Configuring Cisco G.SHDSL HWICs in Cisco Access Routers

This document describes how to configure Cisco G.SHDSL high-speed WAN interface cards (HWICs). Cisco G.SHDSL HWICs connect Cisco access routers with central office digital subscriber line access multiplexer (DSLAMs) and provide as many as four lines of G.SHDSL (ITU-T 991.2) connectivity.

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

CISCO SYSTEMS

Prerequisites for Cisco G.SHDSL HWICs

- Ensure that you have the appropriate Cisco access router to serve as the host router.
  The following Cisco access routers support Cisco G.SHDSL HWICs.

  - Cisco 1841

  - Cisco 2800 series

  - Cisco 3800 series

- Use the **show version** command to ensure that the router is running Cisco IOS Release12.4(11) XJ or a later release.

> ✎
> **Note**   When minimum release requirements are met, you can change images on the router without affecting performance.

- Install the Cisco G.SHDSL HWIC on the router, using the directions provided in the *Cisco Interface Cards Hardware Installation Guide* and *Cisco Network Modules and Interface Cards Regulatory Compliance and Safety Information*.

Information About Cisco G.SHDSL HWICs

Cisco G.SHDSL HWICs support up to four pairs of digital subscriber lines (DSL): two inverse multiplexing over ATM (IMA) lines, and two ATM segmentation and reassembly (SAR) lines. The four DSL pairs are bundled in groups and configured in the Cisco IOS command-line interface (CLI) by using the **dsl-group** command.

G.SHDSL HWICs support the following DSL groups:

- Inverse Multiplexing over ATM *(IMA)* groups—1- 4 DSL pairs

- Multi-Pair Operation (M-Pair) groups—2 or more DSL pairs

- 2-Pair groups—2 DSL pairs

- 1-Pair groups—1 DSL pair

See the "Command Reference" section on page 22 for more information about commands used with Cisco G.SHDSL HWICs.

Cisco G.SHDSL HWICs

Cisco G.SHDSL HWICs are available in two variations:

- The Cisco HWIC-2SHDSL (Figure 1) provides two lines of connectivity through one *RJ-11* connector. It supports *1-Pair* groups or *2-Pair* groups.

Figure 1   *Cisco HWIC-2SHDSL Faceplate*
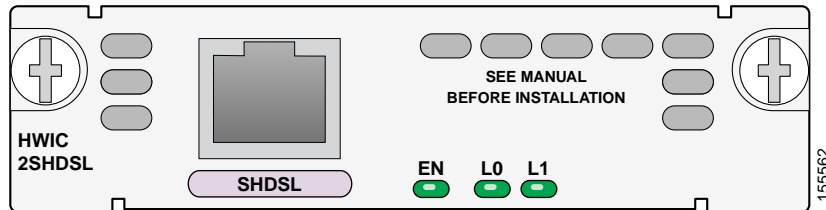
- The Cisco HWIC-4SHDSL (Figure 2) provides four lines of connectivity through one *RJ-45* connector. It combines four lines of data into one line or two lines with either inverse multiplexing over ATM (*IMA*) groups or *M-pair* groups, and it supports *1-Pair* groups or *2-Pair* groups.

Figure 2   *Cisco HWIC-4SHDSL Faceplate*
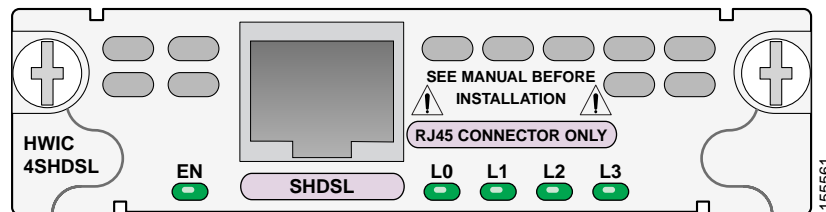
Note   The Cisco HWIC-2SHDSL provides support for the Dying Gasp feature; however, the Cisco HWIC-4SHDSL does not provide support for this feature. The term *dying gasp* refers to power status as defined in ITU-T standard G.991.2, section 7.1.2.5.3.

EN	Status of the system:
	Green—Operating system is running.
	Amber—Interface card is resetting.
	Blinking—System is initializing.
L0, L1, L2, L3	Status of link:
	On—Link is active.
	Off—Link is inactive (disabled).
	Blinking— Link is training / Link alarm

What to do next

See the"Connecting Cisco G.SHDSL HWICs to the Network" section on page 4 for cable information.

Connecting Cisco G.SHDSL HWICs to the Network

Connect Cisco G.SHDSL HWICs as described next:

- Cisco HWIC-2SHDSL—Use a standard *RJ-11* straight-through cable to establish connection between the HWIC and a network device.

- Cisco HWIC-4SHDSL—Use a standard *RJ-45* straight-through cable to establish connection between the HWIC and a network device.

Figure 3 shows the *RJ-45* pin assignment. Table 1 identifies the *RJ-45* signal assignment by pin.

⚠ Caution   Inserting an *RJ-11* connector into the Cisco HWIC-4SHDSL port may deform pins 1 and 8, which may prevent solid contact between the connector and the plug in subsequent connections. If solid contact is prevented, line -1 tip and line -3 ring will not work properly.

Figure 3   RJ-45 Pin Assignment
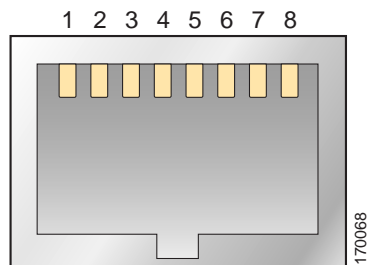

Table 1   RJ-45 Signal Assignment by Pin

Pin	Signal
1	Line 1 tip
2	Line 1 ring
3	Line 2 tip
4	Line 0 tip
5	Line 0 ring
6	Line 2 ring
7	Line 3 tip
8	Line 3 ring

To connect the Cisco HWIC-4SHDSLwith a DSLAM that supports two or four *RJ-11* connections, modify the standard *RJ-45* cable, using one of the following diagrams as applicable:

- Figure 4 shows how to modify the cable and connect the Cisco HWIC-4SHDSL with a DSLAM that supports four *RJ-11* cable connections.

- Figure 5 shows how to modify the cable and connect the Cisco HWIC-4SHDSL with a DSLAM that supports two *RJ-11* cable connections.

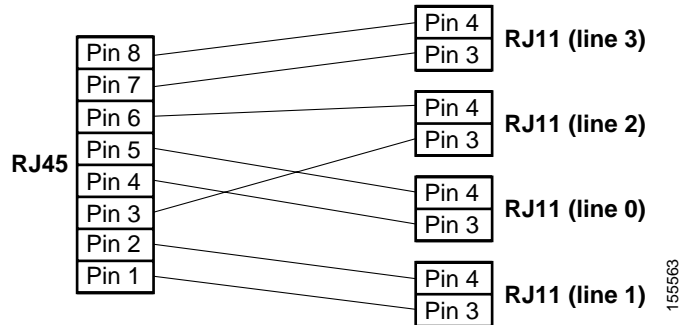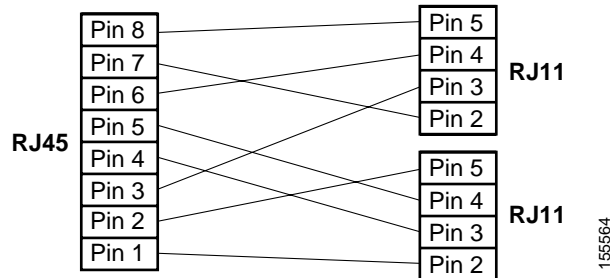*Figure 4*   *Standard RJ-45 Connector to Four Standard RJ-11 Connectors*

Figure 5   *Standard RJ-45 Connector to Two Standard RJ-11 Connectors*

What to Do Next

See the "Configuring Cisco G.SHDSL HWICs" section on page 6 for information about configuring DSL groups.

Configuring Cisco G.SHDSL HWICs

Configure DSL groups on the Cisco G.SHDSL HWIC, using the Cisco IOS CLI on the router in privileged configuration mode.

- Configuring IMA Groups, page 6
- Configuring M-Pair Groups, page 8
- Configuring 1-Pair Groups and 2-Pair Groups, page 9

Configuring IMA Groups

Use the Cisco IOS CLI on the router in global configuration mode to configure an *IMA* group on the Cisco HWIC-4SHDSL.

SUMMARY STEPS

1. `controller shdsl`
2. `dsl-group`
3. `ima link add`
4. `ima group minimum-links`
5. `ima group clock-mode`
6. `shdsl annex`
7. `shdsl rate`
8. `exit`
9. `exit`

DETAILED STEPS

	Command	Purpose

Step 1	`controller shdsl` *slot number/subslot number/0*
	
	Example:
	`Router (config)# controller shdsl 0/2/0`
	`Router (config-controller)#`
		Selects the controller and enters config-controller mode.
		
		See the "controller shdsl" section on page 23 for more information.

Step 2	`dsl-group` *number* `pairs` *link number* [`ima` | `m-pair`] **Example:** `Router (config-controller)# dsl-group 0 pairs 0-3 ima`	Creates a DSL group and enters config-controller-dsl-group mode. See the "dsl-group" section on page 25 for more information.
Step 3	`ima link {add | delete | shutdown}`*number* **Example:** `Router (config-controller-dsl-group)# ima link add 2`	Modifies links in an IMA group. See the "ima link" section on page 33 for more information.

