Asynchronous Transfer Mode
Configuration Guide, Cisco IOS XE
Release 2

C O N T E N T S

Configuring ATM

This chapter describes how to configure ATM on the Cisco ASR 1000 Series Aggregation Services Routers.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Enabling the ATM Interface

This section describes how to configure an ATM interface. For the AIP, all ATM port adapters, and the 1-port ATM-25 network module, the port number is always 0. For example, the *slot/port* address of an ATM interface on an AIP installed in slot 1 is 1/0.

To configure the ATM interface, use the following commands beginning in privileged EXEC mode:

SUMMARY STEPS

1. Router# **configure terminal**
2. Do one of the following:

   - Router(config)# **interface atm** *slot* **/0**
   -
   -
   - Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**
3. Router(config-if)# **ip address** *ip-address mask*
4. Router(config-if)# **no shutdown**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode from the terminal.
Step 2	Do one of the following: • Router(config)# **interface atm** *slot* **/0** • • • Router(config)# **interface atm** *slot* **/** *port-adapter* **/0** **Example:** **Example:** **Example:** `Router(config)#` **interface atm** *number*	Specifies the ATM interface using the appropriate format of the **interface atm** command. To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.
Step 3	Router(config-if)# **ip address** *ip-address mask*	(Optional) If IP routing is enabled on the system, assigns a source IP address and subnet mask to the interface.
Step 4	Router(config-if)# **no shutdown** **Example:**	Changes the shutdown state to up and enables the ATM interface, thereby beginning the segmentation and reassembly (SAR) operation on the interface. • The **no shutdown** command passes an **enable** command to the ATM interface, which then begins segmentation and reassembly (SAR) operations. It also causes the ATM interface to configure itself based on the previous configuration commands sent.

Configuring PVCs

To use a permanent virtual circuit (PVC), you must configure the PVC into both the router and the ATM switch. PVCs remain active until the circuit is removed from either configuration.

When a PVC is configured, all the configuration options are passed on to the ATM interface. These PVCs are writable into the nonvolatile RAM (NVRAM) as part of the Route Processor (RP) configuration and are used when the RP image is reloaded.

Some ATM switches might have point-to-multipoint PVCs that do the equivalent of broadcasting. If a point-to-multipoint PVC exists, then that PVC can be used as the sole broadcast PVC for all multicast requests.

To configure a PVC, perform the tasks in the following sections. The first two tasks are required; the other tasks are optional.

Creating a PVC

Note After configuring the parameters for an ATM PVC, you must exit interface-ATM-VC configuration mode in order to create the PVC and enable the settings.

To create a PVC on the ATM interface and enter interface-ATM-VC configuration mode, use the following command beginning in interface configuration mode:

Command	Purpose
`Router(config-if)#` **pvc** [*name*] *vpi* /*vci*	Configures a new ATM PVC by assigning a name (optional) and VPI/VCI numbers. Enters interface-ATM-VC configuration mode. • Once you specify a name for a PVC, you can reenter the interface-ATM-VC configuration mode by simply entering **pvc** *name*. • See examples of PVC configurations in the section "ATM Configuration Examples, page 20".

Mapping a Protocol Address to a PVC

The ATM interface supports a static mapping scheme that identifies the network address of remote hosts or routers. This section describes how to map a PVC to an address, which is a required task for configuring a PVC.

✎ **Note** If you enable or disable broadcasting directly on a PVC using the **protocol** command, this configuration will take precedence over any direct configuration using the **broadcast** command.

See examples of PVC configurations in the section "ATM Configuration Examples, page 20".

To map a protocol address to a PVC, use the following command in interface-ATM-VC configuration mode:

Command	Purpose
`Router(config-if-atm-vc)#` **protocol** *protocol* *protocol-address* [[**no**] **broadcast**]	Maps a protocol address to a PVC.

Configuring the AAL and Encapsulation Type

To configure the ATM adaptation layer (AAL) and encapsulation type, use the following command beginning in interface-ATM-VC configuration mode:

Command	Purpose
`Router(config-if-atm-vc)#` **encapsulation aal5** *encap*	Configures the ATM adaptation layer (AAL) and encapsulation type. • For a list of AAL types and encapsulations supported for the *aal-encap* argument, refer to the **encapsulation aal5** command in the "ATM Commands" chapter of the *Cisco IOS Wide-Area Networking Command Reference*. The global default is AAL5 with SNAP encapsulation.

Configuring PVC Traffic Parameters

The supported traffic parameters are part of the following service categories: Constant Bit Rate (CBR), Unspecified Bit Rate (UBR), Variable Bit Rate Non Real-Time (VBR-NRT), and real-time Variable Bit Rate (VBR). Only one of these categories can be specified per PVC connection so if a new one is entered, it will replace the existing one.

✎ **Note** The commands in this section are not supported on the ATM port adapter (PA-A1 series). The 1-port ATM-25 network module only supports UBR.

The *-pcr* and *-mcr* arguments are the peak cell rate and minimum cell rate, respectively. The *-scr* and *-mbs* arguments are the sustainable cell rate and maximum burst size, respectively.

For a description of how to configure traffic parameters in a VC class and apply the VC class to an ATM interface or subinterface, refer to the section "Configuring VC Classes, page 12."

To configure PVC traffic parameters, use one of the following commands beginning in interface-ATM-VC configuration mode:

Command	Purpose
Router(config-if-atm-vc)# **cbr** *peak_cell_rate_KBPS*	Configures the Constant Bit Rate (CBR).
Router(config-if-atm-vc)# **ubr** *output-pcr*	Configures the Unspecified Bit Rate (UBR).
Router(config-if-atm-vc)# **vbr-nrt** *output-pcr* *output-scr* *output-mbs*	Configures the Variable Bit Rate-Non Real Time (VBR-NRT) QOS.
Router(config-if-atm-vc)# **vbr-rt** *peak-rate* *average-rate* *burst*	Configures the real-time Variable Bit Rate (VBR). (Cisco MC3810 and Multiport T1/E1 ATM Network Module only.)

Enabling Inverse ARP

Inverse ARP is enabled by default when you create a PVC using the **pvc** command. Once configured, a protocol mapping between an ATM PVC and a network address is learned dynamically as a result of the exchange of ATM Inverse ARP packets.

Inverse ARP is supported on PVCs running IP or IPX and no static map is configured. If a static map is configured, Inverse ARP will be disabled.

When PVC discovery is enabled on an active PVC and the router terminates that PVC, the PVC will generate an ATM Inverse ARP request. This allows the PVC to resolve its own network addresses without configuring a static map.

Address mappings learned through Inverse ARP are aged out. However, mappings are refreshed periodically. This period is configurable using the **inarp** command, which has a default of 15 minutes.

You can also enable Inverse ARP using the **protocol** command. This is necessary only if you disabled Inverse ARP using the **no protocol** command. For more information about this command, refer to the "ATM Commands" chapter in the *Cisco IOS Wide-Area Networking Command Reference*.

For an example of configuring Inverse ARP, see the section "Enabling Inverse ARP Example, page 22".

To enable Inverse ARP on an ATM PVC, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Do one of the following:

   - Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}]
   -
   -
   - Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number*{**multipoint** | **point-to-point**}]

2. Router(config-if)# **pvc** [*name*] *vpi* **/** *vci*

3. Router(config-if-atm-vc)# **encapsulation aal5snap**

4. Router(config-if-atm-vc)# **inarp** *minutes*

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	Do one of the following: • Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}] • • • Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number*{**multipoint** | **point-to-point**}] **Example:** **Example:** **Example:** `Router(config)#` **interface atm** *number*[**.** *subinterface-number* {**multipoint** | **point-to-point**}]	Specifies the ATM interface using the appropriate format of the **interface atm** command.[1]
Step 2	Router(config-if)# **pvc** [*name*] *vpi* **/** *vci*	Specifies an ATM PVC by name (optional) and VPI/VCI numbers.
Step 3	Router(config-if-atm-vc)# **encapsulation aal5snap**	Configures AAL5 LLC-SNAP encapsulation if it is not already configured.
Step 4	Router(config-if-atm-vc)# **inarp** *minutes*	(Optional) Adjusts the Inverse ARP time period.

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1 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

Enabling ANCP on an ATM Interface

The **ancp enable** command should be configured only for the control VCs on which the Access Node Control Protocol (ANCP) message is sent from the DSLAM. Use the following procedure to enable ANCP on ATM interfaces. For an example of enabling ANCP, see the section Enabling ANCP on ATM Interfaces Example, page 22.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ancp adjacency timer** *interval*
4. **interface atm** *slot* / *subslot* / *port* **.** *subinterface*
5. **ip address** *ip-address mask*
6. **pvc** *vpi* / *vci*
7. **ancp enable**
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> **enable**	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# **configure terminal**	Enters global configuration mode.
Step 3	**ancp adjacency timer** *interval* **Example:** Router(config)# **ancp adjacency timer 100**	Sets the ANCP adjacency timer interval, which specifies the amount of time to wait before sending an ANCP hello packet to the DSLAM. • Valid values are defined in units of 100 milliseconds (ms). Default: 100 (10 seconds).
Step 4	**interface atm** *slot* / *subslot* / *port* **.** *subinterface* **Example:** Router(config)# **interface atm 2/0/1.1**	Creates or modifies a subinterface and enters subinterface configuration mode.

Command or Action	Purpose
Step 5 **ip address** *ip-address mask* **Example:** Router(config-subif)# **ip address 10.16.1.2 255.255.0.0**	Assigns an IP address and subnet mask to the subinterface.
Step 6 **pvc** *vpi* / *vci* **Example:** Router(config-subif)# **pvc 2/100**	Enables an ANCP connection over ATM PVC and enters ATM virtual circuit configuration mode.
Step 7 **ancp enable** **Example:** Router(config-if-atm-vc)# **ancp enable**	Enables ANCP on the interface where IP is configured.
Step 8 **exit** **Example:** Router(config-if-atm-vc)# **exit**	Exits ATM virtual circuit configuration mode.

Configuring Loopback Cells to Verify Connectivity

You can optionally configure the PVC to generate end-to-end F5 OAM loopback cells to verify connectivity on the virtual circuit. The remote end must respond by echoing back such cells. If OAM response cells are missed (indicating the lack of connectivity), the PVC state goes down. If all the PVCs on a subinterface go down, the subinterface goes down.

For information about managing PVCs using OAM, see the section "Configuring OAM Management for PVCs, page 15".

For an example of OAM loopback cell generation, see the section "Configuring Loopback Cells Example, page 23".

To configure transmission of end-to-end F5 OAM cells on a PVC, use the following commands in interface-ATM-VC configuration mode:

SUMMARY STEPS

1. Router(config-if-atm-vc)# **oam-pvc** [**manage**] *frequency*
2. Router(config-if-atm-vc)# **oam retry** *up-count down-count retry-frequency*

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config-if-atm-vc)# **oam-pvc** [**manage**] *frequency*	Configures transmission of end-to-end F5 OAM loopback cells on a PVC, specifies how often loopback cells should be sent, and optionally enables OAM management of the connection.
Step 2	Router(config-if-atm-vc)# **oam retry** *up-count down-count retry-frequency*	(Optional) Specifies OAM management parameters for verifying connectivity of a PVC connection. This command is only supported if OAM management is enabled. • Use the *up-count*argument to specify the number of consecutive end-to-end F5 OAM loopback cell responses that must be received in order to change a PVC connection state to up. Use the *down-count*argument to specify the number of consecutive end-to-end F5 OAM loopback cell responses that are not received in order to tear down a PVC. Use the *retry-frequency* argument to specify the frequency (in seconds) that end-to-end F5 OAM loopback cells should be transmitted when a change in UP/DOWN state is being verified. For example, if a PVC is up and a loopback cell response is not received after the *frequency* (in seconds) specified using the **oam-pvc** command, then loopback cells are sent at the *retry-frequency* to verify whether or not the PVC is down.

Configuring Broadcast on a PVC

To send duplicate broadcast packets for all protocols configured on a PVC, use the following command in interface-ATM-VC configuration mode:

Note   If you enable or disable broadcasting directly on a PVC using the **protocol** command, this configuration will take precedence over any direct configuration using the **broadcast** command.

Command	Purpose
Router(config-if-atm-vc)# **broadcast**	Sends duplicate broadcast packets for all protocols configured on a PVC.

Assigning a VC Class to a PVC

By creating a VC class, you can preconfigure a set of default parameters that you may apply to a PVC. To create a VC class, refer to the section "Configuring VC Classes, page 12".

Once you have created a VC class, use the following command in interface-ATM-VC configuration mode to apply the VC class to a PVC:

Command	Purpose
`Router(config-if-atm-vc)#` **class-vc** *vc-class-name*	Applies a VC class to a PVC. • The *vc-class-name* argument is the same as the *name* argument you specified when you created a VC class using the **vc-class atm** command. Refer to the section "Configuring VC Classes, page 12" for a description of how to create a VC class.

Configuring PVC Trap Support

You can configure the PVC to provide failure notification by sending a trap when a PVC on an ATM interface fails or leaves the UP operational state.

PVC Failure Notification

Only one trap is generated per hardware interface, within the specified interval defined by the interval "atmIntPvcNotificationInterval". If other PVCs on the same interface go DOWN during this interval, traps are generated and held until the interval has elapsed. Once the interval has elapsed, the traps are sent if the PVCs are still DOWN.

No trap is generated when a PVC returns to the UP state after having been in the DOWN state. If you need to detect the recovery of PVCs, you must use the SNMP management application to regularly poll your router.

PVC Status Tables

When PVC trap support is enabled, the SNMP manager can poll the SNMP agent to get PCV status information. The table "atmInterfaceExtTable" provides PVC status on an ATM interface. The table "atmCurrentlyFailingPVclTable" provides currently failing and previously failed PVC time-stamp information.

Note PVC traps are only supported on permanent virtual circuit links (PVCLs), not permanent virtual path links (PVPLs).

Prerequisites

Before you enable PVC trap support, you must configure SNMP support and an IP routing protocol on your router. See the "ATM Configuration Examples, page 20" section.

For more information about configuring SNMP support, refer to the chapter "Configuring SNMP Support" in the *Cisco IOS Configuration Fundamentals Configuration Guide*.

For information about configuring IP routing protocols, refer to the *Cisco IOS IP Routing Protocols Configuration Guide*.

To receive PVC failure notification and access to PVC status tables on your router, you must have the Cisco PVC trap MIB called CISCO-IETF-ATM2-PVCTRAP-MIB.my compiled in your NMS application. You can find this MIB on the Web at Cisco's MIB websiteat the URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

Enabling PVC Trap Support

When you configure PVC trap support, you must also enable OAM management on the PVC.

For more information on OAM management, see the section "Configuring OAM Management for PVCs, page 15" later in this chapter.

The new objects in this feature are defined in the IETF draft The Definitions of Managed Objects for ATM Management , which is an extension to the AToM MIB (RFC 1695).

For an example of configuring PVC trap support, see the section "Configuring PVC Trap Support Example, page 23".

To enable PVC trap support and OAM management, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Router(config)# **snmp-server enable traps atm pvc interval** *seconds***fail-interval** *seconds*
2. Do one of the following:

   - Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}]
   -
   -
   - Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}]
3. Router(config-if)# **pvc** [*name*] *vpi* **/** *vci*
4. Router(config-if-atm-vc)# **oam-pvc manage**

DETAILED STEPS

Command or Action	Purpose
Step 1 Router(config)# **snmp-server enable traps atm pvc interval** *seconds***fail-interval** *seconds*	Enables PVC trap support.

