Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source

The Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source features introduce a new compression technique in DSP firmware and add enhancements to Cisco IOS that include cell switching on ATM segmentation and reassembly (SAR), and the use of an external BITS clocking source. These features enable Cisco multiservice routers to be used to transparently groom and compress traffic in a wireless service provider network and enable a service provider to optimize the bandwidth used to backhaul the traffic from a cell site to the mobile central office for more efficient use of existing T1 and E1 lines.

Feature Specifications for Cisco Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source

Feature History	
Release	**Modification**
12.3(4)XD	These features were introduced.
12.3(7)T	These features were integrated into Cisco IOS Release 12.3(7)T.
Supported Platforms	
Cisco 3660, Cisco 3745	

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Contents

This feature module includes the following sections:

Prerequisites for Cisco Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source

The Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source features require a Cisco 3660 or Cisco 3745 with the following components installed:

Table 8 Supported Network Modules

Feature	Cisco 3660	Cisco 3745
Lossless compression R1	NM-HDV	NM-HDV
ATM cell switching	AIM-ATM or AIM-ATM-VOICE-30 NM-*x*FE2W with VWIC-*x*MFT-T1/E1	AIM-ATM or AIM-ATM-VOICE-30 NM-*x*FE2W with VWIC-*x*MFT-T1/E1 VWIC-*x*MFT-T1/E1 (on-board WIC slot)
BITS clocking	NM-HDV NM-*x*FE2W with VWIC-*x*MFT-T1/E1	NM-HDV NM-*x*FE2W with VWIC-*x*MFT-T1/E1 VWIC-*x*MFT-T1/E1 (on-board WIC slot)

Restrictions for Cisco Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source

- Operations, administration, and maintenance (OAM) cell insertion is not supported on cell-switched PVCs.
- AIM-ATM and AIM-ATM-VOICE-30 modules support a maximum of four T1/E1s. This can consist of two incoming and two outgoing, or three incoming and one outgoing T1/E1s. An IMA group cannot be split between multiple AIMs.
- Certain combinations of AIM modules can become inoperable when installed in a Cisco 3745. This problem only affects Cisco 3745 routers manufactured before June 11, 2003. See the following field notice for detailed information about this problem:

  http://www-tac.cisco.com/Support_Library/field_alerts/fn25194.html
- Voice activity detection (VAD) and echo cancellation are disabled when lossless compression is enabled.
- Lossless compression R1 is supported for VoATM calls with AAL2 and subcell multiplexing. VoIP calls are not supported at this time.

- ATM cell switching is limited to a maximum of 25 connections per AIM-ATM.
- Do not configure more than 29 LLCC channels per NM-HDV module. Configuring more than 29 LLCC channels can cause unreliable operation.
- J1 controller is not supported.
- Traffic policing is not supported.
- For Cisco 3660 routers with two NM-HDV modules installed, do not install the modules in the following slot combinations:
  - Slot 1 and Slot 3
  - Slot 2 and Slot 4
  - Slot 5 and Slot 6

  Using these slot combinations can result in packet loss.

Information About Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source

The Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source features work together to groom and compress T1 and E1 traffic between cell sites and a mobile central office. These features require a Cisco 3660 or Cisco 3745 router to be installed at the base transceiver station (BTS). This cell site router performs ATM switching and compression of cell site traffic for transport to the base station controller (BSC). A Cisco MGX 8850 with AUSM and VISM-PR terminates the T1/E1 lines that carry lossless compression codec (LLCC) traffic, converting the traffic back to PCM before passing it to the BSC. Figure 9 shows a sample topology that makes use of the Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source features.

Figure 9 Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source Features

Lossless Compression Codec on NM-HDV

The Lossless Compression R1 feature introduces a new compression technique in DSP firmware and the VISM card— the lossless compression codec (LLCC). LLCC operates in a similar fashion to the existing clear channel codec: the decoded 64kbps PCM stream is a bit-exact replica of the PCM stream provided on the TDM side of the encoding DSP. However, rather than simply packetizing the PCM stream, the LLCC encoder applies a lossless data compression scheme. This results in a net reduction in the data transmission rate, yielding a reduction in the packet transmission rate.

ATM Cell Switching on AIM-ATM and AIM-ATM-VOICE-30

The Cisco ATM Cell Switching feature enables the router to perform cell switching between two ATM connections on AIM-ATM and AIM-ATM-VOICE-30 cards, giving the router the ability to receive ATM traffic from the BTS and backhaul it to the mobile central office.