Step 4	`ima group {shutdown|minimum-links` *number* | `clock-mode}`
	
	Example:
	`Router (config-controller-dsl-group)# ima group minimum-links 2`
		Modifies IMA group behavior.
		
		See the "ima-group" section on page 28 for more information.

	Command	Purpose

Step 5	`ima group clock-mode` {ctc | itc}
	
	Example:
	`Router (config-controller-dsl-group)# ima group`
	`clock-mode ctc`
		Defines the clock mode for an IMA group.
		
		See the "ima group clock-mode" section on page 31 for more information.

Step 6	`shdsl annex` {standard} **Example:** `Router (config-controller-dsl-group)# shdsl annex A`	Defines the SHDSL annex. See the "shdsl annex" section on page 36 for more information.
Step 7	`shdsl rate` {*number* | `auto`} **Example:** `Router (config-controller-dsl-group)# shdsl rate auto`	Defines the SHDSL rate. See the "shdsl rate" section on page 38 for more information.

Step 8	`exit`
	
	Example:
	`Router (config-controller-dsl-group)# exit`
		Exits config-controller-dsl-group mode.

Step 9	`exit`
	
	Example:
	`Router (config-controller)# exit`
		Exits config-controller mode.

Examples

The following example use the G.SHDSL commands to configure an IMA group on a HWIC- 4SHDSL.

```
Router(config)# controller shdsl 0/2/0
Router(config-controller)# dsl-group 1 pairs 1 ima
Router(config-controller-dsl-group)#?

dsl-group configuration sub commands:

  default   Set a command to its defaults
  exit      Exit dsl-group sub commands
  ima       IMA sub commands
  no        Negate a command or set its defaults
  shdsl     Symmetric g.shdsl configuration
  shutdown  Shutdown this dsl-group

Router(config-controller-dsl-group)# ima link add 2
Router(config-controller-dsl-group)# ima group minimum-links 2
Router(config-controller-dsl-group)# ima group clock-mode ?

  ctc  Common Transmit Clock configuration
  itc  Independent Transmit Clock configuration

Router(config-controller-dsl-group)# ima group clock-mode ctc ?
Router(config-controller-dsl-group)# shdsl annex a
Router(config-controller-dsl-group)# shdsl rate auto
Router(config-controller-dsl-group)# exit
Router(config-controller)# exit
```

Configuring M-Pair Groups

Use the Cisco IOS CLI on the router in global configuration mode to configure an M-Pair group on the Cisco HWIC-4SHDSL.

Note To ensure a successful *M-Pair* group configuration, confirm that the central office (CO) network equipment that is connected with the Cisco HWIC-4SHDSL supports *M-Pair* bonding.

SUMMARY STEPS

1. **controller shdsl**
2. **dsl-group**
3. **shdsl annex**
4. **shdsl rate**
5. **exit**
6. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	**controller shdsl** *slot number/subslot number/0* **Example:** Router (config)# **controller shdsl 0/2/0** Router (config-controller)#	Selects the controller and enters config-controller mode. See the "controller shdsl" section on page 23 for more information.
Step 2	**dsl-group** *number* **pairs** *link number* [**ima** | **m-pair**] **Example:** Router (config-controller)# **dsl-group 0 pairs 0-1 m-pair**	Creates a DSL group and enters config-controller-dsl-group mode. See the "dsl-group" section on page 25 for more information.
Step 3	**shdsl annex** {standard} **Example:** Router (config-controller-dsl-group)# **shdsl annex A-B**	Defines the SHDSL annex. See the "shdsl annex" section on page 36 for more information.
Step 4	**shdsl rate** {*number* | **auto**} **Example:** Router (config-controller)# **shdsl rate 2048**	Defines the SHDSL rate. See the "shdsl rate" section on page 38 for more information.
Step 5	**exit** **Example:** Router (config-controller-dsl-group)# **exit**	Exits config-controller-dsl-group mode.
Step 6	**exit** **Example:** Router (config-controller)# **exit**	Exits config-controller mode.

Examples

The following example use the G.SHDSL commands to configure an M-Pair group on a HWIC-4SHDSL.

```
Router(config)#
Router(config)# controller shdsl 0/2/0
Router(config-controller)# dsl-group 1 pairs 0-1 m-pair
Router(config-controller-dsl-group)#

Sep 27 14:16:00.167: %HWIC_SHDSL-5-DSLGROUP_UPDOWN: SHDSL 0/2/0 dsl-group(1) state changed
to down.
Sep 27 14:16:02.167: %LINK-3-UPDOWN: Interface ATM0/2/1, changed state to down
Sep 27 14:16:03.167: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/2/1, changed
state to down

Router(config-controller-dsl-group)# shdsl annex a-b
Router(config-controller-dsl-group)# shdsl rate 2048
Router(config-controller-dsl-group)# exit
Router(config-controller)# exit
Router(config)#
```

Configuring 1-Pair Groups and 2-Pair Groups

To configure a 1-Pair group or 2-Pair group on a Cisco HWIC-4SHDSL or HWIC-2SHDSL, use the Cisco IOS CLI on the router in global configuration mode.

SUMMARY STEPS

1. **controller shdsl**
2. **dsl-group**
3. **shdsl 4-wire mode**
   (For 2-Pair groups only)
4. **shdsl annex**
5. **shdsl rate**
6. **exit**
7. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	**controller shdsl** *slot number/subslot number/0* **Example:** Router (config)# **controller shdsl 0/2/0** Router (config-controller)#	Selects the controller and enters config-controller mode. See the "controller shdsl" section on page 23 for more information.
Step 2	**dsl-group** *number* **pairs** *link number* **Example(1-pair group):** Router (config-controller)# **dsl-group** 0 **pairs** 0 **Example(2-pair group):** Router (config-controller)# **dsl-group** 0 **pairs** 0-1	Creates a DSL group and enters config-controller-dsl-group mode. See the "dsl-group" section on page 25 for more information.

	Command	Purpose

Step 3	`shdsl 4-wire mode enhanced`
	
	Example:
	`Router (config-controller)# shdsl 4-wire mode enhanced`
		Defines a *2-pair* group as enhanced.
		
		See the "shdsl 4-wire mode" section on page 35 for more information.

Step 4	`shdsl annex {standard}`
	
	Example:
	`Router (config-controller-dsl-group)# shdsl annex A-B`
		Defines the SHDSL annex.
		
		See the "shdsl annex" section on page 36 for more information.

Step 5	`shdsl rate {number|auto}`
	
	Example:
	`Router (config-controller)# shdsl rate 2048`
		Defines the SHDSL rate.
		
		See the "shdsl rate" section on page 38 for more information.

Step 6	`exit`
	
	Example:
	`Router (config-controller-dsl-group)# exit`
		Exits config-controller-dsl-group mode.

Step 7	`exit`
	
	Example:
	`Router (config-controller)# exit`
		Exits config-controller mode.

Examples

The following example use the G.SHDSL commands to configure a 1-Pair group and 2-Pair group on a HWIC-4SHDSL and HWIC-2SHDSL.

1-Pair Group Configuration

```
Router(config)# controller shdsl 0/2/0
Router(config-controller)# dsl-group 0 pairs 0
Router(config-controller-dsl-group)#

Oct  4 14:30:48.863: %HWIC_SHDSL-5-DSLGROUP_UPDOWN: SHDSL 0/2/0 dsl-group(0) state changed
to down.
Oct  4 14:30:50.863: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
Oct  4 14:30:51.863: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/2/0, changed
state to down

Router(config-controller-dsl-group)# shdsl annex ?

  A    Annex A of G.991.2 standard
  A-B  Annex A/B of G.991.2 standard
  B    Annex B of G.991.2 standard
  F    Annex F of G.991.2 standard
  F-G  Annex F/G of G.991.2 standard
  G    Annex G of G.991.2 standard

Router(config-controller-dsl-group)# shdsl annex A-B
Router(config-controller-dsl-group)# shdsl rate ?

  <192-2304>  DSL Rate in kbps(line will train at the rate + 16kbps overhead)
  auto        auto rate mode

Router(config-controller-dsl-group)# shdsl rate 2048
Router(config-controller-dsl-group)# exit
Router(config-controller)# exit
Router(config)#
```

2-Pair Group Configuration

```
Router(config)# controller shdsl 0/2/0
Router(config-controller)# dsl-group 0 pairs 0-1
Router(config-controller-dsl-group)#

Oct  4 14:37:01.027: %HWIC_SHDSL-5-DSLGROUP_UPDOWN: SHDSL 0/2/0 dsl-group(0) state changed
to down.
Oct  4 14:37:03.027: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
Oct  4 14:37:04.027: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/2/0, changed
state to down

Router(config-controller-dsl-group)# shdsl ?

  4-wire  Symmetric g.shdsl 4-wire mode configuration
  annex   Symmetric g.shdsl Annex configuration
  rate    DSL line rate configuration

Router(config-controller-dsl-group)# shdsl 4-wire mode ?

  enhanced  4-wire mode start up on both pairs

Router(config-controller-dsl-group)# shdsl 4-wire mode enhanced
Router(config-controller-dsl-group)# shdsl ?

  4-wire  Symmetric g.shdsl 4-wire mode configuration
  annex   Symmetric g.shdsl Annex configuration
  rate    DSL line rate configuration

Router(config-controller-dsl-group)# shdsl annex ?

  A    Annex A of G.991.2 standard
  A-B  Annex A/B of G.991.2 standard
  B    Annex B of G.991.2 standard
  F    Annex F of G.991.2 standard
  F-G  Annex F/G of G.991.2 standard
  G    Annex G of G.991.2 standard

Router(config-controller-dsl-group)# shdsl annex A-B
Router (config-controller-dsl-group)# shdsl rate ?

  <384-4608>  DSL Rate in kbps(line will train at the rate + 16kbps overhead)
  auto        auto rate mode

Router(config-controller-dsl-group)# shdsl rate 2048
Router(config-controller-dsl-group)# exit
Router(config-controller)# exit
```