	Command or Action	Purpose
Step 2	Do one of the following: • Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}] • • Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}] **Example:** `Router(config)#` **interface atm** *number*[**.** *subinterface-number* {**multipoint** | **point-to-point**}]	Specifies the ATM interface using the appropriate form of the **interface atm** command.[2]
Step 3	Router(config-if)# **pvc** [*name*] *vpi* **/** *vci*	Enables the PVC.
Step 4	Router(config-if-atm-vc)# **oam-pvc manage**	Enables end-to-end OAM management for an ATM PVC.

Configuring VC Classes

A VC class is a set of preconfigured VC parameters that you configure and apply to a particular VC or ATM interface. You may apply a VC class to an ATM main interface, subinterface, or PVC. For example, you can create a VC class that contains VC parameter configurations that you will apply to a particular PVC. You might create another VC class that contains VC parameter configurations that you will apply to all VCs configured on a particular ATM main interface or subinterface. Refer to the "ATM Configuration Examples, page 20" section for examples of VC class configurations.

Creating a VC Class

To create a VC class, use the following command in global configuration mode:

For examples of creating VC classes, see the section "Creating a VC Class Example, page 23".

Command	Purpose
`Router(config)#` **vc-class atm** *name*	Creates a VC class and enters vc-class configuration mode.

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2 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

Configuring VC Parameters

After you create a VC class and enter vc-class configuration mode, configure VC parameters using one or more of the following commands:

- **broadcast**
- **cbr**
- **encapsulation aal5**
- **idle-timeout**
- **inarp**
- **oam-pvc**
- **oam retry**
- **protocol**
- **ubr**
- **vbr-nrt**

Refer to the sections "Configuring PVCs, page 3" and "Configuring PVC Trap Support, page 10" for descriptions of how to configure these commands for PVCs.

For examples of creating VC classes, see the section "Creating a VC Class Example, page 23".

Applying a VC Class on an ATM PVC

Once you have created and configured a VC class, you can apply it directly on an ATM PVC, or you can apply it on an ATM interface or subinterface.

To apply a VC class directly on an ATM PVC use the following commands beginning in interface configuration mode:

SUMMARY STEPS

1. Router(config-if)# **pvc** [*name*] *vpi* / *vci*
2. Router(config-if-atm-vc)# **class-vc***vc-class-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config-if)# **pvc** [*name*] *vpi* / *vci*	Specifies an ATM PVC
Step 2	Router(config-if-atm-vc)# **class-vc***vc-class-name*	Applies a VC class directly on the PVC.

Applying a VC Class on an ATM Interface

To apply a VC class on an ATM main interface or subinterface, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Do one of the following:

   - Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}]
   -
   -
   - Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}]

2. Router(config-if)# **class-int** *vc-class-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	Do one of the following: • Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint**	**point-to-point**}] • • • Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number* {**multipoint**	**point-to-point**}] **Example:** **Example:** **Example:** `Router(config)#` **interface atm** *number*[**.** *subinterface-number* {**multipoint**	**point-to-point**}]	Specifies the ATM interface using the appropriate format of the **interface atm** command.[3]
Step 2	Router(config-if)# **class-int** *vc-class-name*	Applies a VC class on an the ATM main interface or subinterface.

Configuring VC Management

When you configure VC management, you enable the router to detect VC connections and disconnections automatically. This notifies protocols to reroute packets immediately, preventing protocols from waiting for unpredictable and relatively long timeout periods.

You may use operation, administration, and maintenance (OAM) to manage your PVCs, and decide which method is reliable in your particular network.

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[3] To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

When a PVC goes down, route caches for protocols configured on that PVC are cleared (or flushed) so that new routes may be learned. The route cache flush is applied on the PVC's interface. When all PVCs on a subinterface go down, VC management shuts down the subinterface in addition to flushing route caches. ATM hardware must keep the PVC active, however, so that OAM cells may flow. When any PVC on a subinterface comes up, the subinterface is brought up.

VC management using OAM is referred to as OAM management.

- Configuring OAM Management for PVCs, page 15
- Configuring Classical IP and Inverse ARP in a PVC Environment, page 17

Configuring OAM Management for PVCs

OAM management may be enabled for PVCs.

By default, end-to-end F5 OAM loopback cell generation is turned off for each PVC. A PVC is determined as down when any of the following is true on that PVC:

- The router does not receive a loopback reply after a configured number of retries of sending end-to-end F5 OAM loopback cells.
- The router receives a Virtual Circuit-Alarm Indication Signals (VC-AIS) cell.
- The router receives a Virtual Circuit-Remote Detect Indicator (VC-RDI) cell.

A PVC is determined as up when all of the following are true on that PVC:

- The router receives a configured number of successive end-to-end F5 OAM loopback cell replies.
- The router does not receive VC-AIS cell for 3 seconds.
- The router does not receive VC-RDI cell for 3 seconds.

To configure OAM management for an ATM PVC, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Do one of the following:
   - Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}]
   -
   -
   - Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}]
2. Router(config-if)# **pvc** [*name*] *vpi* **/** *vci*
3. Router(config-if-atm-vc)# **oam-pvc manage** [*frequency*]
4. Router(config-if-atm-vc)# **oam retry** *up-count down-count retry-frequency*

DETAILED STEPS

	Command or Action	Purpose
Step 1	Do one of the following: • Router(config)# **interface atm** *slot* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}] • • • Router(config)# **interface atm** *slot* **/** *port-adapter* **/0**[**.** *subinterface-number* {**multipoint** | **point-to-point**}] **Example:** **Example:** **Example:** `Router(config)# Router(config)#` **interface atm** *number*[**.** *subinterface-number* {**multipoint** | **point-to-point**}]	Specifies the ATM interface using the appropriate format of the **interface atm** command.[4]
Step 2	Router(config-if)# **pvc** [*name*] *vpi* **/** *vci*	Specifies the ATM PVC.
Step 3	Router(config-if-atm-vc)# **oam-pvc manage** [*frequency*]	Enables OAM management on the PVC.

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4 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

	Command or Action	Purpose
Step 4	Router(config-if-atm-vc)# **oam retry** *up-count down-count retry-frequency*	(Optional) Specifies OAM management parameters for re-establishing and removing a PVC connection.
		• Use the *up-count*argument to specify the number of consecutive end-to-end F5 OAM loopback cell responses that must be received in order to change a PVC connection state to up. Use the *down-count*argument to specify the number of consecutive end-to-end F5 OAM loopback cell responses that are not received in order to tear down a PVC. Use the *retry-frequency* argument to specify the frequency (in seconds) that end-to-end F5 OAM loopback cells should be transmitted when a change in UP/DOWN state is being verified. For example, if a PVC is up and a loopback cell response is not received after the *frequency* (in seconds) specified using the **oam-pvc** command, then loopback cells are sent at the *retry-frequency* to verify whether or not the PVC is down.

Configuring Classical IP and Inverse ARP in a PVC Environment

The ATM Inverse ARP mechanism is applicable to networks that use PVCs, where connections are established but the network addresses of the remote ends are not known. A server function is *not* used in this mode of operation.

By default, Inverse ARP datagrams will be sent on this virtual circuit every 15 minutes. To adjust the Inverse ARP time period, use the **inarp** *minutes* command in interface-ATM-VC configuration mode.

Note   The ATM ARP mechanism works with IP only. The Inverse ATM ARP mechanism works with IP and IPX only. For all other protocols, the destination address must be specified.

In a PVC environment, the ATM Inverse ARP mechanism is enabled by default for IP and IPX when you use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Do one of the following:

   • Router(config)# **interface atm** *slot* **/0**
   •
   •
   • Router(config)# **interface atm** *slot* / *port-adapter* **/0**

2. Router(config-if)# **ip address** *address mask*

3. Router(config-if)# **pvc** [*name*] *vpi* / *vci*

4. Router(config-if-atm-vc)# **no shutdown**

5.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Do one of the following: • Router(config)# **interface atm** *slot* **/0** • • • Router(config)# **interface atm** *slot* / *port-adapter* **/0** **Example:** **Example:** **Example:** `Router(config)#` **interface atm** *number*	Specifies the ATM interface using the appropriate format of the **interface atm** command.[5]
Step 2	Router(config-if)# **ip address** *address mask*	Specifies the IP address of the interface.
Step 3	Router(config-if)# **pvc** [*name*] *vpi* / *vci*	Creates a PVC.
Step 4	Router(config-if-atm-vc)# **no shutdown**	Enables the ATM interface.
Step 5		Repeat Step 3 for each PVC you want to create.

Customizing the ATM Interface

You can customize the ATM interface. The features you can customize have default values that will most likely suit your environment and probably need not be changed. However, you might need to enter configuration commands, depending upon the requirements for your system configuration and the protocols you plan to route on the interface.

Configuring MTU Size

Each interface has a default maximum packet size or maximum transmission unit (MTU) size. For ATM interfaces, this number defaults to 4470 bytes. The maximum is 9188 bytes for the AIP and NPM, 17969 for the ATM port adapter, and 17998 for the ATM-CES port adapter. The MTU can be set on a per-sub-interface basis as long as the interface MTU is as large or larger than the largest subinterface MTU.

To set the maximum MTU size, use the following command in interface configuration mode:

---

5 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

Command	Purpose
`Router(config-if)#` **mtu** *bytes*	Sets the maximum MTU size.

Monitoring and Maintaining the ATM Interface

After configuring an ATM interface, you can display its status. You can also display the current state of the ATM network and connected virtual circuits. To show current virtual circuits and traffic information, use the following commands in EXEC mode:

Command	Purpose
`Router#` **show arp**	Displays entries in the ARP table.
`Router#` **show atm class-links** {*vpi* **/** *vci* | *name*}	Displays PVC parameter configurations and where the parameter values are inherited from.
`Router#` **show atm interface atm** *slot* **/0** `Router#` **show atm interface atm** *slot* **/** *port-adapter* **/0** `Router#` **show atm interface atm** *number*	Displays ATM-specific information about the ATM interface using the appropriate format of the **show atm interface atm** command.[6]
`Router#` **show atm map**	Displays the list of all configured ATM static maps to remote hosts on an ATM network.
`Router#` **show atm pvc** [*vpi* **/** *vci* | *name* | **interface atm** *interface_number*]	Displays all active ATM PVCs and traffic information.
`Router#` **show atm traffic**	Displays global traffic information to and from all ATM networks connected to the router, OAM statistics, and a list of counters of all ATM traffic on this router.
`Router#` **show atm vc** [*vcd-number* | [**range** *lower-limit-vcd upper-limit-vcd*] [**interface ATM** *interface-number*] [**detail** [**prefix** {**vpi/vci** | **vcd** | **interface** | **vc_name**}]] [*connection-name*] | **signalling** [**freed-svcs** | [**cast-type** {**p2mp** | **p2p**}] [**detail**] [**interface ATM** *interface-number*]] | **summary ATM** *interface-number*]	Displays all active ATM virtual circuits (PVCs) and traffic information. **Note** The SVCs and the **signalling** keyword are not supported on the Cisco ASR 1000 series routers.

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6 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

Command	Purpose
Router# **show interfaces atm** Router# **show interfaces atm** *slot* **/0** Router# **show interfaces atm** *slot* **/** *port-adapter* **/0**	Displays statistics for the ATM interface using the appropriate format of the **show interfaces atm** command.
Router# **show network-clocks**	Displays the clock signal sources and priorities that you established on the router.

ATM Configuration Examples

The examples in the following sections illustrate how to configure ATM for the features described in this chapter. The examples below are presented in the same order as the corresponding configuration task sections:

Creating a PVC Example

The following example shows how to create a PVC on an ATM main interface with AAL5/MUX encapsulation configured and a VBR-NRT QOS specified. For further information, refer to the sections "Creating a PVC, page 3" and "Configuring PVC Traffic Parameters, page 4".

```
interface 2/0
 pvc cisco 1/40
 encapsulation aal5mux ip
 vbr-nrt 100000 50000 20
 exit
```

PVC with AAL5 and LLC SNAP Encapsulation Examples

The following example shows how to create a PVC 0/50 on ATM interface 3/0. It uses the global default LLC/SNAP encapsulation over AAL5. The interface is at IP address 1.1.1.1 with 1.1.1.5 at the other end of the connection. For further information, refer to the sections "Creating a PVC, page 3" and "Mapping a Protocol Address to a PVC, page 4".

```
interface atm 3/0
```

```
 ip address 1.1.1.1 255.255.255.0
 pvc 0/50
 protocol ip 1.1.1.5 broadcast
 exit
!
 ip route-cache cbus
```

The following example is a typical ATM configuration for a PVC:

```
interface atm 4/0
 ip address 172.21.168.112 255.255.255.0
 atm maxvc 512
 pvc 1/51
 protocol ip 171.21.168.110
 exit
!
 pvc 2/52
 protocol decnet 10.1 broadcast
 exit
!
 pvc 3/53
 protocol clns 47.004.001.0000.0c00.6e26.00 broadcast
 exit
!
 decnet cost 1
 clns router iso-igrp comet
 exit
!
router iso-igrp comet
 net 47.0004.0001.0000.0c00.6666.00
 exit
!
router igrp 109
 network 172.21.0.0
 exit
!
ip domain-name CISCO.COM
```

PVCs in a Fully Meshed Network Example

The figure below illustrates a fully meshed network. The configurations for routers A, B, and C follow the figure. In this example, the routers are configured to use PVCs. Fully meshed indicates that any workstation can communicate with any other workstation. Note that the two **protocol** statements configured in router A identify the ATM addresses of routers B and C. The two **protocol** statements in router B identify the ATM addresses of routers A and C. The two **protocol** statements in router C identify the ATM addresses of routers A and B. For further information, refer to the sections "Creating a PVC, page 3" and "Mapping a Protocol Address to a PVC, page 4".