BITS Clocking on the Cisco 3660 and Cisco 3745

BITS (Building Integrated Timing Supply) network clocking enables a Cisco 3660 or Cisco 3745 router to derive network timing from the central office. BITS must be configured on the cell site router to support this feature.

How to Configure Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source

The procedures for configuring the Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source features require the following tasks:

- Configuring the Cell Site Router for BITS Clocking, page 179
- Configuring ATM Cell Switching, page 180
- Configuring the Lossless Compression Codec, page 182
- Disabling Connection Admission Control, page 185

The instructions that follow refer to the sample configuration shown in Figure 10. With this configuration, the cell site router supports three E1 connections to the BTS. Compressed cellular traffic is transported to the BSC (by way of the Cisco MGX 8850) over the E1 1/0 and E1 1/1 interfaces. Additionally, BITS clocking is derived from E1 1/1.

Figure 10 Sample Configuration

Configuring the Cell Site Router for BITS Clocking

BITS clocking enables the router at a cell site to derive timing from the mobile central office. BITS clocking ensures that data flows to a single network clock source, preventing mismatches and data slips in traffic between the BTS and the BSC. The procedure that follows configures the AIM to receive BITS clocking from E1 1/1 controller.

Summary Steps

1. **enable**
2. **configure terminal**
3. **network-clock-participate** *slot number*
4. **network-clock-select** *priority slot number*
5. **controller e1** *slot/port*
6. **clock source {line [primary | bits] | internal}**

Detailed Steps

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password when prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**network-clock-participate slot** *number* **Example:** `Router(config)# network-clock-participate slot 1`	Allows the network module in the specified slot to use the network clock for its timing.
Step 4	**network-clock-select** *priority slot number* **Example:** `Router(config)# network-clock-select 1 E1 1/1`	Specifies a port to be used as a timing source for the network clock, and the priority level for the use of that port. The source that is given the highest priority is used first; if it becomes unavailable, the source with the second-highest priority is used, and so forth.
Step 5	**controller t1 | e1** *slot/port* **Example:** `Router(config)# controller e1 1/1`	Enters controller configuration mode for the selected T1 or E1.
Step 6	**clock source {line [primary | bits] | internal}** **Example:** `Router(config-controller)# clock source line bits`	Specifies that the clock is generated from the T1 or E1 BITS source.

Configuring ATM Cell Switching

The procedure that follows configures the cell site router to switch ATM traffic with the Cisco MGX 8850 at the BSC. This procedure configures ATM switching between E1 3/0 and E1 1/0, using the AIM installed in Slot 1.

Summary Steps

1. **enable**
2. **configure terminal**
3. **network-clock-participate slot** *number*
4. **network-clock-participate slot** *number*
5. **network-clock-participate aim** *number*
6. **controller t1 | e1** *slot/port*
7. **mode atm aim** *aim-slot*
8. **controller t1 | e1** *slot/port*
9. **mode atm aim** *aim-slot*
10. **interface atm** *interface-number/subinterface-number*
11. **pvc** *vpi/vci* **l2transport**
12. **interface atm** *interface-number/subinterface-number*
13. **pvc** *vpi/vci* **l2transport**
14. **connect** *id* **atm** *slot/port-1* **atm** *slot/port-2*

Detailed Steps

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password when prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**network-clock-participate slot** *number* **Example:** `Router(config)# network-clock-participate slot 1`	Enables the network module in the specified slot to use the network clock for its timing.
Step 4	**network-clock-participate slot** *number* **Example:** `Router(config)# network-clock-participate slot 3`	Enables the network module in the specified slot to use the network clock for its timing.

	Command or Action	Purpose
Step 5	**network-clock-participate aim** *number* **Example:** `Router(config)# network-clock-participate aim 0`	Specifies that the AIM in Slot 0 will derive clocking from the network source.
Step 6	**controller t1 | e1** *slot/port* **Example:** `Router(config)# controller e1 1/0`	Enters controller configuration mode for the selected T1 or E1.
Step 7	**mode atm aim** *aim-slot* **Example::** `Router(config-controller)# mode atm aim 0`	Sets the mode of the T1 or E1 controller in AIM Slot 0.
Step 8	**controller t1 | e1** *slot/port* **Example:** `Router(config)# controller e1 3/0`	Enters controller configuration mode for the selected T1 or E1.
Step 9	**mode atm aim** *aim-slot* **Example:** `Router(config-controller)# mode atm aim 0`	Sets the mode of the T1 or E1 controller in AIM Slot 0.
Step 10	**interface atm** *interface-number/subinterface-number* **Example:** `Router(config) # interface atm 1/0`	Enters configuration mode for the selected ATM interface.
Step 11	**pvc** *vpi/vci* **l2transport** **Example:** `Router(config-if)# pvc 10/110 l2transport`	Creates a PVC for the virtual path identifier (VPI) and virtual channel identifier (VCI) and specifies that the PVC is switched, not terminated.
Step 12	**interface atm** *interface-number/subinterface-number* **Example:** `Router (config) # interface atm 3/0`	Enters configuration mode for the selected ATM interface.
Step 13	**pvc** *vpi/vci* **l2transport** **Example:** `Router(config-if)# pvc 30/130 l2transport`	Creates a PVC for the VPI and VCI and specifies that the PVC is switched.
Step 14	**connect** *id* **atm** *slot/port-1* **atm** *slot/port-2* `Router(config)# connect Switched-Conn atm 1/0 10/110 atm 3/0 30/130`	Defines connections between T1 or E1 controller ports and the ATM interface.