Troubleshooting Cisco G.SHDSL HWICs

To troubleshoot Cisco G.SHDSL HWICs, use the following new and published Cisco IOS commands. All other Cisco IOS software commands used with G.SHDSL HWICs are documented in the Cisco IOS Release 12.4(11) XJ command reference publication at Cisco.com:

http://www.cisco.com/en/US/products/ps6441/tsd_products_support_series_home.html

SUMMARY STEPS

1. **show controllers shdsl**
   (new command)
2. **show controllers atm**
3. **show ima interface**
4. **show ima interface atm**
5. **show atm pvc**

DETAILED STEPS

	Command	Purpose
Step 1	**show controllers shdsl** *slot number/subslot number/0* [**detailed** | **brief**] **Example:** Router# **show controllers shdsl 0/2/0 detailed**	Displays the status of SHDSL controllers. See the "show controllers shdsl" section on page 40 for more information.
Step 2	**show controllers atm** [*slot/subslot number/ima group-number*] **Example:** Router# **show controllers atm 0/1/ima0**	Displays information about the IMA group.
Step 3	**show ima interface** **Example:** Router# **show ima interface**	Displays information about the IMA interface.
Step 4	**show ima interface atm** [*slot/subslot number/ima group-number*] [**detailed**] **Example:** Router# **show ima interface atm 0/1/ima0**	Displays detailed information about the IMA interface.
Step 5	**show atm pvc** **Example:** Router# **show atm pvc**	Displays information about ATM permanent virtual connections (PVCs) and traffic information.

Examples

The following example uses the **show controllers shdsl** command to display the controller status on a HWIC-4SHDSL.