Figure 1   *Fully Meshed ATM Configuration Example*
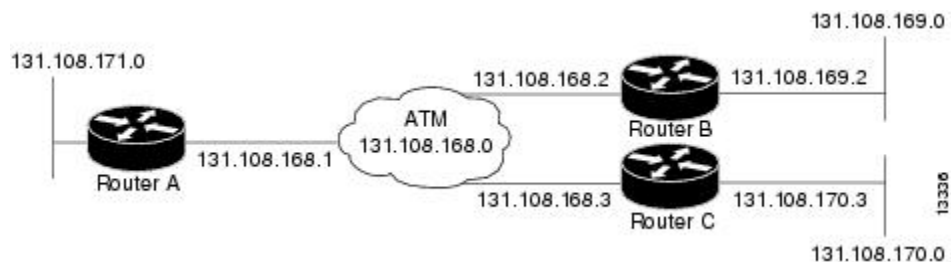
Router A

```
ip routing
```

```
!
interface atm 4/0
 ip address 131.108.168.1 255.255.255.0
 pvc 0/32
 protocol ip 131.108.168.2 broadcast
 exit
!
 pvc 0/33
 protocol ip 131.108.168.3 broadcast
 exit
```

Router B

```
ip routing
!
interface atm 2/0
 ip address 131.108.168.2 255.255.255.0
 pvc test-b-1 0/32
 protocol ip 131.108.168.1 broadcast
 exit
!
 pvc test-b-2 0/34
 protocol ip 131.108.168.3 broadcast
 exit
```

Router C

```
ip routing
!
interface atm 4/0
 ip address 131.108.168.3 255.255.255.0
 pvc 0/33
 protocol ip 131.108.168.1 broadcast
 exit
!
 pvc 0/34
 protocol ip 131.108.168.2 broadcast
 exit
```

Enabling Inverse ARP Example

The following example shows how to enable Inverse ARP on an ATM interface and specifies an Inverse ARP time period of 10 minutes. For further information, refer to the section "Enabling Inverse ARP, page 5".

```
interface atm 2/0
 pvc 1/32
 inarp 10
 exit
```

Enabling ANCP on ATM Interfaces Example

The following example shows how to enable ANCP on an ATM subinterface. In the example, ANCP is enabled on ATM subinterface 2/0/1.1.

```
interface ATM2/0/0.1 point-to-point
     description ANCP Link to one DSLAM
     no ip mroute-cache
     ip address 192.168.0.2 255.255.255.252
     pvc 254/32
       protocol ip 192.168.0.1
       ancp enable
       no snmp trap link-status
```

Configuring Loopback Cells Example

The following example shows how to enable OAM management on an ATM PVC. The PVC is assigned the name routerA and the VPI and VCI are 0 and 32, respectively. OAM management is enabled with a frequency of 3 seconds between OAM cell transmissions. For further information, refer to the section "Enabling ANCP on an ATM Interface, page 7".

```
interface atm 2/0
 pvc routerA 0/32
 oam-pvc manage 3
 oam retry 5 5 10
```

Configuring PVC Trap Support Example

The following example shows how to configure PVC trap support on your Cisco router:

```
!For PVC trap support to work on your router, you must first have SNMP support and
!an IP routing protocol configured on your router:
Router(config)# snmp-server community public ro
Router(config)# snmp-server host 171.69.61.90 public

Router(config)# ip routing
Router(config)# router igrp 109
Router(config-router)# network 172.21.0.0
!
!Enable PVC trap support and OAM management:
Router(config)# snmp-server enable traps atm pvc interval 40 fail-interval 10
Router(config)# interface atm 1/0.1
Router(config-if)# pvc 0/1
Router(config-if-atm-vc)# oam-pvc manage
!
! Now if PVC 0/1 goes down, host 171.69.61.90 will receive traps.
```

For further information, refer to the "Configuring PVC Trap Support, page 10" section.

Creating a VC Class Example

The following example shows how to create a VC class named main and how to configure UBR and encapsulation parameters. For further information, refer to the sections "Creating a VC Class, page 12" and "Configuring VC Parameters, page 13".

```
vc-class atm main
 ubr 10000
 encapsulation aal5mux ip
```

The following example shows how to create a VC class named sub and how to configure UBR and PVC management parameters. For further information, refer to the sections "Creating a VC Class, page 12" and "Configuring VC Parameters, page 13".

```
vc-class atm sub
 ubr 15000
 oam-pvc manage 3
```

The following example shows how to create a VC class named pvc and how to configure VBR-NRT and encapsulation parameters. For further information, refer to the sections "Creating a VC Class, page 12" and "Configuring VC Parameters, page 13".

```
vc-class atm pvc
 vbr-nrt 10000 5000 64
 encapsulation aal5snap
```

Applying a VC Class Example

The following example shows how to apply the VC class named main to the ATM main interface 4/0. For further information, refer to the section "Applying a VC Class on an ATM PVC, page 13".

```
interface atm 4/0
 class-int main
 exit
```

The following example shows how to apply the VC class named sub to the ATM subinterface 4/0.5:

```
interface atm 4/0.5 multipoint
 class-int sub
 exit
```

The following example shows how to apply the VC class named pvc directly on the PVC 0/56:

```
interface atm 4/0.5 multipoint
 pvc 0/56
 class-vc pvc
 exit
```

OAM Management on an ATM PVC Example

The following example shows how to enable OAM management on an ATM PVC. The PVC is assigned the name routerA and the VPI and VCI are 0 and 32, respectively. OAM management is enabled with a frequency of 3 seconds between OAM cell transmissions. For further information, refer to the section "Configuring OAM Management for PVCs, page 15".

```
interface atm 2/0
 pvc routerA 0/32
 oam-pvc manage 3
 oam retry 5 5 10
!
interface atm 4/0.1 point-to-point
 pvc 0/35
 exit
```

No **map-group** and **map-list** commands are needed for IP.

```
interface atm 4/0
 ip address 1.1.1.1 255.0.0.0
 pvc 1/33
 pvc 1/34
 pvc 1/35
 bridge-group 1
!
bridge 1 protocol dec
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

Related Topic	Document Title
ATM commands	*Cisco IOS Asynchronous Transfer Mode Command Reference*
ATM SPAs	"Overview of ATM SPAs" in the *Cisco ASR 1000 Series Aggregation Services Routers SIP and SPA Software Configuration Guide*
Configuring IP to ATM class of service (CoS)	• "IP to ATM CoS Overview" • "Configuring IP to ATM CoS"
Configuring PPP over Ethernet (PPPoE) over ATM	"Configuring PPPoE over ATM"

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
• Cisco PVC trap MIB - CISCO-IETF-ATM2-PVCTRAP-MIB	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Configuring ATM

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1   *Feature Information for Configuring ATM*

Feature Name	Releases	Feature Information
Configuring ATM, ATM Sub-interface Multipoint Enabling ANCP on ATM interfaces	Cisco IOS Release 2.5.0	ATM supports two types of interfaces: point-to-point and multipoint. • Point-to-point subinterface-- With point-to-point subinterfaces, each pair of routers has its own subnet. If you put the PVC on a point-to-point subinterface, the router assumes that there is only one point-to-point PVC configured on the subinterface. Therefore, any IP packets with a destination IP address in the same subnet are forwarded on this virtual circuit (VC). This is the simplest way to configure the mapping and is therefore the recommended method. • Multipoint networks-- Multipoint networks have three or more routers in the same subnet. If you put the PVC in a point-to-multipoint subinterface or in the main interface (which is multipoint by default), you need to either configure a static mapping or enable inverse Address Resolution Protocol (ARP) for dynamic mapping. ANCP needs to be enabled on ATM interface when message is sent from the DSLAM. The following commands were introduced or modified: **pvc**, **protocol**, **cbr**, **ubr**, **encapsulation aal5snap**, **interface atm**, **ip address**, **inarp**, **oam-pvc manage**, **oam-retry**, **class-vc**, **snmp-server enable traps**, **vc-class atm**, **class-int**, **mtu**, **show atm class-links**, **show**

Feature Name	Releases	Feature Information
		atm interface atm, **show atm map**, **show atm pvc**, **show atm traffic**, **show atm vc**, **show network-clocks**, ancp enable, ancp neighbor.

ATM Conditional Debug Support

Most ATM debugging commands are implemented either at the system level or at the interface level. The ATM Conditional Debug Support feature allows debugging to be limited specifically to an ATM interface, to a virtual channel identifier (VCI), or to a virtual path identifier/virtual channel identifier (VPI/VCI) pair, through use of the **debug condition interface** command.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for ATM Conditional Debug Support

One or more ATM-encapsulated interfaces must be enabled, and one or more of the following **debug** commands must be enabled, to use the ATM Conditional Debug Support feature:

- **debug atm arp**
- **debug atm counters**
- **debug atm errors**
- **debug atm events**
- **debug atm oam**
- **debug atm packet**
- **debug atm state**

Restrictions for ATM Conditional Debug Support

- Only the ATM debugging commands listed in the Prerequisites for ATM Conditional Debug Support, page 29 section can use the ATM Conditional Debug Support feature.
- Conditional debugging for virtual circuits (VCs) can be enabled only for permanent virtual circuits (PVCs). Switched virtual circuits (SVCs) are not supported.

Information About ATM Conditional Debug Support

- ATM Debugging Extended to the VC Level, page 30

ATM Debugging Extended to the VC Level

The ATM **debug** commands are implemented either at the interface level or at the system level. The **debug** command output at these levels is not very useful when the user is interested in a particular set of virtual circuits (VCs).

The Cisco IOS XE software has the infrastructure to support conditional debugging based on various filters that are set at the command-line interface (CLI). The conditional debugging infrastructure can filter out or suppress unwanted messages from the output of any existing **debug** command. The ATM Conditional Debug Support feature extends this infrastructure to support conditional debugging at the ATM VC level by extending the **debug condition interface** command with keywords that address specific virtual circuits. This feature can be implemented on top of conventional debugging, so that backward compatibility is ensured and at the same time applications can take advantage of conditional debugging where required. However, the extended **debug condition interface** command has priority over the older version of the command; that is, a debug condition setting using the older **debug condition interface** command will be discarded as soon as a new debug condition is enabled on a virtual circuit.

How to Configure ATM Conditional Debugging on ATM Interfaces

- Enabling Debugging for the ATM Interface, page 30

Enabling Debugging for the ATM Interface

Perform this task to enable conditional debugging on a set of specified interfaces.

You must enable ATM debugging and specify the conditions (interface, VCI, or VPI/VCI pair) for the ATM Conditional Debug Support feature to work.

SUMMARY STEPS

1. **enable**
2. **debug atm** [**arp** | **counters** | **errors** | **events** | **oam** | **packet** | **state**]
3. **debug condition interface** *interface-type interface-number* [**vc** {*vci* | *vpi* / *vci*}]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**debug atm** [**arp** | **counters** | **errors** | **events** | **oam** | **packet** | **state**] **Example:** `Router# debug atm state`	Displays various ATM events.
Step 3	**debug condition interface** *interface-type interface-number* [**vc** {*vci* | *vpi* / *vci*}] **Example:** `Router# debug condition interface ATM1/1/0 vc 10/100`	Limits output for debugging according to the interface or ATM VC number.

Configuration Examples for ATM Conditional Debug Support

Enabling Debugging for an ATM Interface and VPI VCI Pair Example

The following example shows how to enable an ATM interface, specify an IP address for the interface, enable conditional debugging for that interface with a VPI/VCI pair of 10/100, and verify that debugging has been enabled:

```
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface atm 1/1/0.100 point-to-point

Router(config-if)# ip address 10.0.0.5 255.255.255.0
Router(config-if)# pvc 10/100

Router(config-if-atm-vc)# no shutdown

Router(config-if)# exit

Router(config)# exit

Router#
Router# debug atm state

ATM VC States debugging is on
Router# debug condition interface ATM1/1/0 vc 10/100
```

```
Condition 1 set
Router#
```

Enabling Debugging for a Specific VCI Example

The following example shows how to enable conditional debugging on a specific VCI. Note that when you enable conditional debugging on a specific VCI alone, the VPI value is automatically set to 0.

```
Router# debug condition interface atm 1/0 vc 4335
Condition 1 set
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface atm 1/0
Router(config-if)# pvc 4335
Router(config-if-atm-vc)# end
Router#
*Jul 12 21:46:52.487: atmdx_setup_vc(ATM1/0): vc=5, vpi=0, vci=4335,  config_status=0
*Jul 12 21:46:52.487: atmdx_setup_cos(ATM1/0): vc=5, wred_name=, max_q=0
*Jul 12 21:46:52.487: ATM VC Debug: Condition 1, atm-vc 0/4335 AT1/0 triggered, count 1
*Jul 12 21:46:52.487: ATM1/0 Current Active VC count 4

*Jul 12 21:46:52.487:  ATM VC notification event 0
*Jul 12 21:46:52.487: atmdx_platform_set_vc_state(ATM1/0): Setting the VC 5 state to UP
*Jul 12 21:46:52.487: ATM: PVC activated, ATM1/0 VCD 5 (0/4335)
*Jul 12 21:46:52.487:  ATM VC notification event 2
*Jul 12 21:46:52.487: %SYS-5-CONFIG_I: Configured from console by console
Router# show atm vc
Codes: DN - DOWN, IN - INACTIVE

           VCD /                                    Peak Av/Min Burst
Interface  Name       VPI   VCI Type   Encaps    SC   Kbps   Kbps Cells St
1/0        1            0    16 PVC     ILMI      UBR  149760             UP
1/0.10     4            0   100 PVC     SNAP      UBR  149760             UP
1/0        5            0  4335 PVC     SNAP      UBR  149760             UP
1/0.1      one          1    40 PVC     SNAP      UBR  149760             UP
1/0        2            3   100 PVC-A   SNAP      VBR    1000   1000    0 IN
4/ima1     1           23    34 PVC     SNAP      UBR       0             IN
```

Additional References

Related Documents

Related Topic	Document Title
Conditionally triggered debugging	"Conditionally Triggered Debugging" chapter in the *Cisco IOS Debug Command Reference*
ATM Overview	Overview of the ATM SPAs
ATM commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples.	*Cisco IOS Asynchronous Transfer Mode Command Reference*

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for ATM Conditional Debug Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2   *Feature Information for ATM Conditional Debug Support*

Feature Name	Releases	Feature Information
ATM Conditional Debug Support	Cisco IOS XE Release 2.3	ATM Conditional Debug Support feature allows debugging to be limited specifically to an ATM interface, to a VCI, or to a VPI/VCI pair. The following commands are introduced or modified in the feature: **debug condition interface**, **show debug**.

ATM OAM Ping

The ATM OAM Ping feature sends an ATM Operation, Administration, and Maintenance (OAM) packet to confirm the connectivity of a specific permanent virtual circuit (PVC). The status of the PVC is displayed when a response to the OAM packet is received. The ATM OAM Ping feature allows the network administrator to verify PVC integrity and facilitates ATM network troubleshooting.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for the ATM OAM Ping Feature

A PVC corresponding to the virtual path identifier (VPI) and virtual channel identifier (VCI) values entered with the **ping** command should already exist.

Restrictions for the ATM OAM Ping Feature

The ATM OAM Ping feature does not support pings based on the following criteria:

- Network service access point (NSAP) addresses
- Multiple-hop loopbacks
- Loopback location identification

Information About the ATM OAM Ping Feature

Benefits of the ATM OAM Ping Feature

The ATM OAM Ping feature modifies the **ping**command, which can be used to send an OAM packet to verify PVC connectivity. The status of the PVC is displayed when a response to the OAM packet is received. This is a common method for testing the accessibility of devices.

The **ping atm interface atm** command provides two ATM OAM ping options:

- End loopback--Verifies end-to-end PVC integrity.
- Segment loopback--Verifies PVC integrity to the immediate neighboring ATM device.

The **ping atm interface atm** command is used to determine the following:

- Whether a remote host is active or inactive.
- The round-trip delay in communicating with the host.
- Packet loss.

The simpler **ping** command provides an interactive mode for testing ATM network connectivity. The **ping** command first sends an OAM command loopback cell to the destination and then waits for an OAM response loopback cell. The ping is successful only when the following criteria are met:

- The OAM command loopback cell reaches the destination.
- The destination is able to send an OAM loopback response cell back to the source within a predetermined time called a *timeout* . The default value of the timeout is 2 seconds on Cisco routers.

How to Use the ATM OAM Ping Feature

Testing Network Connectivity Using Ping in Normal Mode

Perform this task to test the network connectivity by using the **ping atm interface atm** command in normal mode; that is, by entering all values for the **ping** test on the command line.

SUMMARY STEPS

1. **enable**
2. **ping atm interface atm** *interface-number vpi-value* [*vci-value* [**end-loopback**[*repeat* [*timeout*]]| **seg-loopback** [*repeat* [*timeout*]]]]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**ping atm interface atm** *interface-number* *vpi-value* [*vci-value* [**end-loopback**[*repeat* [*timeout*]]| **seg-loopback** [*repeat* [*timeout*]]]] **Example:** ping atm interface atm 1/1/0.100 0 500 **Example:** end-loopback 1 2 **Example:**	Displays a response to confirm the connectivity of a specific PVC for the ASR 1000 series router. • **atm** *interface-number* --ATM interface name. • *vpi-value* --Virtual path identifier. Range: 0 to 255. • *vci-value* --Virtual channel identifier. Range: 0 to 65535. • **end-loopback** --Sends ATM end loopback cells. This is the default. • **seg-loopback** --Sends ATM segment loopback cells. • *repeat* --Number of ping packets that are sent to the destination. Range: 1 to 1000. Default: 5. • *timeout* --Timeout interval, in seconds. Range: 1 to 30. Default: 2.

Testing Network Connectivity Using Ping in Interactive Mode

Perform this task to test network connectivity by using the **ping** command; that is, by providing values for the **ping** test by typing the value after the prompts displayed and pressing the **Enter** key. Press the **Enter** key without supplying a value to use the default.

SUMMARY STEPS

1. **enable**
2. **ping**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.

Command or Action	Purpose
Step 2 **ping**	Displays a response to confirm the connectivity of a specific PVC.
Example: Router# **ping**	

Aborting a Ping Session

To terminate a ping session, type the escape sequence--by default, Ctrl-Shift-6.

Configuration Examples for ATM OAM Ping

Verifying the Connectivity of a Specific PVC Example

The following example verifies the connectivity of a specific PVC by sending an ATM OAM packet and confirms the connectivity when it is successful:

```
Router# show atm pvc 10/100
ATM1/1/0.100: VCD: 3, VPI: 10, VCI: 100
UBR, PeakRate: 100000 (235850 cps)
AAL5-LLC/SNAP, etype:0x0, Flags: 0x40, VCmode: 0x0, Encapsize: 12
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
Last cell looped No
Loop detect state 0, Last cell looped 0, OAM Retries 0, Loop Retries 0
OAM VC Status: Not Managed
ILMI VC status: Not Managed
InARP frequency: 15 minutes(s)
Transmit priority 3
InPkts: 78310, OutPkts: 78310, InBytes: 218651435, OutBytes: 218651435
InPRoc: 0, OutPRoc: 16, Broadcasts: 15
InFast: 0, OutFast: 0, InAS: 78310, OutAS: 78281
InPktDrops: 0, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0, LengthViolation: 0, CPIErrors: 0
Out CLP=1 Pkts: 0
OAM cells received: 315
F5 InEndloop: 310, F5 InSegloop: 5, F5 InAIS: 0, F5 InRDI: 0
OAM cells sent: 315
F5 OutEndloop: 310, F5 OutSegloop: 5, F5 OutAIS: 0, F5 OutRDI: 0
OAM cell drops: 0
Status: UP
VC 10/100 doesn't exist on 2 of 3 ATM interface(s)
Router#
```

Normal Mode ping atm interface atm Command Example

The following example shows sample output for the **ping atm interface atm**command in normal mode:

```
Router# ping atm interface atm1/1/0.1 500
Type escape sequence to abort.
Sending 5, 53-byte end-to-end OAM echoes, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/16/52 ms
Router# ping atm interface atm1/1/0.1 0 500 seg-loopback
Type escape sequence to abort.
Sending 5, 53-byte segment OAM echoes, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
Router# ping atm interface atm1/1/0.1 0 500 end-loopback 100 25
Type escape sequence to abort.
Sending 100, 53-byte end-to-end OAM echoes, timeout is 25 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (100/100), round-trip min/avg/max = 4/13/180 ms
Router# ping atm interface atm1/1/0.1 0 500 seg-loopback 50 20
Type escape sequence to abort.
Sending 50, 53-byte segment OAM echoes, timeout is 20 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (50/50), round-trip min/avg/max = 1/1/4 ms
Router# show atm pvc 10/100

ATM1/1/0.100: VCD: 3, VPI: 10, VCI: 100
UBR, PeakRate: 100000 (235850 cps)
AAL5-LLC/SNAP, etype:0x0, Flags: 0x40, VCmode: 0x0, Encapsize: 12
OAM frequency: 10 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Received
Last cell looped No
Loop detect state 0, Last cell looped 0, OAM Retries 0, Loop Retries 0
OAM VC Status: Verified
ILMI VC status: Not Managed
VC is managed by OAM.
InARP frequency: 15 minutes(s)
Transmit priority 3
InPkts: 78310, OutPkts: 78310, InBytes: 218651435, OutBytes: 218651435
InPRoc: 0, OutPRoc: 16, Broadcasts: 15
InFast: 0, OutFast: 0, InAS: 78310, OutAS: 78281
InPktDrops: 0, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0, LengthViolation: 0, CPIErrors: 0
Out CLP=1 Pkts: 0
OAM cells received: 331
F5 InEndloop: 326, F5 InSegloop: 5, F5 InAIS: 0, F5 InRDI: 0
OAM cells sent: 331
F5 OutEndloop: 326, F5 OutSegloop: 5, F5 OutAIS: 0, F5 OutRDI: 0
OAM cell drops: 0
Status: UP
VC 10/100 doesn't exist on 2 of 3 ATM interface(s)
Router#
```

Interactive ping Command Example

The following is sample output for the **ping**command in the interactive mode:

```
router# ping

Protocol [ip]: atm
ATM Interface: atm1/1/0.100
VPI value [0]: 10
VCI value [1]: 100
Loopback - End(0), Segment(1) [0]:
Repeat Count [5]:
Timeout [2]:
```

```
Type escape sequence to abort.
Sending 5, 53-byte end-to-end OAM echoes, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
Router#
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
ATM commands	*Cisco IOS Asynchronous Transfer Mode Command Reference*
ATM Overview	"Overview of the ATM SPAs"
Configuring ATM OAM traffic reduction	"ATM OAM Traffic Reduction"
Detecting failures when using OAM cells and PVC management	"Troubleshooting PVC Failures When Using OAM Cells and PVC Management"

Standards

Standard	Title
ITU-T Specification I.610 (ITU-T specification for B-ISDN operation and maintenance principles and functions).	I.610 Series I: Integrated Services Digital Network Maintenance principles

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.	http://www.cisco.com/techsupport
To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.	
Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	

Feature Information for ATM OAM Ping

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 3   ***Feature Information for ATM OAM Ping***

Feature Name	Releases	Feature Information
ATM OAM Ping	Cisco IOS XE Release 2.3	The ATM OAM Ping feature sends an ATM OAM packet to confirm the connectivity of a specific PVC. The status of the PVC is displayed when a response to the OAM packet is received. The ATM OAM Ping feature allows the network administrator to verify PVC integrity and facilitates ATM network troubleshooting. The following command was introduced or modified: **ping atm interface atm**.

ATM OAM Traffic Reduction

The ATM OAM Traffic Reduction feature is a mechanism for reducing overhead when loopback cells are being used for fault detection in bidirectional virtual circuits (VCs) over ATM.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for ATM OAM Traffic Reduction

The Operations and Maintenance (OAM) loopback cells described in this document are defined in International Telecommunication Union (ITU) specification *I.610 SERIES I: INTEGRATED SERVICES DIGITAL NETWORK,Maintenance principles* , and understanding this specification is requisite to understanding the ATM OAM Traffic Reduction feature.

Restrictions for ATM OAM Traffic Reduction

- This feature supports only permanent virtual circuits (PVCs) for F5 END_TO_END OAM loopback cells. This feature is not applicable for F4 OAM cells, AIS/RDI cells, or F5 SEGMENT OAM loopback cells.
- This feature breaks OAM loopback functionality when there is a unidirectional breakage and when retry frequency is configured to be the same as the F5 OAM loopback frequency.

Information About ATM OAM Traffic Reduction

OAM Traffic Flow

The OAM management portion of a PVC sends OAM loopback cells at periodic intervals. When OAM management is enabled at both ends of the PVC, the cells are transmitted and looped back at both ends. This transmission is redundant, because the OAM cells travel through the same physical circuit twice.

In the figure below, assume PVCs are configured between router R1 and router R2 , and that OAM management is enabled on both ends of the PVC. Router R1, upon receiving OAM command cells from router R2, can stop its own OAM command cell transmission and can manage the link on the basis of incoming OAM command cells. Router R1 can reinitiate OAM command cell transmission upon discovering the absence of command cells from router R2.

Figure 2   **ATM OAM Traffic Flow**
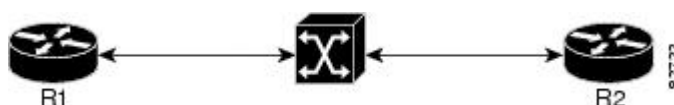
When router R1 detects the first OAM command cell from router R2, time stamp T1 is noted. When the next OAM command cell is detected, time stamp T2 is noted. The interval T1 minus T2 provides the OAM the loopback frequency of router R2. The average value of this interval is taken by measuring it a random number of times. (The interval needs to be taken a random number of times to avoid a race condition that *might* happen when routers R1 and R2 implement this algorithm and the frequency is the same.)

At the end of the random time period, router R1 stops sending OAM command cells and starts the OAM traffic monitoring timer. This timer in router R1 checks for a change in interval frequency in router R2. If there is a change, the traffic monitoring timer is stopped and the VC goes into Retry mode and checks whether the link is still up. In Retry mode, OAM command loopback cells are transmitted at an interval of one per second for 3 seconds. If router R1 does not receive a response to the command cell, the link is changed to the Down state.

Note If ATM OAM traffic reduction is enabled on routers R1 and R2, then because of the random nature of the traffic reduction algorithm, either router can initiate OAM command cells and the other router will have to listen to the incoming OAM command cells. If this feature is enabled on only one router (R1, for example), then the frequency of that router must be greater than or equal to the interval frequency set in the other router (R2) in order for router R1 to stop sending OAM command cells. The ATM OAM Traffic Reduction feature is enabled by the **oam-pvc** command. When the **optimum** keyword is enabled, and when a change in the interval frequency of router R2 is detected, the VC initiates an OAM command cell from router R1 and does not go into the Retry mode immediately. If no response is obtained, the VC goes into the Retry mode and follows the OAM Retry procedure.

How to Configure ATM OAM Traffic Reduction

Configuring ATM OAM Traffic Reduction on an ATM Interface

To configure ATM OAM traffic reduction on an ATM interface, use the following commands .

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *interface-number* **.** *subinterface-number*
4. **pvc** *vpi* **/** *vci*
5. **oam-pvc** [*frequency* | **manage** [*frequency* [**auto-detect** [**optimum**] | **keep-vc-up** [**seg aisrdi failure**] | **loop-detection**]]]
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. - Enter your password if 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 1/1/1.100`	Configures an ATM interface type and enters interface configuration mode.

	Command or Action	Purpose
Step 4	**pvc** *vpi* / *vci* **Example:** `Router(config-if)# pvc 0/100`	Assigns a name to an ATM PVC and enters ATM VC configuration mode.
Step 5	**oam-pvc** [*frequency* | **manage** [*frequency* [**auto-detect** [**optimum**] | **keep-vc-up** [**seg aisrdi failure**] | **loop-detection**]]] **Example:** `Router(config-if-atm-vc)# oam-pvc manage auto-detect optimum`	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM PVC or VC class, including the ATM OAM Traffic Reduction feature. • **auto-detect** --Initiates auto-detection of peer OAM command cells. • **optimum** --Configures an optimum mode so that when the traffic monitoring timer expires, the PVC sends an OAM command cell at the locally configured frequency instead of going into Retry mode immediately. If there is no response, the PVC goes into Retry mode.
Step 6	**exit** **Example:** `Router(config-if-atm-vc)# exit`	Exits the configuration mode. • Enter the **exit** command for each command mode to exit.

Configuring ATM OAM Traffic Reduction on a VC Class

To configure ATM OAM traffic reduction on a VC class, use the following commands.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vc-class atm** *vc-class-name*
4. **oam-pvc** [*frequency* | **manage** [*frequency* [**auto-detect** [**optimum**] | **loop-detection**]]]
5. **exit**
6. **interface atm** *interface-number* **.** *subinterface-number*
7. **class-int** *vc-class-name*
8. **pvc** *vpi* / *vci*
9. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**vc-class atm** *vc-class-name* **Example:** `Router(config)# vc-class atm word`	Creates a VC class to an ATM VC bundle member.
Step 4	**oam-pvc** [*frequency* | **manage** [*frequency* [**auto-detect** [**optimum**] | **loop-detection**]]] **Example:** `Router(config-vc-class)# oam-pvc manage auto-detect optimum`	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM PVC or VC class, including the ATM OAM Traffic Reduction feature. • **auto-detect** --Initiates autodetection of peer OAM command cells. • **optimum** --Configures an optimum mode so that when the traffic monitoring timer expires, the PVC sends an OAM command cell at the locally configured frequency instead of going into Retry mode. If there is no response, the PVC goes into Retry mode.
Step 5	**exit** **Example:** `Router(config-vc-class)# exit`	Exits the vc-class mode.
Step 6	**interface atm** *interface-number* **.** *subinterface-number* **Example:** `Router(config)# interface atm 1/1/2.100`	Configures an ATM interface and enters interface configuration mode.

	Command or Action	Purpose
Step 7	**class-int** *vc-class-name* **Example:** Router(config-if)# class-int test	Assigns a VC class to an ATM main interface.
Step 8	**pvc** *vpi* / *vci* **Example:** Router(config-if)# pvc 0/100	Creates an ATM PVC and attaches it to the designated network virtual path identifier (VPI) and virtual channel interface (VCI). In this case, more than one PVC is created.
Step 9	**exit** **Example:** Router(config-if)# exit Router(config)# exit	Ends the configuration mode. • Enter the **exit** command for each command mode to exit.

Verifying ATM OAM Traffic Reduction

To verify that the ATM OAM Traffic Reduction feature is working, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **show atm oam auto-detect** [**atm** *interface-number* **.** *subinterface-number*]
3. **show atm pvc** [**interface atm** *type number*[*vpi* / *vci* | *vci* | *word*] *vpi* / *vci* | *vci* | *word*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show atm oam auto-detect** [**atm** *interface-number* **.** *subinterface-number*] **Example:** Router# show atm oam auto-detect atm 1/1/2.100	(Optional) Displays the state of the OAM cells when the ATM OAM traffic reduction is enabled. • The **show atm oam auto-detect** command reports the number of VCs in autodetection mode and in OAM loopback mode.

	Command or Action	Purpose
Step 3	**show atm pvc** [**interface atm** *type number*[*vpi / vci*	*vci*	*word*] *vpi / vci*	*vci*	*word*] **Example:** `Router# show atm pvc`	(Optional) Displays ATM PVCs and traffic reduction information. The **show atm pvc** command reports the OAM autodetect state, the OAM peer frequency, and the time the last OAM command cell was received.