Configuring the Lossless Compression Codec

The procedure that follows configures an LLCC voice channel on E1 4/0 and sends it over the ATM network using E1 1/0 and the AIM installed in Slot 1.

Summary Steps

1. **enable**
2. **configure terminal**
3. **network-clock-participate slot** *number*
4. **network-clock-participate slot** *number*
5. **network-clock-participate aim** *number*
6. **voice service {pots | voatm | vofr | voip}**
7. **session protocol aal2**
8. **subcell-mux**
9. **codec aal2-profile custom** *profile-number* **codec**
10. **controller t1 | e1** *slot/port*
11. **mode atm aim** *aim-slot*
12. **controller t1 | e1** *slot/port*
13. **ds0-group** *ds0-group-number* **timeslots** *timeslot-list* **type** *signaling method*
14. **interface atm** *interface-number/subinterface-number*
15. **pvc** *vpi/vci*
16. **vbr-rt** *peak-rate average-rate burst*
17. **encapsulation aal2**
18. **dial-peer voice** *tag* **voatm**
19. **destination-pattern** *string*
20. **session protocol aal2-trunk**
21. **session target** *interface* **pvc** *vpi/vci*
22. **signal-type cas | cept | ext-signal | transparent**
23. **codec aal2-profile custom** *profile-number* **codec**
24. **voice-port** {*slot-number/subunit-number/port* | *slot/port*:*ds0-group-no*}
25. **playout-delay {fax | maximum | nominal}** *milliseconds*
26. **connection {plar | tie-line | plar-opx}** *digits* | **{trunk** *digits* **[answer-mode]}**

Detailed Steps

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password when prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**network-clock-participate slot** *number* **Example:** `Router(config)# network-clock-participate slot 1`	Enables the network module in the specified slot to use the network clock for its timing.
Step 4	**network-clock-participate slot** *number* **Example:** `Router(config)# network-clock-participate slot 4`	Enables the network module in the specified slot to use the network clock for its timing.
Step 5	**network-clock-participate aim** *number* **Example:** `Router(config)# network-clock-participate aim 0`	Specifies that the AIM in Slot 0 will derive clocking from the network source.
Step 6	**voice service {pots | voatm | vofr | voip}** **Example:** `Router(config)# voice service voatm`	Enters voice service configuration mode and specifies VoATM as the encapsulation type.
Step 7	**session protocol aal2** **Example:** `Router(config-voi-serv)# session protocol aal2`	Enters voice-service-session configuration mode and specifies ATM adaptation layer 2 (AAL2) trunking.
Step 8	**subcell-mux** **Example:** `Router(conf-voi-serv-sess)# subcell-mux`	Enables AAL2 common part sublayer (CPS) subcell multiplexing.
Step 9	**codec aal2-profile custom** *profile-number* **codec** **Example:** `Router# codec aal2-profile custom 51 0 0 llcc 40 0 15`	Sets the codec profile for the DSP on a per-call basis and specifies the lossless compression codec.
Step 10	**controller t1 | e1** *slot/port* **Example:** `Router(config)# controller e1 1/0`	Enters controller configuration mode for the selected T1 or E1.