show controllers shdsl

```
Router# show controllers shdsl 0/2/0 detailed
Controller SHDSL 0/2/0 is UP
```

```
Hardware is HWIC-4SHDSL, rev 2 on slot 0, hwic slot 2
Capabilities: IMA, M-pair, 2/4 wire, Annex A, B, F & G, CPE termination
cdb=0x43D8E90C, plugin=0x43CC44D0, ds=0x43D75284 base=0xB8000000
FPGA Version is REL.3.4.0, NIOSII FW:Ver 2.6, status Running
SDC-16i HW:Rev 1.2, status UP, FW:Ver 1.2-1.1.3__57, status Running
SDFE-4 HW:Rev 1.2, status UP, FW:Ver 1.1-1.5.2__001  , status Running
NIOSII Firmware image: System
SDC16i Firmware image: System
SDFE4  Firmware image: System
Number of pairs 4, number of groups configured 1
Ignored CLI cmds(0), Event buffer: in use(0), failed(0)
Group (0) info:
      Type: 2-wire g.shdsl, status: Configure Firmware
      Interface: ATM0/2/0, hwidb: 0x43D8EA54, UTOPIA phy 0
      Configured/active num links: 1/0, bit map: 0x1/0x0
      Line termination: CPE, line mode: 2-wire, Annex-B, PMMS disabled
      Line coding: 16-TCPAM, configured/actual rate: 2304/0 kbps
      SHDSL wire-pair (0) is in DSL DOWN state
        Termination: CPE, line mode: 2-wire, Annex-B
        Line coding: 16-TCPAM, configured/actual rate: 2304/0 kbps
        CONNECT state: MAIN_PRE_ACT, cond: NONE, reason: ERR_NONE
        Power back off: 0dB, FE power back off: 0dB
        LoopAttn: 0dB, SnrMargin: 0dB, Status noDefect
        Current 15 minute statistics (Time Elapsed 608 seconds):
            ES: 0, SES: 0, CRC: 0, LOSWS: 0, UAS: 0
        Previous 15 minute statistics:
            ES: 0, SES: 0, CRC: 0, LOSWS: 0, UAS: 0
        Current 24 hr statistics:
            ES: 0, SES: 0, CRC: 0, LOSWS: 0, UAS: 0
        Previous 24 hr statistics:
            ES: 0, SES: 0, CRC: 0, LOSWS: 0, UAS: 0
        ATM-TC Tx: data cells: 0, Idle/Unassigned: 0
        ATM-TC Rx: data cells: 0, uncorr HEC: 0, corr HEC: 0
        ATM-TC Rx: OCD: 0, LCD start: 0, LCD end: 0
  Group (1) is Not configured.
***** Firmware Status Information Start *****

ticks: 537140002, heapmem used: 223744 bytes

Utopia information:
  ints: 1, last intr status: 0x00000000
  utopia_tx_stuck_count: 1, utopia_rx_stuck_count: 1
  sar0_rcv_parity_errs: 0, sar0_rcv_errs: 0
  sar1_rcv_parity_errs: 0, sar1_rcv_errs: 0

IPC information:
  tx_polling: false
  Tx ok 538289, poll 0, fails qfull 0, noinit 0, dma 0
  Rx ok 53867, fails nobufs 0, noapp 0

DMA information:
  Write req 538294, complete 538294, underruns 0, overruns 0

VOS:
  write fail1: 0, fail2: 0, fail3: 0

App Group information:
  grp 0, tsnid   9, linkmap 0x1, flags 0x00, imacmd 0, realMWMaster 0
  grp 1, tsnid   0, linkmap 0x0, flags 0x00, imacmd 0, realMWMaster 0

App information:
  ch 0, pre_st 6, cur_st 6, tr 2, flags 0x210
  ch 1, pre_st 8, cur_st 8, tr 3, flags 0x000
  ch 2, pre_st 1, cur_st 5, tr 3, flags 0x000
```

```
       ch 3, pre_st 1, cur_st 5, tr 3, flags 0x000

Chip information:
  ch 0, state 1, cond 0, reason 0, prims 0xff, fbits 0x0f, vendFe 0
  sa 1 crca 1 sd 1 loswd 1 snrmd 1 lad 1 loswf 1 trr 1 pwr status 1
  ch 1, state 0, cond 0, reason 0, prims 0xff, fbits 0x0f, vendFe 0
  sa 1 crca 1 sd 1 loswd 1 snrmd 1 lad 1 loswf 1 trr 1 pwr status 1
  ch 2, state 0, cond 0, reason 0, prims 0xff, fbits 0x0f, vendFe 0
  sa 1 crca 1 sd 1 loswd 1 snrmd 1 lad 1 loswf 1 trr 1 pwr status 1
  ch 3, state 0, cond 0, reason 0, prims 0xff, fbits 0x0f, vendFe 0
  sa 1 crca 1 sd 1 loswd 1 snrmd 1 lad 1 loswf 1 trr 1 pwr status 1

Global information:
  DSL wait 0, flags 0x7, cctmsgs  0, ipcmsgs  0
  DSL rate mismatch 0, cct write fails 0, ipc write fails 0
  DSL cmds sent: line_cfg 9, start_data 9
                 stop_data 8, rel_conn 8
  IMA cmds sent: addgrp 0, delgrp 0, addlink 0
                 dellink 0, set_param 0
  IMA fails addgrp 0, delgrp 0, addlink 0 dellink 0
  /pipe/dsl_ipc_norm, mqp 0x3f66f0, nmsgs 32, msgsize 4
  magic 0xbeefbacc, p_start 0x3f6720, p_end 0x3f68a0, memsize 384
  free mhead 0x3f6780 mtail 0x3f6774 numfree 32
  read qhead 0x0 qtail 0x0 qcount 0

CC information:
  global state 4, restart 0, AppWrite fails 0
  fatalError 0, selectErr 0
  rxEctEvtNoMsgs 0, rxMctEvtNoMsgs 0, rxAppEvtNo Msgs 0
  dciMsg2MctFails 0, ctrlMsg2MctFails 0, ectSendFails 0
  sciMsg2MctFails 0, sciAuxMsg2MctFails 0, sciRsMsg2MctFails 0

Channel cfg:
  ch 0, state 5, substate 12, conntype 1, mwire 0, realMwMaster 0
  ch 1, state 4, substate 0, conntype 1, mwire 1, realMwMaster 0
  ch 2, state 4, substate 0, conntype 1, mwire 0, realMwMaster 0
  ch 3, state 4, substate 0, conntype 1, mwire 0, realMwMaster 0

Channel var:
  ch 0, state 5, atmsync 0, atmtcenable 0, delayMt 0, delay 0
  ch 1, state 1, atmsync 0, atmtcenable 0, delayMt 0, delay 0
  ch 2, state 1, atmsync 0, atmtcenable 0, delayMt 0, delay 0
  ch 3, state 1, atmsync 0, atmtcenable 0, delayMt 0, delay 0

IMA group info:
  idx 0, state 0, rate 0, id 0, GrpId 255, mod 0, mismatch 0
  idx 1, state 0, rate 0, id 0, GrpId 255, mod 0, mismatch 0
  idx 2, state 0, rate 0, id 0, GrpId 255, mod 0, mismatch 0
  idx 3, state 0, rate 0, id 0, GrpId 255, mod 0, mismatch 0

IMA link info:
  idx 0, imaGrp 255, linkId 255, rate 0, mismatch 0
  idx 1, imaGrp 255, linkId 255, rate 0, mismatch 0
  idx 2, imaGrp 255, linkId 255, rate 0, mismatch 0
  idx 3, imaGrp 255, linkId 255, rate 0, mismatch 0

MC information:
  state 5, nDciInUse 0, fatalerr 0

DciInUse >= 10 msgs err:
  dsDci 0, dsSci 0, dsSciAux 0, dsSciRs 0, rxCCT 0 rxEct 0

Other Stats:
  dsDciWrFails1 0, dsDciWrFails2 0, dsSciAckLost 0
```

```
      dsSciWrFails1 0, dsSciWrFails2 0, dsSciAuxWrFails1 0
      dsSciAuxWrFails2 0, dsSciRsWrFails1 0, dsSciRsWrFails2 0
      usSciInvalidLen 0, usSciUnexpectedAck 0, usSciMsgFw2EctFails 0
      usSciMsgFw2CctFails 0, usSciAuxInvalidLen 0, usSciSendFails 0
      usDciSendFails 0, sciBlocking 0, dciBlocking 0

  EC information:
      mctMsgsRx 0, mctMsgsTxFails 0, mctMsgsTxOks 0

  VOS Pipes:
      /pipe/CCT_FROM_APP_0, mqp 0x3c0c78, nmsgs 32, msgsize 400
      magic 0xbeefbacc, p_start 0x3c0ca8, p_end 0x3c3fa8, memsize 13056
      free mhead 0x3c3e10 mtail 0x3c3c78 numfree 32
      read qhead 0x0 qtail 0x0 qcount 0

      /pipe/CCT_TO_APP_0, mqp 0x3c4018, nmsgs 64, msgsize 400
      magic 0xbeefbacc, p_start 0x3c4048, p_end 0x3ca648, memsize 26112
      free mhead 0x3c6e80 mtail 0x3c6ce8 numfree 64
      read qhead 0x0 qtail 0x0 qcount 0

      /pipe/CCT_FROM_MCT_0, mqp 0x3ca6b8, nmsgs 96, msgsize 400
      magic 0xbeefbacc, p_start 0x3ca6e8, p_end 0x3d3fe8, memsize 39168
      free mhead 0x3cabb0 mtail 0x3caa18 numfree 96
      read qhead 0x0 qtail 0x0 qcount 0

      /pipe/CCT_FROM_ECT_0, mqp 0x3d4058, nmsgs 32, msgsize 400
      magic 0xbeefbacc, p_start 0x3d4088, p_end 0x3d7388, memsize 13056
      free mhead 0x3d4088 mtail 0x3d71f0 numfree 32
      read qhead 0x0 qtail 0x0 qcount 0

      /pipe/MCT_TO_ECT_0, mqp 0x3d73f8, nmsgs 64, msgsize 400
      magic 0xbeefbacc, p_start 0x3d7428, p_end 0x3dda28, memsize 26112
      free mhead 0x3d7428 mtail 0x3dd890 numfree 64
      read qhead 0x0 qtail 0x0 qcount 0

      /pipe/CCT_TO_ECT_0, mqp 0x3dda98, nmsgs 32, msgsize 400
      magic 0xbeefbacc, p_start 0x3ddac8, p_end 0x3e0dc8, memsize 13056
      free mhead 0x3e0a98 mtail 0x3e0900 numfree 32
      read qhead 0x0 qtail 0x0 qcount 0

      /pipe/CCT_TO_MCT_0, mqp 0x3e36e8, nmsgs 96, msgsize 400
      magic 0xbeefbacc, p_start 0x3e3718, p_end 0x3ed018, memsize 39168
      free mhead 0x3ead08 mtail 0x3eab70 numfree 96
      read qhead 0x0 qtail 0x0 qcount 0

      /pipe/MCT_FROM_ECT_0, mqp 0x3ed088, nmsgs 64, msgsize 400
      magic 0xbeefbacc, p_start 0x3ed0b8, p_end 0x3f36b8, memsize 26112
      free mhead 0x3ed0b8 mtail 0x3f3520 numfree 64
      read qhead 0x0 qtail 0x0 qcount 0


  Tasks:
          tIPC delay 00000 flags 0x002 schedcnt 106899104
        tMCT_0 delay 00000 flags 0x000 schedcnt 21379921
          tCCT delay 00011 flags 0x000 schedcnt 10743684
          sCCT delay 00236 flags 0x000 schedcnt 537184
          tECT delay 00460 flags 0x000 schedcnt 537195
          tDMT delay 00010 flags 0x000 schedcnt 11280188


  ***** Firmware Status Information End *****

      IPC Info:  host_base=0xF59B040, sram_base=0xB81E0000
       CmdType  Tx        TxErr      Rx         RxFailed   RxUnknown
```

```
        GEN     6          0          8          0          0
        DBG     0          0          0          0          0
        DSL     34         0          536537     0          0
        IMA     0          0          0          0          0
        EOC     0          0          0          0          0
******* HWIC Common Registers at B8000000 *******
HWIC ID:        0x1
HWIC Revision: 0x4
HWIC Status:   0x0
HWIC DDR TXCRC:0x0
HWIC Control:  0x8040
    DDR  Enable             1      Software Reset          0
    Interrupt Module Reset  0      GDF Module Reset        0
    DMA Module Reset        0      Flow Control Reset      0
    IRQ2 Global Int Mask    0      IRQ1 Global Int Mask    1
    DDR TXCRC Int Mask      0      DDR TXClk Loss Int Mask 0
    TX Fifo Overrun Int Mask 0
HWIC Interrupt Event: 0x0
    DDR TXCRC Int           0      DDR TXClk Loss Int      0
    TX Fifo Overrun Int     0
HWIC Diag 1: 0x0
HWIC Diag 2: 0x1E0F

******* HWIC Host Registers at B8A00000 *******
Status (0x00):
    Card Present Low         0      Graceful Stop Tx Complete  0
Config (0x00000806):
    Hwic Reset              0      Hwic Host Reset            0
    Hwic IRQ2 Type          Err    Hwic IRQ1 Type             Net
    Rx Queue Watermark Enable 0    Auto XOFF When Full        0
    Rx Int On Last          0      Graceful Stop Tx           0
    Generic Rx Enable       0      Generic Tx Enable          1
    DDR Enable              1      Loopback                   0
Error Interrupt Enable (0x37EFF):
    Rx Done Error Int       1      Card Present Change Int    1
    Hwic Int Frame Error Int 0x07  Tx First Last Error Int    1
    Tx Done Error Int       1      IRQ2 Int                   1
    IRQ1 Int                0      Host Specific Error Int    1
    Rx Overrun Int          1      DDR RxClk Missing Int      1
    Reg RW Timeout Int      1      Reg RW Error Int           1
    Rx CRC Int              1      Rx Format Error Int        1
    DMA Error Int           1
Management Interrupt Enable (0xA000):
    Hwic Int Frame Mgmt Int 0x0A
    IRQ2 Int                0
    IRQ1 Int                0      Graceful Stop Tx Int       0
Network Interrupt Enable (0x003F):
    Rx Frame Drop Int       0      Generic Frame Tx Int       0
    Generic Frame Rx Int    0      DMA Write Int              0
    IRQ2 Int                0      IRQ1 Int                   0
    Int Frame Network Int   0x3F
Error Interrupt Event (0x0000):
    Rx Done Error Event     0      Card Present Change Event  0
    Hwic Int Frame Error Event 0x00 Tx First Last Error Event 0
    Tx Done Error Event     0      IRQ2 Event                 0
    IRQ1 Event              0      Host Specific Error Event  0
    Rx Overrun Event        0      DDR RxClk Missing Event    0
    Reg RW Timeout Event    0      Reg RW Error Event         0
    Rx CRC Event            0      Rx Format Error Event      0
    DMA Error Event         0
Management Interrupt Event (0x0000):
    Hwic Int Frame Mgmt Event 0x00
    IRQ2 Int                0
    IRQ1 Int                0      Graceful Stop Tx Event     0
```

```
Network Interrupt Event (0x1000):
    Rx Frame Drop Event          0         Generic Frame Tx Event      1
    Generic Frame Rx Event       0         DMA Write Event             0
    IRQ2 Event                   0         IRQ1 Event                  0
    Int Frame Network Event     0x00
HWICRegisterOffset            0x0000       HWICRegisterErrorAddress  0x00000000
HWICRegisterTimeout           0x0000C350
TxControlFrameCounter         0x2B4F3F     RxControlFrameCounter     0x264A19
TxDataFrameCounter            0x00D271     RxDataFrameCounter        0x0836E6
RegisterRWErrorCounter        0x0000       RxOverrunErrorCounter     0x0000
RxCRCErrorCounter             0x0000       RxFrameDropCounter        0x0000
TxBufferExtension             0x00         RxBufferExtension         0x00
HWICQueueBaseExtension        0x00         HWICQueueBase             0x0F59
TXQueueTailBase Register      0xC088
TxQueueBase                   0x18         TxQueueTail               0x11
TxQueueSize                   0x20         TxQueueHead               0x11
RxQueueHeadBase Register      0x0000
RxQueueBase                   0x00         RxQueueHead               0x00
RxQueueSize                   0x00         RxQueueTail               0x00
RxBufferSize                  0x0000       RxQueueHighWaterMark      0x00
RxQueueLowWaterMark           0x00         DMAOffsetExtension        0x00
DMAOffset                     0x0000       DMAWindow                 0x0000
```

The following example uses the **show controllers atm** command to display information about an IMA group.

