



Asynchronous Transfer Mode Configuration Guide, Cisco IOS XE Fuji 16.9.x

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CHAPTER 1

Read Me First

Important Information about Cisco IOS XE 16

Effective Cisco IOS XE Release 3.7.0E (for Catalyst Switching) and Cisco IOS XE Release 3.17S (for Access and Edge Routing) the two releases evolve (merge) into a single version of converged release—the Cisco IOS XE 16—providing one release covering the extensive range of access and edge products in the Switching and Routing portfolio.

Feature Information

Use [Cisco Feature Navigator](#) to find information about feature support, platform support, and Cisco software image support. An account on Cisco.com is not required.

Related References

- [Cisco IOS Command References, All Releases](#)

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see [What's New in Cisco Product Documentation](#).

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CHAPTER 2

Configuring ATM

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

- [Finding Feature Information, on page 3](#)
- [Restrictions for Configuring ATM, on page 3](#)
- [ATM Interface, on page 4](#)
- [How to Configure ATM, on page 6](#)
- [ATM Configuration Examples, on page 31](#)
- [Monitoring and Maintaining the ATM Interface, on page 37](#)
- [Feature Information for Configuring ATM, on page 38](#)
- [Additional References, on page 41](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 Configuring ATM

Restrictions for PVC Bundle Management

ATM PVC Bundling Support on ASR1K

- A maximum of 8 PVCs can be configured in one PVC bundle.

ATM Interface

Asynchronous Transfer Mode (ATM) uses one Virtual Circuit (VC) to carry all traffic to the next hop address. Even with VC multiplexing, a single VC carries all traffic of the same protocol to the next hop address. Though Weighted Random Early Discard (Per-VC (D)WRED) and WFQ can classify and prioritize the packets, they all share one single Quality of Service (QoS) VC.

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. Device# **configure terminal**
2. Do one of the following:
 - Device(config)# **interface atm slot /0**
 - Device(config)# **interface atm slot / port-adapter /0**
3. Device(config-if)# **ip address ip-address mask**
4. Device(config-if)# **no shutdown**

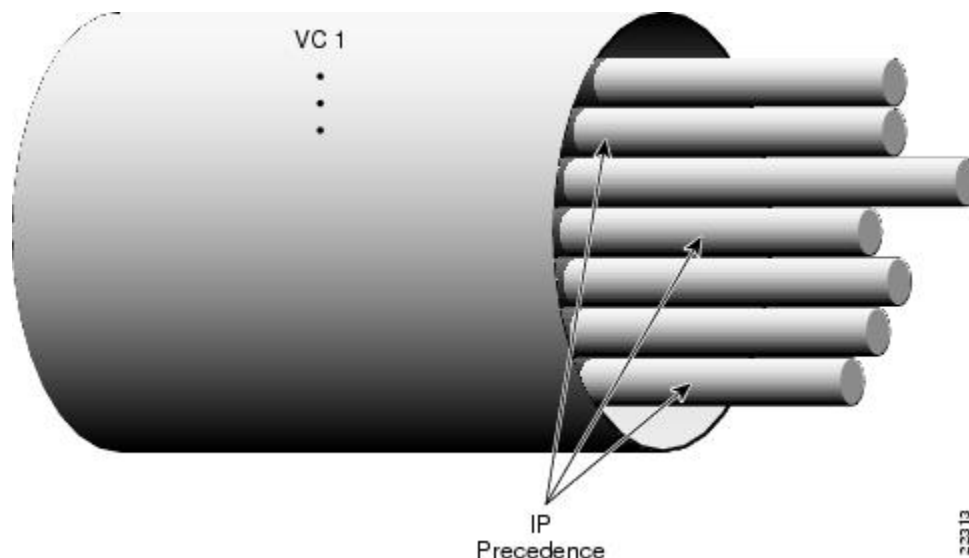
DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | Device# configure terminal | Enters global configuration mode from the terminal. |
| Step 2 | Do one of the following: <ul style="list-style-type: none"> • Device(config)# interface atm slot /0 • Device(config)# interface atm slot / port-adapter /0 Example: Device(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 device documentation. |
| Step 3 | Device(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 | Device(config-if)# no shutdown | Changes the shutdown state to up and enables the ATM interface, thereby beginning the segmentation and reassembly (SAR) operation on the interface. <ul style="list-style-type: none"> • 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. |

VC Bundle Support and Bundle Management

ATM VC bundle management allows you to configure multiple VCs that have different QoS characteristics between any pair of ATM-connected routers. As shown in the figure below, these VCs are grouped in a bundle and are referred to as bundle members.