	Command or Action	Purpose
Step 11	**mode atm aim** *aim-slot* **Example:** `Router(config-controller)# mode atm aim 0`	Sets the mode of the T1 or E1 controller in AIM Slot 0.
Step 12	**controller t1 | e1** *slot/port* **Example:** `Router(config)# controller e1 4/0`	Enters controller configuration mode for the selected T1 or E1.
Step 13	**ds0-group** *ds0-group-number* **timeslots** *timeslot-list* **type** *signaling method* **Example:** `Router(config-controller)# ds0-group 0 timeslots 1 type ext-sig`	Specifies the DS0 time slots that make up a logical voice port on a T1 or E1 controller and specifies the signaling type used by the router.
Step 14	**interface atm** *interface-number/subinterface-number* **Example:** `Router(config) # interface atm 1/0`	Enters configuration mode for the selected ATM interface.
Step 15	**pvc** *vpi/vci* **Example:** `Router(config-if-atm)# pvc 10/110`	Enters configuration mode for the selected PVC.
Step 16	**vbr-rt** *peak-rate average-rate burst* **Example:** `Router(config-if-atm-pvc)# vbr-rt 1920 1920 255`	Configures real-time variable bit rate (VBR) for VoATM voice connections.
Step 17	**encapsulation aal2** **Example:** `Router(config-if-atm-pvc)# encapsulation aal2`	Configures the encapsulation type for the ATM virtual circuit.
Step 18	**dial-peer voice** *tag* **voatm** **Example:** `Router(config)# dial-peer voice 1001 voatm`	Defines a dial-peer and specifies the method of voice encapsulation as VoATM.
Step 19	**destination-pattern** *string* **Example:** `Router(config-dial-peer)# destination-pattern 1001`	Specifies the prefix to be used by the dial peer.
Step 20	**session protocol aal2-trunk** **Example:** `Router(config-dial-peer)# session protocol aal2-trunk`	Specifies the dial peer uses AAL2 nonswitched trunk session protocol.

	Command or Action	Purpose
Step 21	**session target** *interface* **pvc** *vpi/vci* **Example:** `Router(config-dial-peer)# session target atm 1/0 pvc 10/100 9`	Specifies the network-specific address for the VoATM dial peer.
Step 22	**signal-type cas | cept | ext-signal | transparent** **Example:** `Router(config-dial-peer)# signal-type ext-signal`	Specifies that external signaling is used when connecting to the dial peer. The DSP does not generate any signaling frames.
Step 23	**codec aal2-profile custom** *profile-number* **codec** **Example:** `Router(config-dial-peer)# codec aal2-profile custom 51 llcc`	Sets the codec profile for the DSP on a per-call basis and specifies the lossless compression codec.
Step 24	**voice-port** {*slot-number*/*subunit-number*/*port* | *slot*/*port*:*ds0-group-no*} **Example:** `Router(config)# voice-port 2/0:0`	Enters voice-port configuration mode.
Step 25	**playout-delay {fax | maximum | nominal}** *milliseconds* **Example:** `Router(config-voice-port)# playout-delay nominal 25`	Tunes the playout buffer to accommodate packet jitter caused by switches in the WAN. The **nominal** keyword specifies the initial (and minimum allowed) delay time that the DSP inserts before playing out voice packets, in milliseconds.
Step 26	**connection {plar | tie-line | plar-opx}** *digits* | **{trunk** *digits* **[answer-mode]}** **Example:** `Router(config-voice-port)# connection trunk 1001`	Associates this voice-port to destination-pattern 1001.

Note To ensure that the voice-port configuration takes affect, issue the **shutdown** command, followed by **no shutdown** to enable it again.

Disabling Connection Admission Control

Connection admission control (CAC) is a set of actions taken by each ATM switch during connection setup to determine whether the requested QoS will violate the QoS guarantees for established connections. CAC reserves bandwidth for voice calls, however, the bandwidth required when LLCC is used is dynamic and usually less than what is generally reserved by CAC. Disabling CAC may help in better utilization of bandwidth when LLCC is used. The procedure that follows disables CAC.

Summary Steps

1. **enable**
2. **configure terminal**
3. **interface atm** *interface-number/subinterface-number*
4. **pvc** *vpi/vci*
5. **cac_off**

Detailed Steps

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password when prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface atm** *interface-number/subinterface-number* **Example:** `Router(config) # interface atm 1/0`	Enters configuration mode for the selected ATM interface.
Step 4	**pvc** *vpi/vci* **Example:** `Router(config-if-atm)# pvc 10/110`	Enters configuration mode for the selected PVC.
Step 5	**cac_off** **Example:** `Router# (config-if-atm-vc)# cac_off`	Disables call admission control.