show controllers atm

```
Router#show controllers atm 0/1/ima0
DSL SAR Info
Interface: ATM0/1/IMA0 Hardware: DSLSAR WITH IMA State: up
IDB: 0x4358A1F8  Instance: 0x435B70C8  dpi: 0x435D3C90
PHY bw: 4608 kbps Cell tick: 0x00121ECA Current TST: 1
NetIO enable: 0x003F Int status: 0x0000, sram_base(h): 0xB0240000
SAR reg base: 0xB0202400 Host reg base: 0xB0A00400
SAR config: 0x200D0A20 SAR status: 0x00000000
RPQ head: 0x0F394330 RPQ tail:0x0F394330
RCQ head: 0x0F390D40 RCQ tail:0x0F390D40
FBQ head: 0x000198DC FBQ tail:0x00019CBC
TBQ head: 0x0F392260 TBQ tail:0x0F392260
RCT base: 0x0001A000 RCID base:0x00030000
Tx ints: 0x00005842 Rx pkt ints: 0x00005495
Rx cell ints: 0x000003E9 Rx pkts: 0x00005118
Tx pkts: 0x00005119 Tx OAM cells: 0x000003C0
Rx raw cells: 0x000003C0
Utopia Tx cells: 0x0009D5C2 Utopia Rx cells: 0x0009D5C2
Utopia Tx rate: 10742.43 cps, 4554790 bps
Tx idle rate: 0.00 cps, 0 bps
Utopia Rx rate: 10742.43 cps, 4554790 bps
Bad tbd_ids: 0x00000000, Tx error: 0x00000000
oam_nobuf: 0x00000000 no_tbd_id: 0x00000000 shaping_defer: 0x00000000
bad_oam_rx: 0x00000000 delayed_rpqe: 0x00000000 delayed_tbqe: 0x00000000
DSL SAR Info
Unknown vpi/vci: 0x00000000, Inv cells: 0x00000000
TCD[0]: 0x00000000  TCD[1]: 0x00000040
TST[0]: 0x00000240  TST[1]: 0x0000CB6C
Boot jump: 0x00019498 RCTE[0]: 0x0001A000 FBQ: 0x00019800
lp_tcq[0][0]: 0x0001B000  lp_tcq[0][1]: 0x0001B010
lp_tcq[1][0]: 0x0001C000  lp_tcq[1][1]: 0x0001C010
hp_tcq[0][0]: 0x00024000  hp_tcq[0][1]: 0x00024010
hp_tcq[1][0]: 0x00025000  hp_tcq[1][1]: 0x00025010
rx_conn_id[0]: 0x00030000  rcte[0]: 0x0001A000
```

```
Configured vcs:
  VCD  VPI  VCI  QoS(c)  QoS(a)    BW(c)     BW(a)     RCTE     rd(min/max/var)
   1    1   11    5        5          0       4608   0x000A220B   3370/22859/19489
   2    1   12    5        5          0       4608   0x000A221C   4035/23100/19064
   3    1   13    5        5          0       4608   0x000A2211   3197/22446/19248
   4    1   14    5        5          0       4608   0x000A2203   3607/21524/17917
   5    1   15    5        5          0       4608   0x000A0000   4022/29498/25476
   6    1   16    5        5          0       4608   0x000A2209    20/12401/12381
   7    1   17    5        5          0       4608   0x000A0000      --
   8    1   18    5        5          0       4608   0x000A0000   5651/19762/14110
VC Tx stats:
  VCD     Tx(hp)        Tx(lp)     ring(p/b) pkts(h/l) bufs(h/l)  td(min/max/var)
   0   0x00000440    0x00000000    30/30      0/0       0/0       7176/7916/739
   1   0x00000B81    0x00000000    30/30     30/0      30/0       15160/15402/241
DSL SAR Info
   2   0x00000B81    0x00000000    30/30     30/0      30/0       15160/15402/241
   3   0x00000B9E    0x00000000    30/30     30/0      30/0       15160/15415/255
   4   0x00000B9E    0x00000000    30/30     30/0      30/0       15160/15415/255
   5   0x00000B9F    0x00000000    30/30     30/0      30/0       15160/15402/241
   6   0x00000B9E    0x00000000    30/30     30/0      30/0       15160/15456/295
   7   0x00000B9E    0x00000000    30/30     30/0      30/0       15160/15469/309
   8   0x00000B9E    0x00000000    30/30     30/0      30/0       15160/15415/255
  Unreserved TBDIDs: 512


OAM table(0x0000CB6C):
    0
 0x6000CB6C 0x00100274 0x001018BC 0x001018E4 0x0010190C 0x00801934
 0x00000240 0x00000274 0x0000195C 0x000045E0 0x00007264


CBR table(0x0000CBA0):
    *
  EOT(0x0000CBA0) -- entries: 1


VBR1 poll table (0x0000E1E8):

  EOT(0x0000E1E8) -- entries: 0
VBR1 redirect table (0x0000E288):
    *
DSL SAR Info
  EOT(0x0000E288) -- entries: 1


VBR2 poll table (0x0000E210):

  EOT(0x0000E210) -- entries: 0
VBR2 redirect table (0x00010F0C):
    *
  EOT(0x00010F0C) -- entries: 1


VBR3 poll table (0x0000E238):

  EOT(0x0000E238) -- entries: 0
VBR3 redirect table (0x00013B90):
    *
  EOT(0x00013B90) -- entries: 1


VBR4 poll table (0x0000E260):
   1   2   3   4   5   6   7   8
  EOT(0x0000E260) -- entries: 8
VBR4 redirect table (0x00016814):
   1   2   3   4   5   6   7   8   1   2   3   4   5   6   7   8
   1   2   3   4   5   6   7   8   1   2   3   4   5   6   7   8
   1   2   3   4   5   6   7   8   1   2   3   4   5   6   7   8
DSL SAR Info
   1   2   3   4   5   6   7   8   1   2   3   4   5   6   7   8
```

```
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8
      1     2     3     4     5     6     7     8     1     2     3     4     5     6     7     8

    EOT(0x00016814) -- entries: 288
  TCD (vc = 0):
    0x0001B000 0x000246D0 0x00040000 0x00005800
    0x00840000 0x00005800 0x0F0D8400 0x00040000
    0x00040000 0x00000000 0x000006D0 0xFFFFFFFF
    0x00000000 0x00000000 0x00000000 0x00000000
  TCD (vc = 1):
  DSL SAR Info
    0x0001C000 0x00025430 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0F1E2800 0x00000800
    0x00000800 0x00000000 0x04000250 0x0D127909
    0x0ABE025A 0x0F473928 0x000005BA 0x001000B2
  TCD (vc = 2):
    0x0001D000 0x00026420 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0F1E4C00 0x00000800
    0x00000800 0x00000000 0x04000240 0xAFF7CE80
    0x0AB900DA 0x0F014948 0x000005BA 0x001000C2
  TCD (vc = 3):
    0x0001E000 0x00027420 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0F1E5000 0x00000800
    0x00000800 0x00000000 0x04000240 0xD6F45716
    0x0ABA00DA 0x0F42B128 0x000005BA 0x001000D2
  TCD (vc = 4):
    0x0001F000 0x00028430 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0F1E5400 0x00000800
    0x00000800 0x00000000 0x00000570 0xFFFFFFFF
    0x0858001A 0x0F0E87C8 0x000005BA 0x001000E2
  TCD (vc = 5):
    0x00020000 0x00029740 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0FDEE800 0x00000800
    0x00000800 0x00000000 0x04000560 0x09A10FE1
  DSL SAR Info
    0x0859022A 0x0F0DB5B8 0x000005BA 0x001000F2
  TCD (vc = 6):
    0x00021000 0x0002A740 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0FDEEC00 0x00000800
    0x00000800 0x00000000 0x04000560 0xD2A68842
    0x085C034A 0x0F034758 0x000005BA 0x00100102
  TCD (vc = 7):
    0x00022000 0x0002B740 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0FDF1000 0x00000800
    0x00000800 0x00000000 0x04000560 0xC1679389
    0x085D031A 0x0F0F6B08 0x000005BA 0x00100112
  TCD (vc = 8):
    0x00023000 0x0002C740 0x00000800 0x00008800
    0x00000800 0xFFFFFFFF 0x0FDF1400 0x00000800
    0x00000800 0x00000000 0x04000560 0x7943233E
    0x085E031A 0x0F0B1C08 0x000005BA 0x00100122
  FIPS-frodo#
```

The following example uses the **show ima interface** command to display information about an IMA interface.

show ima interface

```
Router#show ima interface
Interface ATM0/2/IMA0 is down
        Group index is 0, group ifIndex is 11
        Ne state is startUp, failure status is noFailure
        Active links bitmap 0x0
    IMA Group Current Configuration:
        Tx/Rx configured links bitmap 0x3/0x3
        Tx/Rx minimum required links 1/1
        Maximum allowed diff delay is 25ms, Tx frame length 128
        Ne Tx clock mode CTC, configured timing reference link Pair 0
        Test pattern procedure is disabled
    IMA Group Current Counters (time elapsed 0 seconds):
        0 Ne Failures, 0 Fe Failures, 0 Unavail Secs
    IMA Group Total Counters (last 0 15 minute intervals):
        0 Ne Failures, 0 Fe Failures, 0 Unavail Secs
    IMA link Information:
        Link      Physical Status        NearEnd Rx Status      Test Status
        ----      ---------------        -----------------      -----------
        Pair 0    down                   notInGroup             disabled
        Pair 1    down                   notInGroup             disabled
Router#
```

