code 4 (Time Server Option).
    - Option code 7 (Log Server Option).
- For DOCSIS 1.0 cable modems, the Vendor Class Identifier (Option 60) MAY be set to include the string "docsis 1.0". For modems running higher versions of DOCSIS a string indicating the capabilities of the Cable Modem MUST be included in the Vendor Class Identifier (Option 60) (For example "docsis1.1:xxxxxx" where xxxxxx is an ASCII representation of the modem capabilities.

The following fields are expected in the DHCP response returned to the CM. The CM MUST configure itself based on the DHCP response.

- The IP address to be used by the CM (`yiaddr`).
- The IP address of the TFTP server for use in the next phase of the bootstrap process (`siaddr`).
- If the DHCP server is on a different network (requiring a relay agent), then the IP address of the relay agent (`giaddr`).

  Note: This MAY differ from the IP address of the first hop router.
- The name of the CM configuration file to be read from the TFTP server by the CM (`file`).
- The subnet mask to be used by the CM (Subnet Mask, option 1).
- The time offset of the CM from Universal Coordinated Time (UTC) (Time Offset, option 2). This is used by the CM to calculate the local time for use in time−stamping error logs.
- A list of addresses of one or more routers to be used for forwarding CM−originated IP traffic (Router Option, option 3). The CM is not required to use more than one router IP address for forwarding.
- A list of [RFC−868] time−servers from which the current time MAY be obtained (Time Server Option, option 4).
- A list of SYSLOG servers to which logging information MAY be sent (Log Server Option, option 7); please see the CableLabs DOCSIS Specifications .

Configuration File Settings

The following configuration settings MUST be included in the configuration file and MUST be supported by all CMs.

- Network Access Configuration Setting.
- Class of Service Configuration Setting.
- End Configuration Setting.

In order for CPE devices connected to the CM to be granted network connectivity, the Network Access value must be set to 1. Also, the CM needs a profile for Class of Service depending on the service level agreement with the customer.

Cisco supplies sample DOCSIS 1.0 configuration files in the "Downloadable DOCSIS configuration Files" section of the document Building DOCSIS 1.0 Configuration Files Using Cisco DOCSIS Configurator.

Lastly, the configuration file MUST have an "End of File" marker. This in done by a data maker, the values MUST be `ff`..

The following configuration settings MAY be included in the configuration file and if present MUST be supported by all CMs.

- Downstream Frequency Configuration Setting
- Upstream Channel ID Configuration Setting

  One important note to make is that on the CM configuration file the value is entered from 1−6 and the Cisco uBR72xx router sends a UCD from 0−5. If a value of zero is used for the Upstream Channel ID configuration setting, this typically indicates to a dual modem telephone company (telco)−return/two−way CM that it should use the telco−return mode of operation.
- Baseline Privacy Configuration Setting. In order for this to work, there are four conditions:

  1. The CM MUST have a software image that supports baseline privacy.
  2. The CMTS MUST have software image that supports baseline privacy.
  3. The Baseline Privacy field MUST be enabled with a 1.
  4. If the CMTS is DOCSIS 1.1 enabled then at least one of the Baseline Privacy configurations settings must be configured. This means that one of Authorize Wait Timeout, Reauthorize

Wait Timeout, Authorization Grace Time, Operational Wait Timeout, Rekey Wait Timeout, TEK Grace Time or Authorize Reject Wait Timeout must be set.

- Software Upgrade Filename Configuration Setting.
- Simple Network Management Protocol (SNMP) Write−Access Control.
- SNMP MIB Object.
- Software Server IP Address.
- Customer premises equipment (CPE) Ethernet MAC Address.
- Maximum Number of Hosts on the ethernet port of the CM (CPEs) in the range 1 through to 255. If a value is not set, the default is set to 1.
- Pad Configuration Setting.

The Telephone Settings Option configuration MAY be included in the configuration file and if present, and applicable to this type of modem, MUST be supported.

The Vendor−Specific Configuration Settings MAY be included in the configuration file, and if present, MAY be supported by a CM.

Depending on the RF design and the services provided by the Multiple Service Operator (MSO), additional fields are used in the CM configuration file.

If you have further questions or want to get full details on this document, refer to CableLabs .

Related Information

- **CableLabs**
- **CableLabs DOCSIS Specifications**
- **Cable Product Support Page**
- **Troubleshooting uBR Cable Modems Not Coming Online**
- **Technical Support − Cisco Systems**

Updated: Nov 15, 2007 Document ID: 10961