Configuration Examples for ATM OAM Traffic Reduction

ATM OAM Traffic Reduction on an ATM Interface Example

The following example enables ATM OAM traffic reduction on an ATM interface:

```
interface ATM1/1/1.100 point-to-point
 ip address 60.1.2.1 255.255.255.0
 no atm enable-ilmi-trap
 pvc 11/111
  oam-pvc manage auto-detect optimum
  encapsulation aal5snap
```

ATM OAM Traffic Reduction on a VC Class Example

The following example enables ATM OAM traffic reduction using a VC class:

```
vc-class atm oam-tests
 oam-pvc manage auto-detect optimum
interface ATM1/1/2.100 point-to-point
 ip address 60.1.3.1 255.255.255.0
 class-int oam-tests
 no atm enable-ilmi-trap
 pvc 12/222
  encapsulation aal5snap
```

Verify ATM OAM Traffic Reduction Example

In the following examples, the output is displayed for each command in the task.

Sample Output for the show atm oam auto-detect Command

The following is sample output from the **show atm oam auto-detect** command:

```
Router# show atm oam auto-detect atm 1/1/2.100

ATM OAM Auto Detect statistics on ATM1/1/2
Auto Detection statistics:
ATM OAM AUTO DETECT INIT : 1
```

```
ATM OAM SENDING MONITORING : 0
ATM OAM MONITORING : 0
OAM Loopback statistics:
 DownRetry : 0
 UpRetry : 0
 Verified : 1
 Not Verified : 0
 Verified and Not Monitoring: 1
Router#
```

Sample Output for the show atm pvc Command

The following is sample output from the **show atm pvc** command with ATM OAM traffic reduction enabled:

```
Router# show atm pvc 12/222

ATM1/1/2.100: VCD: 1, VPI: 12, VCI: 222
UBR, PeakRate: 149760 (353208 cps)
AAL5-LLC/SNAP, etype:0x0, Flags: 0x1840, VCmode: 0x0, Encapsize: 12
OAM frequency: 10 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Received
Last cell looped No
Loop detect state 0, Last cell looped 0, OAM Retries 0, Loop Retries 0
OAM VC Status: Verified
OAM Auto Detect state: ATM OAM AUTO DETECT INIT
OAM PEER frequency: 0 second(s)
```

Additional References

Related Documents

Related Topic	Document Title
ATM Commands	*Cisco IOS Asynchronous Transfer Mode Command Reference*

Standards

Standards	Title
ITU-I Specification	*I.610 SERIES I: INTEGRATED SERVICES DIGITAL NETWORK, Maintenance principles*

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:
	http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.	http://www.cisco.com/techsupport
To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.	
Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	

Feature Information for ATM OAM Traffic Reduction

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 4 *Feature Information for ATM OAM Traffic Reduction*

Feature Name	Releases	Feature Information
ATM OAM Traffic Reduction	Cisco IOS XE Release 2.3	The ATM OAM Traffic Reduction feature is a mechanism for reducing overhead when loopback cells are being used for fault detection in bidirectional virtual circuits (VCs) over ATM..
		The following commands were introduced or modified: **oam-pvc show atm oam auto-detect show atm pvc**

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

Configuring ATM SNMP Trap and OAM Enhancements

The ATM SNMP Trap and OAM Enhancements feature provides the ability to send Simple Network Management Protocol (SNMP) notifications for ATM permanent virtual circuits (PVCs) when the PVC state changes and when Operation, Administration and Maintenance (OAM) loopback fails for a PVC. This feature also provides information about the virtual path identifier/virtual channel identifier (VPI/VCI) in the ATM PVC traps.

The ATM OAM AIS-RDI Monitoring feature extends the existing ATM virtual circuit OAM functionality to include monitoring of the Alarm Indication Signal-Remote Defect Indication (AIS-RDI).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for ATM SNMP Trap and OAM Enhancements

Before you enable ATM PVC trap support, you must configure Simple Network Management Protocol (SNMP) support and an IP routing protocol on your router. For more information about configuring SNMP support, refer to the chapter "Configuring SNMP Support" in the *Cisco IOS XE Network Management Configuration Guide*.

To receive PVC failure notification and to allow access to PVC status tables on your router, you must have the Cisco extended ATM PVC trap MIB called CISCO-IETF-ATM2-PVCTRAP-MIB-EXTN.my compiled

in your Network Management System (NMS) application. You can find this MIB at Cisco's MIB website: http://www.cisco.com/go/mibs.

The legacy ATM PVC trap must be disabled by using the **no snmp-server enable traps atm pvc** command before extended ATM PVC traps are configured.

Restrictions for ATM SNMP Trap and OAM Enhancements

- Extended ATM PVC traps cannot be used at the same time as the legacy ATM PVC trap. The legacy ATM PVC trap must be disabled by using the **no snmp-server enable traps atm pvc** command before extended ATM PVC traps are configured.
- ATM PVC UP traps are not generated for newly created PVCs. They are generated only for PVCs that go from the DOWN state to the UP state.

Information About ATM SNMP Trap and OAM Enhancements

The ATM SNMP Trap and OAM Enhancements feature introduces the following enhancements to the SNMP notifications for ATM permanent virtual circuits (PVCs) and to OAM functionality:

- ATM PVC traps will be generated when the operational state of a PVC changes from the DOWN state to the UP state.
- ATM PVC traps will be generated when OAM loopback fails, and the PVC will remain in the UP state, rather than going down.
- The ATM PVC traps are now extended to include virtual path identifier/virtual channel identifier (VPI/VCI) information, the number of state transitions a PVC goes through in an interval, and the time stamp of the first and the last PVC state transition.

ATM PVC Up Trap

Before the introduction of the ATM SNMP trap and OAM enhancements, the only SNMP notifications for ATM PVCs were the ATM PVC failure traps that were generated when a PVC failed or left the UP operational state. The ATM SNMP trap and OAM enhancements introduce ATM PVC up traps, which are generated when a PVC changes from the DOWN state to the UP state.

ATM PVC OAM Failure Trap

The ATM SNMP trap and OAM enhancements introduce the ATM PVC OAM failure trap. OAM loopback is a mechanism that detects whether a connection is up or down by sending OAM end-to-end loopback command/response cells. An OAM loopback failure indicates that the PVC has lost connectivity. The ATM

PVC OAM failure trap is generated when OAM loopback for a PVC fails and is sent at the end of the notification interval.

When OAM loopback for a PVC fails, the PVC is included in the atmStatusChangePVclRangeTable or atmCurrentStatusChangePVclTable and in the ATM PVC OAM failure trap.

Before this feature was introduced, if OAM loopback failed, the PVC was placed in the DOWN state. When the ATM PVC OAM failure trap is enabled, the PVC remains up even if OAM loopback fails, and thus it ensures continuous flow of data.

Note   ATM PVC traps are generated at the end of the notification interval. It is possible to generate three types of ATM PVC traps (the ATM PVC failure trap, ATM PVC up trap, and ATM PVC OAM failure trap) at the end of the same notification interval. However, only one type of trap is generated for each PVC.

Extended ATM PVC Traps

The ATM SNMP Trap and OAM Enhancements feature introduces extended ATM PVC traps. The extended traps include VPI/VCI information for affected PVCs, the number of up-to-down and down-to-up state transitions that a PVC goes through in an interval, and the time stamp of the first and the last PVC state transition.

Note   Extended ATM PVC traps cannot be used at the same time as the legacy ATM PVC trap. The legacy ATM PVC trap must be disabled by using the **no snmp-server enable traps atm pvc** command before extended ATM PVC traps are configured.

ATM PVC High Watermark Trap

The ATM SNMP Trap and OAM Enhancements feature introduces a high watermark trap. A trap is generated when the number of configured PVCs in an interface and related subinterfaces exceeds a preconfigured high watermark threshold. When the number of configured PVCs in an interface and related subinterfaces falls below the high watermark threshold, another trap is generated to indicate that the fault is cleared. A minimum duration between the occurrence of two consecutive high watermark thresholds can also be set.

Supported MIB Objects and Tables

The ATM PVC trap is defined in the ATM PVC trap MIB. The ATM SNMP trap and OAM enhancements introduce the following tables and MIB objects:

- The table atmInterfaceExt2Table displays the status of ATM PVCs and is indexed by ifIndex. This table contains the following objects:

  ◦ atmIntfCurrentlyDownToUpPVcls
  ◦ atmIntfOAMFailedPVcls
  ◦ atmIntfCurrentlyOAMFailingPVcls

- The table atmCurrentStatusChangePVclTable displays information about ATM PVCs that undergo an operational state change and is indexed by ifIndex, atmVclVpi, and atmVclVci. This table contains the following objects:

- ◦ atmPVclStatusTransition
- ◦ atmPVclStatusChangeStart
- ◦ atmPVclStatusChangeEnd
- The table atmStatusChangePVclRangeTable displays information about ATM PVC ranges and is indexed by ifIndex, atmVclVpi, and rangeIndex. This table contains the following objects:
  - ◦ atmPVclLowerRangeValue
  - ◦ atmPVclHigherRangeValue
  - ◦ atmPVclRangeStatusChangeStart
  - ◦ atmPVclRangeStatusChangeEnd
- The ATM PVC Up Trap "atmIntfPvcUpTrap" contains the following objects:
  - ◦ ifIndex
  - ◦ atmIntfCurrentlyDownToUpPVcls
- The ATM PVC OAM Failure Trap atmIntfPvcOAMFailureTrap contains the following objects:
  - ◦ ifIndex
  - ◦ atmIntfOAMFailedPVcls
  - ◦ atmIntfCurrentlyOAMFailingPVcls

ATM OAM AIS-RDI Monitoring

The ATM OAM Alarm Indication Signal--Reverse Defect Indication (AIS-RDI) Monitoring feature extends the existing ATM VC OAM functionality to include monitoring of the AIS-RDI. Once the feature is enabled, OAM AIS-RDI is monitored on the VCs. If the number of consecutive OAM AIS-RDI cells received is greater than a configurable number, the VC is brought down. The VC is brought up when there are no OAM AIS-RDI cells received within a configurable interval.

Benefits of Configuring ATM SNMP Trap and OAM Enhancements

The ATM SNMP Trap and OAM Enhancements and the ATM OAM AIS-RDI Monitoring features have the following benefits:

- Enables you to use SNMP to detect the recovery of PVCs that are down.
- Enables you to use SNMP to detect when OAM loopback fails for a PVC.
- Keeps the PVC in the UP state when OAM loopback fails to allow continuous flow of data.
- Provides VPI/VCI information in the ATM PVC traps to let you know the PVC that changed operational state or encountered an OAM loopback failure.
- Provides statistics on the number of state transitions that a PVC goes through.
- Provides flexibility to control the status change of a PVC when a faulty condition is detected on a VC and OAM VC-AIS cells are generated.
- Generates a trap to identify if configured PVCs under an interface and related subinterfaces exceed the configured threshold.

How to Configure ATM SNMP Trap and OAM Enhancements

Configuring Extended ATM PVC Trap Support

Perform this task to configure extended ATM PVC trap support.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server enable traps atm pvc extension** {**up**| **down**| **oam failure**[**aisrdi**| **loopback**]}
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**snmp-server enable traps atm pvc extension** {**up**| **down**| **oam failure**[**aisrdi**| **loopback**]} **Example:** `Router(config)# snmp-server enable traps atm pvc extension oam failure loopback`	Enables the sending of extended ATM PVC traps. The keywords are as follows: • **up** --Enables ATM PVC up traps that are generated when a PVC changes from the down state to the up state. • **down** --Enables ATM PVC failure traps that are generated when a PVC changes from the up state to the down state. • **oam failure** --Enables ATM PVC OAM failure traps that are generated when an OAM failure occurs. • **aisrdi** --(optional) Enables AIS/RDI OAM failure traps that are generated when an AIS/RDI OAM failure occurs. • **loopback** --(optional) Enables OAM failure loopback traps that are generated when an OAM loopback failure occurs.
Step 4	**end** **Example:** `Router(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.

Configuring ATM PVC High Watermark Trap Support

Perform this task to configure ATM PVC high watermark trap support using Remote Monitoring (RMON).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *subslot* / *port* **.** *subinterface-number* **point-to-point**
4. **no atm enable-ilmi-trap**
5. **exit**
6. **rmon event** *number* **log trap** *community* **owner** *owner-name*
7. **rmon alarm** *number variable interval* **absolute rising-threshold** *value* [*event-number*] **falling-threshold** *value* [*event-number*] **owner** *owner-name* **interface atm** *slot* / *subslot* / *port* **.** *subinterface-number* **trap**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface atm** *slot* / *subslot* / *port* **.** *subinterface-number* **point-to-point** **Example:** `Router(config)# interface atm 1/0/0.2 point-to-point`	Configures the ATM interface. The command syntax is as follows: • *slot/subslot/port* --Specifies a (physical) ATM interface (for example, 0/2/0). • **.** *subinterface-number* --Specifies a subinterface number. A dot (.) must be used to separate the interface number from the subinterface number (for example, 0/2/0.1). • **point-to-point** --Specifies point-to-point as the interface type for which a subinterface is to be created.
Step 4	**no atm enable-ilmi-trap** **Example:** `Router(config-if)# no atm enable-ilmi-trap`	Does not generate an Integrated Local Management Interface (ILMI) atmfVccChange trap when an ATM interface or subinterface is enabled or shut down.

Command or Action	Purpose
Step 5 **exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and enters global configuration mode.
Step 6 **rmon event** *number* **log trap** *community* **owner** *owner-name* **Example:** `Router(config)# rmon event 3 log trap public owner Test`	Creates RMON event, which is the prerequisite for generating a trap.
Step 7 **rmon alarm** *number variable interval* **absolute rising-threshold** *value* [*event-number*] **falling-threshold** *value* [*event-number*] **owner** *owner-name* **interface atm** *slot* / *subslot* / *port* . *subinterface-number* **trap** **Example:** `Router(config)# rmon alarm 1 ciscoAtmIfPVCs 4 absolute rising-threshold 5 1 falling-threshold 4 1 owner conf interface Atm3/0 trap`	Generates a trap when the number of configured PVCs in an interface and related subinterfaces exceed a preconfigured high watermark threshold. The **interface** keyword enables RMON to monitor the ciscoAtmIfPVCs object for the specific interface. The **trap**keyword enables RMON to include the interface name in the generated trap.
Step 8 **end** **Example:** `Router(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.

Enabling OAM Management

When you configure PVC trap support, you must also enable OAM management on the PVC. Perform this task to enable OAM management.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *subslot* / *port* [**.** *subinterface-number*{**multipoint** | **point-to-point**}]
4. **pvc** [*name*] *vpi* / *vci*
5. **oam-pvc manage**
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface atm** *slot* / *subslot* / *port* [**.** *subinterface-number*{**multipoint** | **point-to-point**}] **Example:** Router(config)# interface atm 0/2/0	Specifies the ATM interface. The command syntax is as follows: • *slot/subslot/port* --Specifies a (physical) ATM interface (for example, 0/2/0). • **.** *subinterface-number* --Specifies a subinterface number. A dot (.) must be used to separate the interface number from the subinterface number (for example, 0/2/0.1). • **multipoint** --Specifies multipoint as the interface type for which a subinterface is to be created. • **point-to-point** --Specifies point-to-point as the interface type for which a subinterface is to be created.
Step 4	**pvc** [*name*] *vpi* / *vci* **Example:** Router(config-if)# pvc oam 0/5	Enables the PVC and enters ATM VC configuration mode.
Step 5	**oam-pvc manage** **Example:** Router(config-if-atm-vc)# oam-pvc manage	Enables end-to-end OAM management for an ATM PVC.
Step 6	**end** **Example:** Router(config-if-atm-vc)# end	Exits ATM VC configuration mode and returns to priviledged EXEC mode.