The following example uses the **show ima interface detail** command to display detailed information about an IMA interface.

show ima interface detail

```
Router#show ima interface atm 0/2/ima0 detailed
Interface ATM0/2/IMA0 is down
        Group index is 0, group ifIndex is 11
        Ne state is startUp, failure status is noFailure
        Active links bitmap 0x0
    IMA Group Current Configuration:
        Tx/Rx configured links bitmap 0x3/0x3
        Tx/Rx minimum required links 1/1
        Maximum allowed diff delay is 25ms, Tx frame length 128
        Ne Tx clock mode CTC, configured timing reference link Pair 0
        Test pattern procedure is disabled
    Detailed group Information:
        Ne IMA version in operation IMA Version 1.1
        Fe IMA version in operation IMA Version 1.1
        Tx/Rx Ima_id 0x0/0xFFFFFFFF, symmetry symmetricOperation
        Number of Tx/Rx configured links 2/2
        Number of Tx/Rx active links 0/0
        Fe Tx clock mode CTC, Rx frame length 128
        Tx/Rx timing reference link 0/-1
        Maximum observed diff delay 0ms, least delayed link -1
        Running seconds 0
        GTSM last changed 16:06:16 UTC Wed Oct 4 2006
    IMA Group Current Counters (time elapsed 0 seconds):
        0 Ne Failures, 0 Fe Failures, 0 Unavail Secs
    IMA Group Total Counters (last 0 15 minute intervals):
        0 Ne Failures, 0 Fe Failures, 0 Unavail Secs
    Detailed IMA link Information:

Link Pair 0 is down
        ifIndex 12, Group ifIndex 11, Row Status is active
        Tx/Rx Lid -1/-1, relative delay 0ms
```

```
            Ne Tx/Rx state notInGroup/notInGroup
            Fe Tx/Rx state notInGroup/notInGroup
            Ne Rx failure status is noFailure
            Fe Rx failure status is noFailure
            Rx test pattern 0x0, test procedure disabled
        IMA Link Current Counters (time elapsed 0 seconds):
            0 Ima Violations, 0 Oif Anomalies
            0 Ne Severely Err Secs, 0 Fe Severely Err Secs
            0 Ne Unavail Secs, 0 Fe Unavail Secs
            0 Ne Tx Unusable Secs, 0 Ne Rx Unusable Secs
            0 Fe Tx Unusable Secs, 0 Fe Rx Unusable Secs
            0 Ne Tx Failures, 0 Ne Rx Failures
            0 Fe Tx Failures, 0 Fe Rx Failures
        IMA Link Total Counters (last 0 15 minute intervals):
            0 Ima Violations, 0 Oif Anomalies
            0 Ne Severely Err Secs, 0 Fe Severely Err Secs
            0 Ne Unavail Secs, 0 Fe Unavail Secs
            0 Ne Tx Unusable Secs, 0 Ne Rx Unusable Secs
            0 Fe Tx Unusable Secs, 0 Fe Rx Unusable Secs
            0 Ne Tx Failures, 0 Ne Rx Failures
            0 Fe Tx Failures, 0 Fe Rx Failures

Link Pair 1 is down
            ifIndex 13, Group ifIndex 11, Row Status is active
            Tx/Rx Lid -1/-1, relative delay 0ms
            Ne Tx/Rx state notInGroup/notInGroup
            Fe Tx/Rx state notInGroup/notInGroup
            Ne Rx failure status is noFailure
            Fe Rx failure status is noFailure
            Rx test pattern 0x0, test procedure disabled
        IMA Link Current Counters (time elapsed 0 seconds):
            0 Ima Violations, 0 Oif Anomalies
            0 Ne Severely Err Secs, 0 Fe Severely Err Secs
            0 Ne Unavail Secs, 0 Fe Unavail Secs
            0 Ne Tx Unusable Secs, 0 Ne Rx Unusable Secs
            0 Fe Tx Unusable Secs, 0 Fe Rx Unusable Secs
            0 Ne Tx Failures, 0 Ne Rx Failures
            0 Fe Tx Failures, 0 Fe Rx Failures
        IMA Link Total Counters (last 0 15 minute intervals):
            0 Ima Violations, 0 Oif Anomalies
            0 Ne Severely Err Secs, 0 Fe Severely Err Secs
            0 Ne Unavail Secs, 0 Fe Unavail Secs
            0 Ne Tx Unusable Secs, 0 Ne Rx Unusable Secs
            0 Fe Tx Unusable Secs, 0 Fe Rx Unusable Secs
            0 Ne Tx Failures, 0 Ne Rx Failures
            0 Fe Tx Failures, 0 Fe Rx Failures
```

The following example uses the **show atm pvc** command to display information about permanent virtual connections (PVCs) and traffic information.

show atm pvc

```
Router# show atm pvc
          VCD /                                        Peak  Avg/Min Burst
Interface Name         VPI  VCI  Type  Encaps   SC   Kbps   Kbps   Cells  Sts
0/0/0     1            1    66   PVC   SNAP     UBR  4608                  UP
0/0/0     2            1    77   PVC   SNAP     UBR  4608                  UP
0/0/0     3            1    88   PVC   SNAP     UBR  4608                  UP
0/1/0     1            1    44   PVC   SNAP     UBR  4608                  UP
Router#
```

Configuring Cisco G.SHDSL HWICs in Cisco Access Routers

Command Reference

Command Reference

This section documents the following new and modified Cisco IOS commands. All other Cisco IOS software commands used with this HWIC are documented in the Cisco IOS Release 12.4(11) XJ command reference publication at Cisco.com:

http://www.cisco.com/en/US/products/ps6441/tsd_products_support_series_home.html

New Commands

- dsl-group, page 25
- ima group clock-mode, page 31
- ima link, page 33
- shdsl 4-wire mode, page 35
- shdsl annex, page 36
- shdsl rate, page 38

Modified Commands

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controller shdsl

To configure a controller for single-pair high-bit-rate digital subscriber line (SHDSL) mode, use the **controller shdsl** command in global or controller configuration mode.

Cisco HWIC-4SHDSL and HWIC-2SHDSL

    controller shdsl *slot number*/*subslot number*/*port number*

Cisco IAD2420 Series

    controller shdsl *number*

Syntax Description

number	Controller number. The valid controller number is 0.
slot number	Defines the slot on the router in which the high-speed WAN interface cards (HWIC) is installed.
subslot number	Defines the subslot on the router in which the HWIC is installed.
port number	Defines the port on the router in which the HWIC is installed. By default, Cisco HWIC-4SHDSL and HWIC-2SHDSL use port number 0.

Command Defaults   Controller number: 0

Command Modes

Cisco HWIC-4SHDSL and HWIC-2SHDSL

Global configuration

Controller configuration

Cisco IAD2420 Series

Global configuration

Command History

Release	Modification
11.3(5)AAA	This command was introduced.
12.2(8)T	This command was implemented on Cisco IAD2420 series IADs.
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router, and on the Cisco 2800 and 3800 series access routers.

Usage Guidelines   This command is used to configure the controller mode and the controller number.

Examples

Cisco HWIC-4SHDSL and HWIC-2SHDSL

The following example uses the **controller shdsl** command to configure a Cisco HWIC-4SHDSL installed in a Cisco access router, controller number 0, subslot 2, port number 0); the example enters controller configuration mode:

```
Router(config)# controller shdsl 0/2/0
Router(config-controller)#
```

Cisco IAD2420 Series

The following example uses the **controller shdsl** command to enter SHDSL controller mode on controller number 0; the example also configures ATM mode:

```
Router# controller shdsl 0
Router# mode atm
```

Related Commands

Command	Description
show controller shdsl	Displays the controller status and statistics.

dsl-group

To create a digital subscriber line (DSL) group and enter config-controller-dsl-group mode, use the **dsl-group** command in config-controller mode. To disable the DSL group, use the **no** form of this command.

> **dsl-group** *number* **pairs** *link number* [**ima**| **m-pair**]

> **no dsl-group** *number* **pairs** *link number*

Syntax Description		
number	Defines the dsl-group number. The dsl-group number can be one of the following numbers: • 0 • 1
pairs	Defines the DSL wire pairs.
link number	Designates the pair's link number. Link number options are limited to one of the following choices, based on the hardware interface and the desired DSL group. **HWIC-4SHDSL** IMA DSL Group • 0 • 1 • 2 • 3 • Any combination of the numbers 0,1,2,3 M-Pair DSL Group • 0-1 • 0-2 • 0-3 2-Pair DSL Group • 0-1 • 2-3 1-Pair DSL Group • 0 • 1 • 2 • 3

	HWIC-2SHDSL
	DSL Group 0
	• 0
	• 1
	• 0-1
	DSL Group 1
	• 1
ima	Defines a DSL group as an inverse multiplexing over ATM (IMA) group.
m-pair	Defines a DSL group as an M-pair group.

Command Default

No DSL group is defined.

Command Modes

Config controller

Command History

Release	Modification
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router and the Cisco 2800 and 3800 series access routers.

Usage Guidelines

From config-controller mode, use the **dsl-group** command to define the DSL group and enter config-controller-dsl-group mode.