Verifying Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source Configuration

This section provides a set of **show** commands you can use to verify the configuration of the Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source features. It includes the following commands:

- show connection all
- show voice dsp
- show voice call port-id
- show voice trunk supervisory summary
- show interfaces

show connection all

The following example shows output from the **show connection all** command. In this example, Switched-Conn is a cell-switched connection established between PVC 10/110 and PVC 30/130, which are configured under ATM1/0 and ATM3/0 respectively.

```
Router# show connection all
ID    Name             Segment 1             Segment 2           State
=============================================================================
3     V-100-700        E1 1/0(VOICE) 00      DSP 07/00/00        UP
4     V-120-700        E1 1/2(VOICE) 00      DSP 07/00/00        UP
5     Switched-Conn    ATM1/0 10/110         ATM3/0 30/130       UP
```

The **show connection all** command displays the state of Switched-Conn. If it is in the UP state, then it means the ATM cell switching connection is operational.

show voice dsp

The following example shows output from the **show voice dsp** command:

```
Router# show voice dsp
DSP  DSP             DSPWARE CURR  BOOT                          PAK  TX/RX
TYPE NUM CH CODEC    VERSION STATE STATE   RST AI VOICEPORT TS ABORT PACK COUNT
==== === == ======== ======= ===== ======= === == ========= == ===== ==========
C549 000 04 llcc     4.3.392 busy  idle          0 4/0:0     04     0 1752/1752
```

The **show voice dsp** command shows if the LLCC codec has been applied to the voice port. Additionally, the TX/RX COUNT indicates if packet exchange is occurring. If LLCC is operational, then TX/RX COUNT will display similar values.

show voice call *port-id*

The **show voice call** command gives detailed information about the lossless compression codec. The following example shows output from the **show voice call** command:

Note The **show voice call** command has a limitation that causes it to display invalid values. To ensure that accurate values are reported, invoke this command twice and look at the second output.

```
Router# show voice call 4/0:0
4/0:0 1
      vtsp level 0 state = S_CONNECTvpm level 1 state = S_TRUNKED
vpm level 0 state = S_UP

lossless compression summary:
    average compression ratio since reset       = 50
    current compression ratio                   = 50
    max buffer size (ms)                        = 41
    nominal buffer size (ms)                    = 25
    current buffer size (ms)                    = 26
    total encoder input frame count             = 5534
    total encoder output frame count            = 2767
    encoded tx front-end compressed frame count = 2767
    encoded tx back-end compressed frame count  = 0
    encoded tx frame count (no compression)     = 0
    underflow error count                       = 0
    overflow error count                        = 0
    decode error count                          = 0
    tx signalling frame count                   = 11
    rx signalling frame count                   = 10
    rx bad checksum frame count                 = 0
    rx good checksum frame count                = 2777
```

show voice trunk supervisory summary

The following example shows output from the **show voice trunk supervisory summary** command:

```
Router# show voice trunk supervisory summary
SLOW SCAN
4/0:0(1) : state : TRUNK_SC_CCS_CONNECT, master
```

show interfaces

The following example shows output from the **show interfaces** command:

```
Router# show interfaces atm1/0
ATM1/0 is up, line protocol is up
  Hardware is ATM AIM E1
  MTU 4470 bytes, sub MTU 4470, BW 1920 Kbit, DLY 20000 usec,
     reliability 0/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Encapsulation(s): AAL5
  255 maximum active VCs, 256 VCs per VP, 0 current VCCs
  VC Auto Creation Disabled.
  VC idle disconnect time: 300 seconds
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: Per VC Queueing
  30 second input rate 0 bits/sec, 0 packets/sec
  30 second output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Additional References

For additional information related to the Cisco Lossless Compression R1, ATM Cell Switching, and External BITS Clocking Source feature, refer to the following references:

Related Documents

Related Topic	Document Title
Configuring voice features	Cisco IOS Voice Configuration Library, Release 12.3
Configuring ATM advanced integration modules	AIM-ATM and AIM-ATM-VOICE-30 on the Cisco 2600 Series, Cisco 3660, and Cisco 3700 Series
Configuring high-density voice network modules	Digital E1 Packet Voice Trunk Network Module Interfaces

Standards

Standards[1]	Title
No new standards are supported by this feature.	

1. Not all supported standards are listed.

MIBs

MIBs	MIBs Link
• No new MIBs are supported by this feature. • CISCO-VOICE-COMMON-DIAL-CONTROL-MIB was modified.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs[1]	Title
No new RFCs are supported by this feature.	

1. Not all supported RFCs are listed.

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

Command Reference

The following new and modified commands are pertinent to this feature. To see the command pages for these commands and other commands used with this feature, go to the *Cisco IOS Master Commands List*, Release 12.4, at http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124mindx/124index.htm.

- **cac_off**
- **clock source (T1/E1 controller)**
- **codec aal2-profile**
- **connect (atm)**