Enabling OAM AIS-RDI Monitoring

Perform this task to enable OAM AIS-RDI monitoring on VCs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *subslot* / *port* [**.** *subinterface-number* {**multipoint** | **point-to-point**}]
4. **pvc** [*name*] *vpi* / *vci*
5. **oam ais-rdi** [*down-count* [*up-count*]]
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface atm** *slot* / *subslot* / *port* [**.** *subinterface-number* {**multipoint**	**point-to-point**}] **Example:** `Router(config)# interface atm 2/0/0`	Specifies the ATM interface and enters interface configuration mode.
Step 4	**pvc** [*name*] *vpi* / *vci* **Example:** `Router(config-if)# pvc 0/400`	Enables the PVC and enters ATM VC configuration mode.
Step 5	**oam ais-rdi** [*down-count* [*up-count*]] **Example:** `Router(config-if-atm-vc)# oam ais-rdi 1 3`	Configures an ATM PVC to be brought down after a specified number of OAM AIS/RDI cells have been received on the PVC or to be brought up if no OAM AIS/RDI cells have been received in a specified interval.

Command or Action	Purpose
Step 6 **end** **Example:** `Router(config-if-atm-vc)# end`	Exits ATM VC configuration mode and returns to privileged EXEC mode.

Verifying ATM PVC Traps

To verify the configuration of ATM PVC traps, use the **show running-config** command.

SUMMARY STEPS

1. **show atm vc**

DETAILED STEPS

show atm vc

The following is sample output from the **show atm vc** command:

Example:

```
Router# show atm vc
Codes: DN - DOWN, IN - INACTIVE
          VCD /                                        Peak Av/Min Burst
Interface Name       VPI   VCI Type   Encaps     SC    Kbps   Kbps Cells St
0/2/0      oam         0     5 PVC    SNAP       UBR    0                IN
0/2/0      7           0    10 PVC    SNAP       UBR    0                IN
0/2/0      2           0    40 PVC    SNAP       UBR    0                IN
0/2/0      1           0   100 PVC    SNAP       UBR    0                IN
0/2/0      name        1     1 PVC    SNAP       UBR    0                IN
0/2/0      4           2   200 PVC    SNAP       UBR    0                IN
0/2/0      vpi/vci     3   100 PVC    SNAP       UBR    0                IN
0/2/0      8           4   100 PVC    SNAP       UBR    0                IN
```

Configuration Examples for ATM SNMP Traps and OAM Enhancements

Example Configuring Extended ATM PVC Trap Support

The following example shows the three extended ATM PVC traps enabled on a router. If PVC 0/1 either leaves the up state or down state or encounters an OAM loopback failure, then the host 172.16.61.90 receives SNMP notifications:

```
! Configure SNMP support and an IP routing protocol on your router:
Router(config)# snmp-server community public ro
Router(config)# snmp-server host 172.16.61.90 public
Router(config)# ip routing
Router(config)# router igrp 109
Router(config-router)# network 172.16.0.0
!
! Enable extended ATM PVC trap support and OAM management:
Router(config)# snmp-server enable traps atm pvc extension down
Router(config)# snmp-server enable traps atm pvc extension up
Router(config)# snmp-server enable traps atm pvc extension oam failure loopback
Router(config)# interface atm 0/1/0.1
Router(config-if)# pvc 0/1
Router(config-if-atm-vc)# oam-pvc manage
```

Examples Extended ATM PVC Trap Output

This section contains examples of output for the extended ATM PVC traps.

Extended ATM PVC Failure Trap Output

The following example shows the output for the extended ATM PVC failure trap for PVCs 1/100, 1/102, and 1/103. Note that only one trap is generated for all the PVCs associated with the same interface or subinterface (in contrast to the legacy ATM PVC failure trap that generates a separate trap for each PVC). The VPI/VCI information and timing are located in the objects that are associated with the trap.

```
00:23:56:SNMP:Queuing packet to 1.1.1.1
00:23:56:SNMP:V2 Trap, reqid 2, errstat 0, erridx 0
sysUpTime.0 = 143636
snmpTrapOID.0 = atmIntfPvcFailuresTrap
ifEntry.1.19 = 19
atmIntfPvcFailures.2 = 7
atmIntfCurrentlyFailingPVcls.2 = 3
atmPVclLowerRangeValue.19.1.2 = 102
atmPVclHigherRangeValue.19.1.2 = 103
atmPVclRangeStatusChangeStart.19.1.2 = 140643
atmPVclRangeStatusChangeEnd.19.1.2 = 140698
atmPVclStatusTransition.19.1.100 = 1
atmPVclStatusChangeStart.19.1.100 = 140636
atmPVclStatusChangeEnd.19.1.100 = 140636
00:23:56:SNMP:Packet sent via UDP to 1.1.1.1
```

Extended ATM PVC Up Trap Output

The following example shows the output for the extended ATM PVC up trap for PVCs 1/100, 1/102, and 1/103:

```
00:31:29:SNMP:Queuing packet to 1.1.1.1
00:31:29:SNMP:V2 Trap, reqid 2, errstat 0, erridx 0
sysUpTime.0 = 188990
snmpTrapOID.0 = atmIntfPvcUpTrap
ifEntry.1.19 = 19
atmIntfCurrentlyDownToUpPVcls.2 = 3
atmPVclLowerRangeValue.19.1.2 = 102
atmPVclHigherRangeValue.19.1.2 = 103
atmPVclRangeStatusChangeStart.19.1.2 = 186005
```

```
atmPVclRangeStatusChangeEnd.19.1.2 = 186053
atmPVclStatusTransition.19.1.100 = 1
atmPVclStatusChangeStart.19.1.100 = 185990
atmPVclStatusChangeEnd.19.1.100 = 185990
00:31:30:SNMP:Packet sent via UDP to 1.1.1.1
```

Example Enabling OAM AIS-RDI Monitoring

The following example shows how to enable OAM ASI-RDI monitoring in ATM VC configuration mode:

```
Router> enable
Router# configure terminal
Router(config)# interface atm 2/0/0
Router(config-if)# pvc 0/400
Router(config-if-atm-vc)# oam ais-rdi 25 5
Router(config-if-atm-vc)# end
```

The following example shows how to enable OAM ASI-RDI monitoring in ATM VC class configuration mode:

```
Router> enable
Router# configure terminal
Router(config)# vc-class atm vctest
Router(config-vc-class)# oam ais-rdi 14 5
Router(config-vc-class)# end
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
ATM commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples	*Cisco IOS Asynchronous Transfer Mode Command Reference*
SNMP commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples	*Cisco IOS Network Management Command Reference*
Overview of ATM SPAs	"Configuring ATM"

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
• CISCO-ATM-IF-MIB • CISCO-ATM-PVC-MIB • CISCO-ATM-PVCTRAP-EXTN-MIB • CISCO-IETF-ATM2-PVCTRAP-MIB-EXTN	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for ATM SNMP Trap and OAM Enhancements

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 5   *Feature Information for Configuring ATM SNMP Trap and OAM Enhancements*

Feature Name	Releases	Feature Information
ATM SNMP Trap and OAM Enhancements	Cisco IOS XE Release 2.3 Cisco IOS XE Release 3.2S	The feature provides enhancements to the Simple Network Management Protocol (SNMP) notifications for ATM permanent virtual circuits (PVCs) and to Operation, Administration, and Maintenance (OAM) functionality. The ATM SNMP Trap and OAM Enhancements feature introduces a high watermark trap. A trap is generated when the number of configured PVCs in an interface and related subinterfaces exceeds a preconfigured high watermark threshold. The following commands were introduced or modified: **oam-pvc manage**, **rmon alarm, snmp-server enable traps atm pvc extension**.
ATM OAM AIS-RDI Monitoring	Cisco IOS XE Release 2.3	The ATM OAM AIS-RDI Monitoring feature extends the existing ATM virtual circuit OAM functionality to include monitoring of the AIS-RDI. The following commands were introduced or modified: **oam ais-rdi**.

Glossary

inform --SNMP trap message that includes a delivery confirmation request.

MIB --Management Information Base. Database of network management information that is used and maintained by a network management protocol such as SNMP. The value of a MIB object can be changed or retrieved using SNMP commands, usually through a network management system (NMS). MIB objects are organized in a tree structure that includes public (standard) and private (proprietary) branches.

NMS --Network Management System. An application or suite of applications that are designed to monitor networks using SNMP. CiscoView is one example of an NMS.

OAM --Operation, Administration, and Maintenance. The ATM Forum specifies OAM cells that are used to monitor virtual circuits. OAM cells provide a virtual circuit-level loopback in which a router responds to the cells, demonstrating that the circuit is up and the router is operational.

PVC --Permanent Virtual Circuit. Virtual circuit that is permanently established. PVCs save bandwidth that is associated with circuit establishment and teardown in situations where certain virtual circuits must exist all the time. In ATM terminology, PVC also stands for permanent virtual connection.

SNMP --Simple Network Management Protocol. An application-layer protocol that provides a message format for communication between SNMP managers and agents and is exclusively used in TCP/IP networks. SNMP provides a means to monitor and control network devices and to manage configurations, statistics collection, performance, and security.

trap --A message from an SNMP agent alerting the SNMP manager to a condition on the network.

VCI --Virtual Channel Identifier. A 16-bit field in the header of an ATM cell. The VCI, together with the VPI, is used to identify the next destination of a cell as it passes through a series of ATM switches on its way to its destination. ATM switches use the VPI/VCI fields to identify the next network VCL that a cell needs to transit on its way to its final destination.

VCL --Virtual Channel Link. A connection between two ATM devices.

VPI --Virtual Path Identifier. An 8-bit field in the header of an ATM cell. The VPI, together with the VCI, is used to identify the next destination of a cell as it passes through a series of ATM switches on its way to its destination. ATM switches use the VPI/VCI fields to identify the next VCL that a cell needs to transit on its way to its final destination. The function of the VPI is similar to that of the DLCI in Frame Relay.

ATM PVC F5 OAM Recovery Traps

The ATM PVC F5 OAM Recovery Traps feature introduces Simple Network Management Protocol (SNMP) traps that notify the administrator when a permanent virtual circuit (PVC) has recovered from F5 Operation, Administration, and Maintenance (OAM) end-to-end loopback failures, and F5 OAM alarm indication signal/remote defect indication (AIS/RDI) failures.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for ATM PVC F5 OAM Recovery Traps

Extended ATM PVC up and down traps and ATM PVC traps for, OAM F5 AIS/RDI, and OAM F5 loopback failures and recoveries cannot be used at the same time as the legacy ATM PVC trap. The legacy ATM PVC trap must be disabled by using the **no snmp-server enable traps atm pvc** command before extended ATM PVC up and down traps and ATM PVC traps for OAM F5 CC, OAM F5 AIS/RDI, and OAM F5 loopback failures and recoveries can be configured.

OAM management must be enabled on the PVC before you can use any ATM PVC traps.

Restrictions for ATM PVC F5 OAM Recovery Traps

The F5 OAM recovery traps are supported for ATM PVCs only.

Information About ATM PVC F5 OAM Recovery Traps

F5 OAM Recovery Traps for ATM PVCs

F5 OAM cells are used to detect connectivity failures and recoveries at the ATM layer. Before the introduction of this feature, Cisco IOS software provided support for SNMP traps (also called SNMP notifications) for F5 end-to-end loopback, and F5 AIS/RDI connectivity failures on a PVC. The ATM PVC F5 OAM Recovery Traps feature introduces SNMP traps that notify the network management system (NMS) when connectivity is restored to a PVC after the following types of failures:

• F5 OAM end-to-end loopback failures
• F5 OAM segment AIS/RDI failures
• F5 OAM end-to-end AIS/RDI failures

Information in the traps includes the number of PVCs that recovered and time stamps indicating when the first and last recoveries occurred during the notification interval.

To limit the amount of traffic that can be generated by the F5 OAM failure and recovery traps, only one trap of each type can be generated in each trap interval. Each trap can report on multiple PVCs, and successive PVCs that have the same failure or recovery are reported as a range.

In addition to the traps, MIB tables are maintained to provide information about the failures and recoveries on PVCs.

For a complete description of the extended ATM PVC Trap MIB, including the supported notifications and tables, see the MIB file called CISCO-ATM-PVCTRAP-EXTN-MIB.my, available through Cisco.com at the following URL:

http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

Benefits of F5 OAM Recovery Traps for ATM PVCs

Before the introduction of this feature, when F5 OAM failures were detected on PVCs, failure notifications were sent to the NMS, and the operational state of the PVC was kept up. There was no mechanism for notifying the NMS when connectivity was restored to the PVCs after F5 OAM failures. The F5 OAM Recovery Traps feature introduces traps that asynchronously notify the NMS when PVCs have recovered from F5 OAM failures.

How to Configure F5 OAM Recovery Traps for ATM PVCs

Configuring ATM OAM Support

Perform this task to configure ATM OAM support on an ATM PVC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *number*
4. **ip address** *ip-address mask*
5. **pvc** [*name*] *vpi* / *vci*
6. **oam-pvc manage** [**keep-vc-up** [**end aisrdi failure** | **seg aisrdi failure**]]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.
		• Enter your password if prompted.
	Example:	
	Router> enable	
Step 2	**configure terminal**	Enters global configuration mode.
	Example:	
	Router# configure terminal	
Step 3	**interface atm** *number*	Specifies an interface for configuration and enters interface configuration mode.
	Example:	
	Router(config)# interface atm 0	
Step 4	**ip address** *ip-address mask*	Sets a primary or secondary IP address for an interface.
	Example:	
	Router(config-if)# ip address 10.0.0.3 255.255.255.0	
Step 5	**pvc** [*name*] *vpi* / *vci*	Creates an ATM PVC and enters ATM virtual circuit configuration mode.
	Example:	
	Router(config-if)# pvc 0/40	

Command or Action	Purpose
Step 6 **oam-pvc manage** [**keep-vc-up** [**end aisrdi failure** | **seg aisrdi failure**]] **Example:** `Router(config-if-atm-vc)# oam-pvc manage`	Configures ATM OAM management.

Enabling OAM F5 Failure and Recovery Traps

Perform this task to enable the MIB and SNMP notifications that support ATM OAM F5 CC management.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server enable traps atm pvc extension** {**up** \| **down** \| **oam failure** [**aisrdi** \| **loopback** }

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3 **snmp-server enable traps atm pvc extension** {**up** | **down** | **oam failure** [**aisrdi** | **loopback** } **Example:** `Router(config)# snmp-server enable traps atm pvc extension oam failure aisrdi`	Enables ATM OAM F5 AIS/RDI failure and recovery traps and ATM OAM F5 end-to-end loopback failure and recovery traps.

•

Troubleshooting Tips

• Use the **show running-config** command to verify the configuration of ATM OAM management.

- Use the **show atm pvc**command to verify that ATM OAM management is enabled and to display the state of the PVC.
- Use the **debug snmp packet** command to display which SNMP traps are being generated.

Configuration Examples for ATM PVC F5 OAM Recovery Traps

Enabling OAM PVC Managment Example

The following example shows how to enable ATM PVC OAM management.