Examples

The following example uses the **dsl-group** command to create an IMA-DSL group and enter config-controller-dsl-group mode:

```
Router(config-controller)# dsl-group 1 pairs 0-1 ima

Router(config-controller-dsl-group)#

Sep 14 13:15:40.285:%HWIC_SHDSL-5-DSLGROUP_UPDOWN: SHDSL 0/2/0 dsl-group(1) state changed
to down.
Sep 14 13:15:42.285:%LINK-3-UPDOWN: Interface ATM0/2/IMA1, changed state to down
Sep 14 13:15:43.285:%LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/2/IMA1, changed
state to down
```

Related Commands

Command	Description
controller shdsl	Configures a controller for SHDSL mode and enters config-controller mode.
ima group	Defines physical links as IMA group members.
ima group clock-mode	Sets the clock mode for an IMA group.
ima link	Defines physical links in an IMA group.

Command	Description
shdsl 4-wire mode enhanced	Defines the SHDSL to use enhanced mode in a *2*-pair DSL group.
shdsl annex	Defines the SHDSL G.991.2 standard.
shdsl rate	Defines the SHDSL rate.
show controller shdsl	Displays the status of the controller that is configured for SHDSL mode.

ima-group

To define inverse multiplexing over ATM (IMA) groups, use the **ima-group** command in interface configuration mode for Cisco 7100, 7200, and 7500 series routers; use the command in config controller mode for the Cisco HWIC-4SHDSL. To remove the group, use the **no** form of this command.

Cisco HWIC-4SHDSL

    ima-group [**shutdown** | **minimum-links** *number* | **clock-mode**]

Cisco 7100, 7200, and 7500 series routers

    ima-group *group-number*

    no ima-group *group-number*

Syntax Description

clock-mode	Sets the clock mode for an IMA group
group-number	Specifies an IMA group number from 0 to 3. IMA groups can span multiple ports on a port adapter but cannot span port adapters.
minimum-links *number*	Defines the number of minimum links that must remain in operation for an IMA group to remain in service.
shutdown	Shuts down physical links in an IMA group.

Command Defaults   No IMA groups are defined.

Command Modes   **Cisco HWIC-4SHDSL**

Config controller

Config controller DSL group

Cisco 7100, 7200, and 7500 series routers

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS Release 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was added
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

12.4 (11)XJ	This command was integrated into Cisco IOS Release 12.4 (11)XJ.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

For usage guidelines for using the **clock-mode** keyword, see the command reference page for the **ima group clock-mode** command.

Cisco HWIC-4SHDSL

Use the **dsl-group** command with the optional keyword **ima** to create an IMA DSL group and to enter config-controller-dsl-group mode. Use the **ima group** command to define the links as IMA group members.

Cisco 7100, 7200, and 7500 series routers

When the configuration is first performed or when the group number is changed, the interface is automatically disabled, moved to the new group, and then enabled.

Examples

Cisco HWIC-4SHDSL

The following example uses the **dsl-group** command to create an IMA group and enter config-controller-dsl-group mode on the Cisco HWIC-4SHDSL in a Cisco access router:

```
Router(config-controller)# dsl-group 1 pairs 0-1 ima
Router(config-controller-dsl-group)#

Sep 26 11:43:55.798: %HWIC_SHDSL-5-DSLGROUP_UPDOWN: SHDSL 0/2/0 dsl-group(1) state changed
to down.
Sep 26 11:43:57.798: %LINK-3-UPDOWN: Interface ATM0/2/IMA1, changed state to down
Sep 26 11:43:58.798: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/2/IMA1, changed
state to down

Router (config-controller-dsl-group)# ?

dsl-group configuration sub commands:
  default   Set a command to its defaults
  exit      Exit dsl-group sub commands
  ima       IMA sub commands
  no        Negate a command or set its defaults
  shdsl     Symmetric g.shdsl configuration
  shutdown  Shutdown this dsl-group

Router (config-controller-dsl-group)# ima ?

  group  IMA group configuration
  link   IMA link configuration

Router (config-controller-dsl-group)# ima group ?

  clock-mode     IMA group clock mode configuration
  minimum-links  Minimum number of active links for group UP
  shutdown       IMA group shutdown
```

Cisco 7100, 7200, and 7500 series routers

The following example assigns interface 1 on the ATM module in slot 0 to a member of IMA group 2:

```
interface atm0/1
 ima-group 2
```

Related Commands	Command	Description
	ima group clock-mode	Sets the clock mode for an IMA group.
	ima link	Defines physical links for an IMA group.
	interface atm	Configures an ATM interface.
	interface atm ima	Configures an ATM IMA group.
	show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.
	shutdown (interface)	Disables an interface.

ima group clock-mode

To set the clock mode for an inverse multiplexing over ATM (IMA) group, use the **ima group clock-mode** command in config controller DSL group mode. To disable the current configuration, use the **no** form of this command.

> **ima group clock-mode** {**ctc** | **itc**}

> **no ima group clock-mode**

Syntax Description		
ctc	Sets the transmit clocks for all the links in the IMA group to be derived from the same source.	
itc	Sets the transmit clock source for at least one link in the IMA group to be different from the clock source used by the other links.	

Command Defaults   ctc mode

Command Modes   Config controller DSL group

Command History

Release	Modification
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router, and Cisco 2800 and 3800 series access routers.

Usage Guidelines   This command controls the clock for the IMA group as a whole. If all the links in the group share a clock source, use the **ctc** keyword. If all the links use different clock sources, use the **itc** keyword.

When the **ctc** keyword is set, the **clock source** ATM interface configuration command for the common link determines clocking for all the links in the group. When the **itc** keyword is set, the **clock source** ATM interface configuration command is used under each interface to determine clocking individually.

Because the system automatically chooses a replacement for the common link when it fails, any link in an IMA group can potentially provide the recovered transmit clock. For this reason, even when the common keyword is set with a specific link stipulated by the port value, you should use the ATM interface configuration **clock source** command to make sure that the clock source is configured correctly on each interface in the IMA group.

Examples   The following example uses the **ima group clock-mode** command to configure the clock source for an IMA group:

```
Router(config-controller-dsl-group)# ima group clock-mode ?

  ctc  Common Transmit Clock configuration
  itc  Independent Transmit Clock configuration
```

```
Router(config-controller-dsl-group)# ima group clock-mode ctc ?

  <cr>
```

Related Commands	Command	Description
	clock source	Configures the clock source of a DS1 link.
	interface atm ima	Configures an ATM IMA group.
	show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.

ima link

To modify an inverse multiplexing over ATM (IMA) group link, use the **ima link** command in config controller DSL group mode.

ima link {**add** | **delete** | **shutdown**} *number*

Syntax Description

add	Adds a link to an IMA group.
delete	Deletes a link from an IMA group. The last link cannot be deleted from an IMA group.
shutdown	Shuts down a link in an IMA group.
number	Defines the IMA link number.

Command Defaults

The default value is a minimum of 1 link.

Command Modes

Config controller DSL group

Command History

Release	Modification
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSLrunning on the Cisco 1841 router and on the Cisco 2800 and 3800 series access routers.

Usage Guidelines

Use the **dsl-group** command with the optional keyword, **ima**, to create an IMA DSL group. Then, use the **ima link** command to define the links in the IMA group.

Examples

The following example uses the **ima link** command to modify an IMA DSL group on a Cisco HWIC-4SHDSL that is installed on a Cisco access router:

```
Router(config-controller-dsl-group)# ima link ?

  add       Add a link to the IMA group
  delete    Delete a link from the IMA group
  shutdown  Shutdown a link in the IMA group

Router(config-controller-dsl-group)# ima link add ?

  <0-3>  Link pair number

Router(config-controller-dsl-group)# ima link add 2 ?
  <cr>
```

■   ima link

Related Commands	Command	Description
	interface atm ima	Configures an ATM IMA group.
	show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.
	shutdown (interface)	Disables an interface.

shdsl 4-wire mode

To define the single-pair high-bit-rate digital subscriber line (SHDSL) to use enhanced mode in a 2-pair digital subscriber line (DSL) group, use the **shdsl 4-wire mode** command in config controller DSL group mode. To disable **shdsl 4-wire mode**, use the **no** form of this command.

> **shdsl 4-wire mode enhanced**

> **no shdsl 4-wire mode enhanced**

Syntax Description		
enhanced		Specifies both pairs in a *2-Pair* DSL group to operate in a symmetric 4-wire configuration.

Command Default Standard mode is the default setting.

Command Modes Config controller DSL group

Command History

Release	Modification
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router and on the Cisco 2800 and 3800 series access routers.

Usage Guidelines Use the **dsl-group** command to create a *2-Pair* DSL group and enter config controller DSL group mode. Use the **shdsl 4-wire mode enhanced** command to define both pairs to operate in a symmetric 4-wire configuration.

Examples The following example uses the **shdsl 4-wire mode enhanced** command to configure both pairs in a 2-Pair DSL group to operate in enhanced mode on the Cisco HWIC-4SHDSL:

```
Router (config-controller-dsl-group)# shdsl 4-wire mode ?

  enhanced  4-wire mode start up on both pairs

Router (config-controller-dsl-group)# shdsl 4-wire mode enhanced ?
  <cr>
```

Related Commands

Command	Description
dsl-group	Creates a DSL group and enters config controller DSL group mode.
shdsl annex	Defines the G.991.2 standard for a DSL group.
shdsl rate	Defines the SHDSL rate.

shdsl annex

To define the single-pair high-bit-rate digital subscriber line (SHDSL) G.991.2 standard, use the **shdsl annex** command in config controller DSL group mode.

> **shdsl annex** {*standard*}

Syntax Description	*standard*	Defines the standard for the selected type of DSL group.
		IMA Group
		• A
		• A-B
		• B
		M-PAIR Group
		• A
		• A-B
		• B
		• F {**coding** *16* / *32*}
		• F-G {**coding** *16* / *32*}
		• G {**coding** *16* / *32*}
		1-PAIR and 2-PAIR Group
		• A
		• A-B
		• B
		• F {**coding** *16* / *32*}
		• F-G {**coding** *16* / *32*}
		• G {**coding** *16* / *32*}

Command Default SHDSL annex B

Command Modes Config controller DSL group

Command History	Release	Modification
	12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router and on the Cisco 2800 and 3800 series access routers.

Usage Guidelines   Use the **dsl-group** command to create a DSL group, and then use the **shdsl annex** command to define the G.991.2 standard for the DSL group.

Examples   The following example uses the **shdsl annex** command to define the annex standard for a 2-Pair DSL group on a Cisco HWIC-4SHDSL:

```
Router(config-controller-dsl-group)# shdsl annex ?

  A    Annex A of G.991.2 standard
  A-B  Annex A/B of G.991.2 standard
  B    Annex B of G.991.2 standard
  F    Annex F of G.991.2 standard
  F-G  Annex F/G of G.991.2 standard
  G    Annex G of G.991.2 standard

Router(config-controller-dsl-group)# shdsl annex g ?

  coding  16-TCPAM or 32-TCPAM line coding

Router(config-controller-dsl-group)# shdsl annex g coding ?

  16-TCPAM  16-TCPAM line coding
  32-TCPAM  32-TCPAM line coding

Router(config-controller-dsl-group)# shdsl annex g coding 16 ?

  <cr>
```

Related Commands

Command	Description
dsl-group	Creates a DSL group and enters config controller DSL group mode.
shdsl rate	Defines the SHDSL rate.

shdsl rate

To define the single-pair high-bit-rate digital subscriber line (SHDSL) rate, use the **shdsl rate** command in config-controller-dsl-group mode.

shdsl rate {*number* | **auto**}

Syntax Description	*number*	Defines the SHDSL rate for the digital subscriber line (DSL) group.
		DSL Group with 1 Pair
		Annex A & B—192-2304 kbps
		Annex F & G (32 TC-PAM)—768-5696 kbps
		Annex F & G (16 TC-PAM)—2304-3840 kbps
		DSL Group with 2 Pairs
		Annex A & B—384-4608 kbps
		Annex F & G (32 TC-PAM)—1536-11392 kbps
		Annex F & G (16 TC-PAM)— 4608-7680 kbps
		DSL Group with 3 Pairs
		Annex A & B—576-6912 kbps
		Annex F & G (32 TC-PAM)—2304-12288 kbps
		Annex F & G (16 TC-PAM)— 6912-11520 kbps
		DSL Group with 4 Pairs
		Annex A & B—768-9216 kbps
		Annex F & G (32 TC-PAM)—3072-16384 kbps
		Annex F & G (16 TC-PAM)— 9216-15360 kbps
	auto	Sets this SHDSL rate to automatic mode.

Command Default   The command default is the maximum annex rate for the selected DSL group.

Command Modes   Config controller DSL group

Command History

Release	Modification
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router and on the Cisco 2800 and 3800 series access routers.

Usage Guidelines   Use the **dsl-group** command to create a DSL group, and then use the **shdsl annex** command to define the G.991.2 standard for the newly created DSL group. Define the SHDSL line rate with the **shdsl rate** command.

Examples   The following example defines the SHDSL line rate for DSL group 1, pairs 0-1 (2 pairs) on a Cisco HWIC-4SHDSL:

```
Router(config-controller)# dsl-group 1 pairs 0-1 ima

Router(config-controller-dsl-group)#
Sep 22 14:53:46.481: %HWIC_SHDSL-5-DSLGROUP_UPDOWN: SHDSL 0/2/0 dsl-group(1) state changed
to down.
Sep 22 14:53:48.481: %LINK-3-UPDOWN: Interface ATM0/2/IMA1, changed state to down
Sep 22 14:53:49.481: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/2/IMA1, changed
state to down

Router(config-controller-dsl-group)# shdsl annex ?

  A    Annex A of G.991.2 standard
  A-B  Annex A/B of G.991.2 standard
  B    Annex B of G.991.2 standard

Router(config-controller-dsl-group)# shdsl annex b ?

  <cr>
Router(config-controller-dsl-group)# shdsl rate auto

  <384-4608>  DSL Rate in kbps(line will train at the rate + 16kbps overhead)
  auto        auto rate mode
```

Related Commands

Command	Description
dsl-group	Creates a DSL group and enters config controller DSL group mode.
shdsl annex	Defines the G.991.2 standard for a DSL group.

show controllers shdsl

To display the status of the controller configured for single-pair high-bit-rate digital subscriber line (SHDSL) mode, use the **show controllers shdsl** command in privileged EXEC mode.

Cisco HWIC-4SHDSL and HWIC-2SHDSL

show controllers shdsl *slot number/subslot number/port number* {**brief** | **detailed**}

Cisco IAD2420

show controller shdsl *number*

Syntax Description		
brief	Provides a summary of the controller's status.	
detailed	Provides a detailed report of the controller's status.	
number	SHDSL controller number. The valid controller number for SHDSL mode is 0.	
slot number	Identifies the slot on the router in which the HWIC is installed.	
subslot number	Identifies the subslot on the router in which the HWIC is installed.	
port number	Identifies the port on the router in which the HWIC is installed. By default, the Cisco HWIC-4SHDSL and HWIC-2SHDSL use port number 0.	

Command Defaults   Controller number

Command Modes   Privileged EXEC

Command History	Release	Modification
	12.4(15)T	This command was updated for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router and on the Cisco 2800 and 3800 series access routers.
	12.2(8)T	This command was introduced on Cisco IAD2420 series.

Usage Guidelines   This command is used to display the controller mode, the controller number, and associated statistics.

Examples

Cisco HWIC-4SHDSL and HWIC-2SHDSL

The following example displays the status of a Cisco HWIC-4SHDSL controller in slot 0, subslot 2, port 0 on a Cisco access router:

```
Router# show controllers shdsl 0/2/0 brief

Controller SHDSL 0/2/0 is UP
  Hardware is HWIC-4SHDSL, rev 2 on slot 0, hwic slot 2
```

```
    Capabilities: IMA, M-pair, 2/4 wire, Annex A, B, F & G, CPE termination
    cdb=0x43EB384C, plugin=0x43DE9410, ds=0x43E9A1C4 base=0xB8000000
    FPGA Version is REL.3.4.0, NIOSII FW:Ver 2.6, status Running
    SDC-16i HW:Rev 1.2, status UP, FW:Ver 1.2-1.1.3__57, status Running
    SDFE-4 HW:Rev 1.2, status UP, FW:Ver 1.1-1.5.2__001  , status Running
    NIOSII Firmware image: System
    SDC16i Firmware image: System
    SDFE4  Firmware image: System
    Number of pairs 4, number of groups configured 1
    Ignored CLI cmds(0), Event buffer: in use(0), failed(0)
    Group (0) is Not configured.
    Group (1) info:
          Type: M-pair over g.shdsl, status: Configure Firmware
          Interface: ATM0/2/1, hwidb: 0x43F04EA0, UTOPIA phy 1
          Configured/active num links: 2/0, bit map: 0x3/0x0
          Line termination: CPE, line mode: M-pair, Annex-B, PMMS disabled
          Line coding: 16-TCPAM, configured/actual rate: 4608/0 kbps
          SHDSL wire-pair (0) is in DSL DOWN state
          SHDSL wire-pair (1) is in DSL config state
Router#
```

Cisco IAD2420 Series

The following example displays the status of the controller that is configured for SHDSL mode on a Cisco IAD2420 series IAD:

```
Router# show controller shdsl 0

 SHDSL 0 controller UP
 SLOT 3: Globespan xDSL controller chipset
 Frame mode: Serial ATM
 Configured Line rate: 1160Kbps
 Line Re-activated 0 times after system bootup
 LOSW Defect alarm: None
 CRC per second alarm: None
 Line termination: CPE
 FPGA Revision: 9
```

Related Commands	Command	Description
	controller shdsl 0	Configures the controller status and the controller number.

Additional References

The following references provide links to related topics, such as the Cisco IOS software resource center, interface card documentation, and additional hardware documentation.

Related Documents

Related Topic	Document Title
Cisco IOS software	*Cisco IOS Software* http://www.cisco.com/en/US/products/sw/iosswrel/tsd_products_support_category_home.html
Interface Cards	*Cisco Interface Cards Hardware Installation Guide* http://www.cisco.com/en/US/products/hw/modules/ps2641/products_module_installation_guide_book09186a0080692b21.html *Cisco Network Modules and Interface Cards Regulatory Compliance and Safety Information* http://www.cisco.com/en/US/products/hw/modules/ps2797/products_regulatory_approvals_and_compliance09186a0080183b96.html
Technical documentation, including feedback and assistance	*What's New in Cisco Product Documentation* (including monthly listings of new and revised documents) at http://www.cisco.com/univercd/cc/td/doc/abtunicd/136957.htm

Standards

Standard	Title
• ITU G.991.2	– Annex A – Annex B – Annex F – Annex G
• af-phy-0086.001	– Inverse Multiplexing over ATM version 1.1

MIBs

MIB	MIBs Link
• Entity MIB • Chassis MIB • Interface MIB • AToM MIB • ILMI MIB • IMA MIB • HDSL2-SHDSL-LINE MIB	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

RFC	Title
• G.SHDSL— RFC# 3276	• HDSL2-SHDSL-LINE MIB

Technical Assistance

Description	Link
The Cisco Technical Support & Documentation website contains thousands of 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/techsupport