```
Router(config)# interface ATM0/3/0.100 point-to-point

Router(config-subif)# pvc pvc100 0/100

Router(config-if-atm-vc)# oam-pvc manage
Router(config-if-atm-vc)# end
```

Note   Enhanced Interior Gateway Routing Protocol (EIGRP) must be configured on the router if you want the notification packets to be sent to the NMS.

ATM PVC Extended Up and Down Notifications Example

Enabling ATM PVC extended up and down notifications: Example

The following example shows how to enable ATM PVC extended up and down notifications:

```
snmp-server community public RW
snmp-server host 172.16.61.90 public
snmp-server enable traps atm pvc extension up
snmp-server enable traps atm pvc extension down
snmp-server host 10.0.0.115 vrf Mgmt-intf version 2c public udp-port 2030
```

ATM PVC Down Notification: Example

The following sample output shows an ATM PVC in the DOWN state:

```
Router# show atm vc
Codes: DN - DOWN, IN - INACTIVE
           VCD /                                    Peak Av/Min Burst
Interface  Name         VPI   VCI Type     Encaps     SC    Kbps   Kbps Cells St
0/3/0.100  pvc100         0   100 PVC      SNAP       UBR  149760             DN
```

The following example shows the corresponding output for the ATM PVC extended down notification:

```
Received SNMPv2c Trap:
Community: public
From: 10.0.0.54
sysUpTimeInstance = 1918435
```

```
snmpTrapOID.0 = catmIntfPvcDownTrap
ifIndex.52 = 52
atmIntfPvcFailures.15 = 4
atmIntfCurrentlyFailingPVcls.15 = 1
ifDescr.52 = ATM0/3/0.100
catmPVclCurFailTime.52.0.100 = 1915435
catmPVclPrevRecoverTime.52.0.100 = 259552
catmPVclFailureReason.52.0.100 = catmLoopbackOAMFailure(1)
```

ATM PVC Up Notification: Example

The following sample output shows an ATM PVC in the UP state:

```
Router# show atm vc
Codes: DN - DOWN, IN - INACTIVE
         VCD /                                     Peak Av/Min Burst
Interface Name         VPI  VCI Type    Encaps    SC    Kbps   Kbps Cells St
0/3/0.100 pvc100         0  100 PVC     SNAP      UBR 149760               UP
```

The following example shows the corresponding output for the ATM PVC extended up notification:

```
Received SNMPv2c Trap:
Community: public
From: 9.0.0.54
sysUpTimeInstance = 1933376
snmpTrapOID.0 = catmIntfPvcUp2Trap
ifIndex.52 = 52
catmIntfCurrentlyDownToUpPVcls.15 = 1
ifDescr.52 = ATM0/3/0.100
catmPVclCurRecoverTime.52.0.100 = 1930676
catmPVclPrevFailTime.52.0.100 = 1915435
catmPVclRecoveryReason.52.0.100 = catmLoopbackOAMRecover(1)
```

ATM OAM Failure Looback Notification Example

Enabling ATM OAM Failure Loopback Notification: Example

```
The following example shows how to enable ATM PVC OAM failure loopback notifications and
extended up and down notifications:
snmp-server community public RW
snmp-server enable traps atm pvc extension up
snmp-server enable traps atm pvc extension down
snmp-server enable traps atm pvc extension oam failure loopback
snmp-server host 10.0.0.115 vrf Mgmt-intf version 2c public udp-port 2030
```

Note   If you configure the **snmp-server enable traps atm pvc extension oam failure** command, you may not see up or down traps when an OAM failure trap is generated. Additionally, the PVC will stay in the UP state.

OAM Loopback Failure Notification: Example

The following sample output shows an ATM PVC that has failed. Note that the output indicates the PVC is still in the UP state.

```
Router# show atm vc
Codes: DN - DOWN, IN - INACTIVE
         VCD /                                     Peak Av/Min Burst
Interface Name         VPI  VCI Type    Encaps    SC    Kbps   Kbps Cells St
0/3/0.100 pvc100         0  100 PVC     SNAP      UBR 149760               UP
```

The following example shows the corresponding output for the OAM loopback failure notification:

```
Received SNMPv2c Trap:
Community: public
From: 9.0.0.54
sysUpTimeInstance = 1964155
snmpTrapOID.0 = catmIntfPvcOAMFailureTrap
ifIndex.52 = 52
catmIntfOAMFailedPVcls.15 = 65
catmIntfCurrentOAMFailingPVcls.15 = 1
ifDescr.52 = ATM0/3/0.100
catmPVclStatusTransition.52.0.100 = 1
catmPVclStatusChangeStart.52.0.100 = 1961155
catmPVclStatusChangeEnd.52.0.100 = 1961155
```

OAM Loopback Recovery Notification: Example

The following sample output shows an ATM PVC in the UP state:

```
Router# show atm vc
Codes: DN - DOWN, IN - INACTIVE
          VCD /                                     Peak Av/Min Burst
Interface Name        VPI   VCI Type    Encaps    SC    Kbps   Kbps Cells St
0/3/0.100 pvc100         0   100 PVC     SNAP      UBR 149760              UP
```

The following example shows the corresponding output for the OAM loopback recovery notification:

```
Received SNMPv2c Trap:
Community: public
From: 9.0.0.54
sysUpTimeInstance = 1986456
snmpTrapOID.0 = catmIntfPvcOAMRecoverTrap
ifIndex.52 = 52
catmIntfOAMRcovedPVcls.15 = 10
catmIntfCurrentOAMRcovingPVcls.15 = 1
ifDescr.52 = ATM0/3/0.100
catmPVclStatusUpTransition.52.0.100 = 1
catmPVclStatusUpStart.52.0.100 = 1983456
catmPVclStatusUpEnd.52.0.100 = 1983456
```

Additional References

Related Documents

Related Topic	Document Title
OAM and ATM PVC trap support commands	*Cisco IOS Asynchronous Transfer Mode Command Reference*

Standards

Standards	Title
No new or modified standards are supported by this feature.	--

MIBs

MIBs	MIBs Link
• CISCO-ATM-PVCTRAP-EXTN-MIB.my.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this features.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for ATM PVC F5 OAM Recovery Traps

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 6　　　　*Feature Information for ATM PVC F5 OAM Recovery Traps*

Feature Name	Releases	Feature Information
ATM PVC F5 OAM Recovery Traps	Cisco IOS XE Release 2.3	The ATM PVC F5 OAM Recovery Traps feature introduces SNMP traps that notify the administrator when a PVC has recovered from F5 OAM end-to-end loopback failures and F5 OAM AIS/RDI failures. The following command was introduced: **snmp-server enable traps atm pvc extension**.

ATM VP Average Traffic Rate

The ATM VP Average Traffic Rate feature is a subscriber and VP traffic reporting feature that enables you to display the 5-minute traffic rates on virtual path (VP) counters.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About ATM VP Average Traffic Rate

ATM VP Average Traffic Rate

The ATM VP Average Traffic Rate feature is a subscriber and VP traffic reporting feature that enables you to display the 5-minute traffic rates on virtual path (VP) counters. This feature extends the **show atm vp** command to provide rate information. Minute counters on the ATM VPs support the **show atm vp** command.

The ATM VP Average Traffic Rate feature provides support for VP-based rate counters and enables you to display the average traffic load on the VP for the last 5 minutes. This feature is enabled by default and requires no configuration. The duration of the counters is set at 5 minutes average.

How to Display ATM VP Average Traffic Rates

- Displaying ATM VP 5-Minute Traffic Rates, page 80

Displaying ATM VP 5-Minute Traffic Rates

To display the 5-minute traffic rates, use the following command in privileged EXEC mode:

Command	Purpose
Router# **show atm vp [vpi]**	Displays statistical information, including the 5-minute traffic rate, for all virtual paths (VPs) on an interface or for a specific VP.
	- (Optional) *vpi* is the ATM network virtual path identifier (VPI) of the permanent virtual path. The range is from 0 to 255. The VPI is an 8-bit field in the header of the ATM cell.

Configuration Examples for ATM VP Average Traffic Rates

- ATM VP 5-Minute Traffic Rates Example, page 80

ATM VP 5-Minute Traffic Rates Example

The following example shows sample output from the **show atm vp** command. The output displays the 5-minute traffic rates for VP 10:

```
Router# show atm vp 10

ATM1/1/0 VPI: 10, PeakRate: 100000, CesRate: 0, DataVCs: 1, CesVCs: 0, Status: INACTIVE
VCD VCI   Type  InPkts   OutPkts   AAL/Encap    Status
1   3     PVC      0        0      F4 OAM       INACTIVE
2   4     PVC      0        0      F4 OAM       INACTIVE
3   100   PVC   78310    78310     AAL5-SNAP    ACTIVE
TotalInPkts: 78310, TotalOutPkts: 78310, TotalInFast: 0, TotalOutFast: 0,
TotalBroadcasts:
5 Min Average Output Rate: 0 packets/sec, 32 bits/sec
TotalInPktDrops: 0, TotalOutPktDrops: 0
Total subscribed rate of active VC's: 0
```

Additional References

Related Documents

Related Topic	Document Title
show atm vp command	*Cisco IOS Asynchronous Transfer Mode Command Reference*

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for ATM VP Average Traffic Rate

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 7 *Feature Information for ATM VP Average Traffic Rate*

Feature Name	Releases	Feature Information
ATM VP Average Traffic Rate	Cisco IOS XE Release 2.3	Enables you to display 5-minute traffic rates at the VP level. The following command was modified: show atm vp.

Local Template-Based ATM PVC Provisioning

The Local Template-Based ATM Provisioning feature enables ATM permanent virtual circuits (PVCs) to be provisioned automatically as needed from a local configuration. ATM PVC autoprovisioning can be configured on a PVC, an ATM PVC range, or a VC class. If a VC class configured with ATM PVC autoprovisioning is assigned to an interface, all the PVCs on that interface will be autoprovisioned; this configuration is sometimes referred to as an *infinite range*.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for Local Template-Based ATM Provisioning

The number of PVCs that can be established on an interface that is configured as an infinite range is limited to the maximum number of VCs that the platform can support.

Information About Local Template-Based ATM Provisioning

Autoprovisioned ATM PVCs are not created until there is activity on the virtual path identifier (VPI)/ virtual channel identifier (VCI) pair. When the interface is disabled and reenabled using the **shutdown** and **no shutdown** commands, autoprovisioned PVCs that are part of a PVC range or infinite range are removed upon shutdown and are not reestablished until the first incoming packet triggers PVC creation. During router reload, autoprovisioned PVCs are created when there is activity on the connection.

The total number of VCs that can be configured on an ATM port adapter is limited by the capacity of the port adapter. In cases of ATM link oversubscription, where a PVC range or infinite range is configured to provision more PVCs than the port adapter allows, the PVCs can be configured with a timeout so that they can be dynamically brought down as needed. When the timeout expires, the idle PVCs are removed, allowing the PVC range or infinite range of PVCs to share system resources.

ATM PVC local autoprovisioning supports the following applications: PPP over ATM, ATM routed bridge encapsulation, and routed RFC 1483.

The Local Template-Based ATM Provisioning feature enables ATM PVCs to be created automatically as needed from a local configuration, making the provisioning of large numbers of digital subscriber line (DSL) subscribers easier, faster, and less prone to error.

How to Configure Local Template-Based ATM Provisioning

Configuring ATM PVC Local Autoprovisioning in a VC Class

A VC class configured with ATM PVC autoprovisioning can be assigned to an ATM interface, an ATM PVC, an ATM PVC range, and an ATM PVC with a range.

Note   If a VC class that is configured with ATM PVC autoprovisioning is assigned to an ATM interface, all PVCs on the interface will be autoprovisioned.

To enable ATM PVC local autoprovisioning in a VC class, use the following commands.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vc-class atm** *vc-class-name*
4. **create on-demand**
5. **idle-timeout** *seconds* [*minimum-rate*]
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**vc-class atm** *vc-class-name* **Example:** Router(config)# vc-class atm auto-pppoe	Creates a VC class for an ATM PVC, SVC, or ATM interface and enters ATM VC class configuration mode.
Step 4	**create on-demand** **Example:** Router(config-vc-class)# create on-demand	Configures ATM PVC autoprovisioning, which enables a PVC or range of PVCs to be created automatically on demand.
Step 5	**idle-timeout** *seconds* [*minimum-rate*] **Example:** Router(config-vc-class)# idle-timeout 300 10	(Optional) Configures the idle timeout parameter for tearing down ATM SVC connections or autoprovisioned ATM PVC connections.
Step 6	**end** **Example:** Router(config-vc-class)# end	(Optional) Exits the ATM VC class configuration mode and returns to privileged EXEC mode.

Configuring ATM PVC Local Autoprovisioning on a PVC

ATM PVC local autoprovisioning can also be configured on a PVC by assigning a VC class that has been configured with ATM PVC local autoprovisioning to the PVC.

To enable ATM PVC local autoprovisioning on a PVC, use the following commands.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** slot/subslot/port[.subinterface]
4. **atm autovc retry** *interval*
5. **pvc** [*name*] *vpi* / *vci*
6. **create on-demand**
7. **idle-timeout** *seconds* [*minimum-rate*]
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface atm** slot/subslot/port[.subinterface] **Example:** Router(config)# interface atm5/0	Configures an ATM interface.
Step 4	**atm autovc retry** *interval* **Example:** Router(config-if)# atm autovc retry 60	(Optional) Configures the interval at which the router will repeat the attempt to create autoprovisioned PVCs after a failure of the initial creation attempt.
Step 5	**pvc** [*name*] *vpi* / *vci* **Example:** Router(config-if)# pvc 1/300	Creates an ATM PVC and enters ATM virtual circuit configuration mode.

Command or Action	Purpose
Step 6 **create on-demand** **Example:** `Router(config-if-atm-vc)# create on-demand`	Configures ATM PVC autoprovisioning, which enables a PVC or range of PVCs to be created automatically on demand.
Step 7 **idle-timeout** *seconds* [*minimum-rate*] **Example:** `Router(config-if-atm-vc)# idle-timeout 300 10`	(Optional) Configures the idle timeout parameter for tearing down ATM SVC connections or autoprovisioned ATM PVC connections.
Step 8 **end** **Example:** `Router(config-if-atm-vc)# end`	(Optional) Exits the ATM virtual circuit configuration mode and returns to privileged EXEC mode.

Configuring ATM PVC Local Autoprovisioning on an ATM PVC Range

ATM PVC local autoprovisioning can also be configured on a range by assigning a VC class that has been configured with ATM PVC local autoprovisioning to the range.

To enable ATM PVC autoprovisioning on an ATM PVC range, use the following commands.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** slot/subslot/port[**.** *subinterface*]
4. **atm autovc retry** *interval*
5. **range** [*range-name*] **pvc** *start-vpi* **/** *start-vci end-vpi* **/** *end-vci*
6. **create on-demand**
7. **idle-timeout** *seconds* [*minimum-rate*]
8. **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface atm** slot/subslot/port[**.** *subinterface*] **Example:** Router(config)# interface atm5/0	Configures an ATM interface.
Step 4	**atm autovc retry** *interval* **Example:** Router(config-if)# atm autovc retry 60	(Optional) Configures the interval at which the router will repeat the attempt to create autoprovisioned PVCs after a failure of the initial creation attempt.
Step 5	**range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi* / *end-vci* **Example:** Router(config-if)# range auto pvc 0/100 1/200	Defines a range of ATM PVCs and enters ATM PVC range configuration mode.
Step 6	**create on-demand** **Example:** Router(config-if-atm-range)# create on-demand	Configures ATM PVC autoprovisioning, which enables a PVC or range of PVCs to be created automatically on demand.
Step 7	**idle-timeout** *seconds* [*minimum-rate*] **Example:** Router(config-if-atm-range)# idle-timeout 300 10	(Optional) Configures the idle timeout parameter for tearing down ATM SVC connections or autoprovisioned ATM PVC connections.
Step 8	**end** **Example:** Router(config-if-atm-range)# end	(Optional) Exits the ATM PVC range configuration mode and returns to privileged EXEC mode.

Configuring ATM PVC Local Autoprovisioning on PVC Within a Range

ATM PVC local autoprovisioning can also be configured on a PVC within a range by assigning a VC class that has been configured with ATM PVC local autoprovisioning to the PVC.

To enable ATM PVC autoprovisioning on a PVC within an ATM PVC range, use the following commands.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** slot/subslot/port[**.** *subinterface*]
4. **atm autovc retry** *interval*
5. **range** [*range-name*] **pvc** *start-vpi* **/** *start-vci end-vpi* **/** *end-vci*
6. **pvc-in-range** [*pvc-name*] [*vpi* **/**]*vci*]
7. **create on-demand**
8. **idle-timeout** *seconds* [*minimum-rate*]
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface atm** slot/subslot/port[**.** *subinterface*] **Example:** `Router(config)# interface atm5/0`	Configures an ATM interface.
Step 4	**atm autovc retry** *interval* **Example:** `Router(config-if)# atm autovc retry 60`	(Optional) Configures the interval at which the router will repeat the attempt to create autoprovisioned PVCs after a failure of the initial creation attempt.

	Command or Action	Purpose
Step 5	**range** [*range-name*] **pvc** *start-vpi* **/** *start-vci end-vpi* **/** *end-vci* **Example:** `Router(config-if)# range auto pvc 0/100 1/200`	Defines a range of ATM PVCs and enters ATM PVC range configuration mode.
Step 6	**pvc-in-range** [*pvc-name*] [*vpi* **/**]*vci*] **Example:** `Router(config-if-atm-range)# pvc-in-range 0/101`	Defines an individual PVC within a PVC range and enables PVC-in-range configuration mode.
Step 7	**create on-demand** **Example:** `Router(config-if-atm-range-pvc)# create on-demands`	Configures ATM PVC autoprovisioning, which enables a PVC or range of PVCs to be created automatically on demand.
Step 8	**idle-timeout** *seconds* [*minimum-rate*] **Example:** `Router(config-if-atm-range-pvc)# idle-timeout 300 10`	(Optional) Configures the idle timeout parameter for tearing down ATM SVC connections or autoprovisioned ATM PVC connections.
Step 9	**end** **Example:** `Router(config-if-atm-range-pvc)# end`	(Optional) Exits the PVC-in-range configuration mode and returns to privileged EXEC mode.

Verifying ATM PVC Autoprovisioning

To verify that ATM PVC local autoprovisioning is configured and working correctly, perform the tasks in the following steps:

SUMMARY STEPS

1. Enter the **show running-config** command to verify that the configuration is correct.
2. Enter the **show atm pvc** command. PVCs that have been autoprovisioned will have the value "PVC-A" ("A" stands for automatic) in the Type field.
3. Enter the **show atm pvc** command with the *vpi*/*vci* arguments to see if ATM PVC local autoprovisioning is configured on a specific PVC. If ATM PVC local autoprovisioning is configured, the text "VC Auto Creation Enabled: local" will appear in the output.

DETAILED STEPS

Step 1   Enter the **show running-config** command to verify that the configuration is correct.

Step 2   Enter the **show atm pvc** command. PVCs that have been autoprovisioned will have the value "PVC-A" ("A" stands for automatic) in the Type field.

Example:

```
Router# show atm pvc
            VCD /                                    Peak  Avg/Min Burst
Interface   Name      VPI   VCI  Type   Encaps   SC  Kbps  Kbps   Cells  Sts
5/0.1       117        0    50   PVC-A  SNAP     UBR 149760               UP
5/0.1       118        0    51   PVC-A  SNAP     UBR 149760               UP
5/0.1       119        0    52   PVC-A  SNAP     UBR 149760               UP
```

Step 3   Enter the **show atm pvc** command with the *vpi*/*vci* arguments to see if ATM PVC local autoprovisioning is configured on a specific PVC. If ATM PVC local autoprovisioning is configured, the text "VC Auto Creation Enabled: local" will appear in the output.

Example:

```
Router# show atm pvc 0/51
ATM5/0.1: VCD: 118, VPI: 0, VCI: 51
UBR, PeakRate: 149760
AAL5-LLC/SNAP, etype:0x0, Flags: 0x20000C20, VCmode: 0x0
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM VC state: Not Managed
ILMI VC state: Not Managed
InARP frequency: 15 minutes(s)
Transmit priority 4
InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
InPRoc: 0, OutPRoc: 0, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
InPktDrops: 0, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0, LengthViolation: 0, CPIErrors: 0
Out CLP=1 Pkts: 0
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
OAM cell drops: 0
Status: UP
PPP: Virtual-Access3 from Virtual-Template1
VC Auto Creation Enabled: local
```

Monitoring and Maintaining ATM PVC Local Autoprovisioning

To monitor and maintain ATM PVC autoprovisioning, use one or more of the following commands.

SUMMARY STEPS

1. **enable**
2. **debug atm autovc** {**event** | **error** | **all**}
3. **show atm pvc**
4. **show atm vc**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**debug atm autovc** {**event**	**error**	**all**} **Example:** `Router# debug atm autovc all`	Displays information about autoprovisioned ATM PVC events and errors.
Step 3	**show atm pvc** **Example:** `Router# show atm pvc`	Displays all ATM PVCs and traffic information.
Step 4	**show atm vc** **Example:** `Router# show atm vc`	Displays all ATM PVCs and SVCs and traffic information.

Configuration Examples for Local Template-Based ATM Provisioning

ATM PVC Local Autoprovisioning on an ATM Interface Example

In the following example, local autoprovisioning is enabled on all PVCs on ATM interface 5/0:

```
vc-class atm auto-pppoe
 vbr-nrt 1000 100
 protocol pppoe
 create on-demand
 idle-timeout 300 10
!
interface atm 5/0
 class-int auto-pppoe
 atm autovc retry 10
```

ATM PVC Local Autoprovisioning on a PVC Example

The following example shows the configuration of local autoprovisioning on a PVC:

```
interface atm 5/0
 pvc 1/300
   create on-demand
   idle-timeout 300 10
```

ATM PVC Local Autoprovisioning on an ATM PVC Range Example

The following example shows the configuration of local autoprovisioning on an ATM PVC range called "auto":

```
interface atm 5/0
 range auto pvc 0/100 1/200
   create on-demand
```

ATM PVC Local Autoprovisioning on a PVC Within a Range Example

The following example shows the configuration of local autoprovisioning on a PVC within a PVC range:

```
interface atm 5/0
 range auto pvc 0/100 1/200
  pvc-in-range 0/101
    create on-demand
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
ATM commands	*Cisco IOS Asynchronous Transfer Mode Command Reference*

Related Topic	Document Title
ATM PVC configuration	*Cisco IOS XE Asynchronous Transfer Mode Configuration Guide*

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 1483	*Multiprotocol Encapsulation over ATM Adaptation Layer*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Local Template-Based ATM PVC Provisioning

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 8   *Feature Information for Local Template-Based ATM PVC Provisioning*

Feature Name	Releases	Feature Information
Local Template-Based ATM PVC Provisioning	Cisco IOS XE Release 2.5	This feature was introduced on Cisco ASR 1000 Series Aggregation Services Routers. The Local Template-Based ATM Provisioning feature enables ATM permanent virtual circuits (PVCs) to be provisioned automatically as needed from a local configuration. The following commands were introduced or modified: **atm autovc retry, create on-demand, debug atm autovc, idle-timeout.**

ATM Hierarchical Shaping ATM VC into VP Shaping

Traffic shaping is a quality of service (QoS) mechanism that is used to manage the network traffic by shaping the traffic to a specified rate. Traffic shaping enables the network administrator to:

- Control access to the available bandwidth.
- Ensure that the traffic conforms to the policies.
- Regulate the flow of traffic to avoid congestion that can occur when the transmitted traffic exceeds the access speed of its remote target interface.

Traffic shaping uses queues to constrain data bursts, limit peak data rate, and smooth jitters so that traffic will fit within the promised envelope. Traffic shaping limits the throughput by buffering excess traffic instead of dropping packets.

ATM VP/VC hierarchical shaping provides two levels of traffic shaping--per-VC and per-VP--to control or modify the flow of traffic on an interface. The shaping function also ensures that the traffic from one VC does not adversely impact another VC, thus preventing the loss of data. The traffic is shaped first at the VC level and then at the VP level.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for ATM Hierarchical Shaping

All virtual channels (VCs) within a given virtual path (VP) must belong to the same ATM service category.

Information About ATM Hierarchical Shaping

ATM Hierarchical Shaping

If a service (or an application) wants to use an ATM network to transport a particular kind of traffic, it must first inform the network about what kind of traffic is to be transported, and the performance requirements of that traffic. The ATM service categories provide a method to relate traffic characteristics and QoS requirements to network behavior. Hierarchical shaping requires that all VCs belonging to a given VP have the same ATM service category. This hierarchy ensures that packets are shaped first at the VC level and then at the VP level. At the interface level, the priority is based on the ATM service category. The service category is determined by the first PVC that is configured under a VP. The priority is in the following order:

1 Constant Bit Rate (CBR)
2 Unspecified Bit Rate (UBR)
3 Variable Bit Rate Non Real-Time (VBR-nRT)
4 Real-time Variable Bit Rate (VBR-RT)

If no service category is specified at the VC level, the default is unshaped UBR. The ATM Hierarchical Shaping feature is supported for the following ATM traffic service categories:

- VBR-nRT
- UBR

For VBR-nRT traffic the output sustainable cell rate (SCR) value that is configured will be taken into account for VC shaping. For UBR traffic, the output peak cell rate (PCR) value that is configured will be taken into account for VC shaping.

The ATM Hierarchical Shaping feature supports over-subscription. Over-subscription occurs when the sum of the configured rate of UBR and VBR PVCs exceeds the line rate.

How to Configure ATM Hierarchical Shaping

Configuring ATM Hierarchical Shaping

Perform this task to configure ATM hierarchical shaping.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *interface-number* [**.** *subinterface-number* {**mpls** | **multipoint** | **point-to-point**}]
4. **atm pvp** *vpi* [*peak-rate*]
5. **pvc** *vpi* / *vci*
6. **exit**
7. **range** [*range-name*] **pvc** [*start-vpi* /]*start-vci* [*end-vpi* /]*end-vci*
8. **ubr** *output-pcr*
9. **exit**
10. **atm pvp** *vpi* [*peak-rate*]
11. **pvc** *vpi* / *vci*
12. **vbr-nrt** *output-pcr output-scr* [*output-maxburstsize*]
13. **create on-demand**
14. **end**
15. **show atm pvc**
16. **show atm vp**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface atm** *interface-number* [**.** *subinterface-number* {**mpls**	**multipoint**	**point-to-point**}] **Example:** Router(config)# interface atm 0/3/2.1 multipoint	Configure an ATM interface and enters subinterface configuration mode.

	Command or Action	Purpose
Step 4	**atm pvp** *vpi* [*peak-rate*] **Example:** `Router(config-subif)# atm pvp 2`	Creates a permanent virtual path (PVP) used to multiplex (or bundle) one or more VCs.
Step 5	**pvc** *vpi* / *vci* **Example:** `Router(config-subif)# pvc 2/200`	Creates or assigns a name to an ATM PVC and enters ATM virtual circuit configuration mode.
Step 6	**exit** **Example:** `Router(config-if-atm-vc)# exit`	Exits ATM virtual circuit configuration mode and returns to subinterface configuration mode.
Step 7	**range** [*range-name*] **pvc** [*start-vpi /*]*start-vci* [*end-vpi /*]*end-vci* **Example:** `Router(config-subif)# range range1 pvc 2/100 2/102`	Defines a range of ATM PVCs.
Step 8	**ubr** *output-pcr* **Example:** `Router(config-if-atm-vc)# ubr 4000`	Configures UBR QoS and specifies the output PCR for an ATM PVC, PVC range, switched virtual circuit (SVC), VC class, or VC bundle member.
Step 9	**exit** **Example:** `Router(config-if-atm-vc)# exit`	Exits ATM virtual circuit configuration mode and returns to subinterface configuration mode.
Step 10	**atm pvp** *vpi* [*peak-rate*] **Example:** `Router(config-subif)# atm pvp 3`	Creates a PVP used to multiplex (or bundle) one or more VCs.

	Command or Action	Purpose
Step 11	**pvc** *vpi* / *vci* **Example:** Router(config-subif)# pvc 3/150	Creates or assigns a name to an ATM PVC and enters ATM virtual circuit configuration mode.
Step 12	**vbr-nrt** *output-pcr output-scr* [*output-maxburstsize*] **Example:** Router(config-if-atm-vc)# vbr-nrt 1000 1000	Configures the VBR-nRT QoS and specifies output PCR, output SCR, and output maximum burst cell size for an ATM PVC, PVC range, SVC, VC class, or VC bundle member.
Step 13	**create on-demand** **Example:** Router(config-if-atm-vc)# create on-demand	Configures ATM PVC autoprovisioning, which enables a PVC or range of PVCs to be created automatically on demand.
Step 14	**end** **Example:** Router(config-if-atm-vc)# end	Exits ATM virtual circuit configuration mode and returns to privileged EXEC mode.
Step 15	**show atm pvc** **Example:** Router# show atm pvc	(Optional) Displays the statistics for all VPs on an interface or for a specific VP.
Step 16	**show atm vp** **Example:** Router# show atm vp	(Optional) Displays all ATM PVCs and traffic information.

Configuration Examples for ATM Hierarchical Shaping

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Example Configuring ATM Hierarchical Shaping

The following example shows how to configure ATM hierarchical shaping:

```
enable
 configure terminal
  interface atm 0/3/2.1 multipoint
   atm pvp 2
   pvc 2/200
    exit
   range range1 pvc 2/100 2/102
    ubr 4000
    exit
   atm pvp 3
   pvc 3/100
    vbr-nrt 1000 1000
    create on-demand
    end
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
ATM commands	*Cisco IOS Asynchronous Transfer Mode Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for ATM Hierarchical Shaping

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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Table 9   ***Feature Information for ATM Hierarchical Shaping***

Feature Name	Releases	Feature Information
ATM Hierarchical Shaping-- ATM VC into VP Shaping	Cisco IOS XE Release 3.3S	ATM VP/VC hierarchical shaping provides two levels of traffic shaping--per-VC and per-VP--to control or modify the flow of traffic on an interface. The shaping function also ensures that traffic from one VC does not adversely impact another VC, thus preventing loss of data. The traffic is shaped first at the VC level and then at the VP level.