Figure 1: ATM VC Bundle

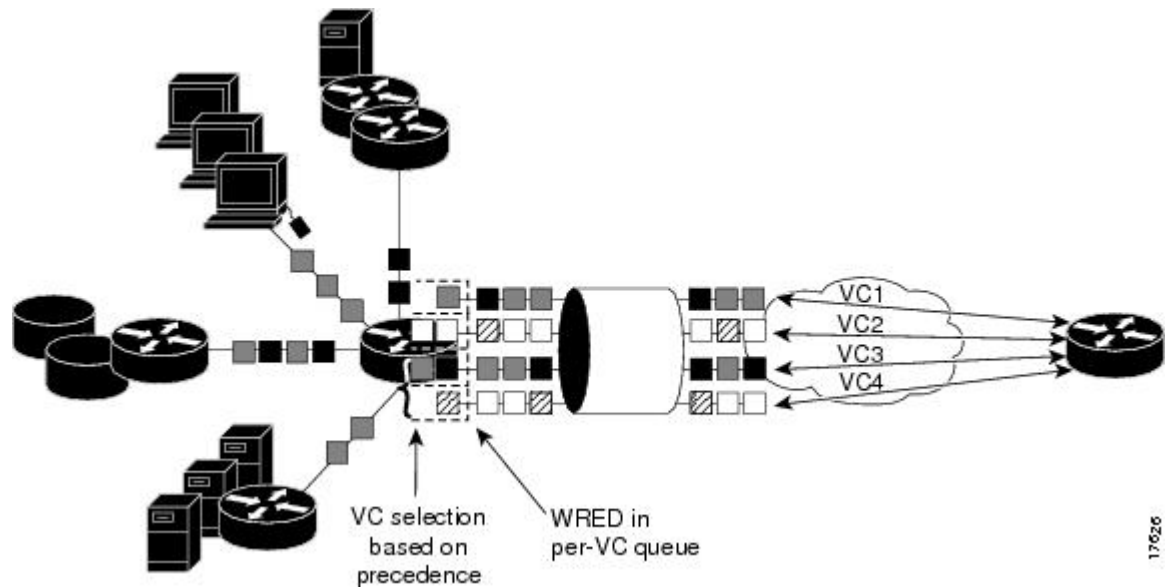


ATM VC bundle management allows you to define an ATM VC bundle and add VCs to it. Each VC of a bundle has its own ATM traffic class and ATM traffic parameters. You can apply attributes and characteristics to discrete VC bundle members or you can apply them collectively at the bundle level.

Using VC bundles, you can create differentiated service by flexibly distributing IP precedence levels over the different VC bundle members. You can map a single precedence level or a range of levels to each discrete VC in the bundle, thereby enabling individual VCs in the bundle to carry packets marked with different precedence levels. You can use WRED (or DWRED) to further differentiate service across traffic that has different IP precedences but that uses the same VC in a bundle.

To determine which VC in the bundle to use to forward a packet to its destination, the ATM VC bundle management software matches precedence levels between packets and VCs (see the figure below). IP traffic is sent to the next hop address for the bundle because all VCs in a bundle share the same destination, but the VC used to carry a packet depends on the value set for that packet in the IP Precedence bits of the type of service (ToS) byte of its header. The ATM VC bundle management software matches the IP precedence of the packet to the IP Precedence value or range of values assigned to a VC, sending the packet out on the appropriate VC. Moreover, the ATM VC bundle management feature allows you to configure how traffic will be redirected when the VC the packet was matched to goes down. The figure below illustrates how the ATM VC bundle management software determines which permanent virtual circuit (PVC) bundle member to use to carry a packet and how WRED (or DWRED) is used to differentiate traffic on the same VC.

Figure 2: ATM VC Bundle PVC Selection for Packet Transfer



The support of multiple parallel ATM VCs allows you to create stronger service differentiation at the IP layer. For instance, you might want to provide IP traffic belonging to real-time CoS (such as Voice over IP traffic) on an ATM VC with strict constraints (constant bit rate (CBR) or variable bit rate real-time (VBR-rt), for example), while transporting traffic other than real-time traffic over a more elastic ATM available bit rate (ABR) PVC. Using a configuration such as this would allow you to fully utilize your network capacity. You could also elect to transport best-effort IP traffic over an unspecified bit rate (UBR) PVC--UBR is effectively the ATM version of best-effort service.

How to Configure ATM

To configure ATM, complete the tasks in the following sections. The first task is required, and then you must configure at least one PVC or SVC. The virtual circuit options you configure must match in three places: on the router, on the ATM switch, and at the remote end of the PVC or SVC connection. The remaining tasks are optional.

Configuring a VC Bundle

Creating a VC Bundle

| Command | Purpose |
|--|--|
| Device(config-if) # bundle <i>bundle-name</i> | Creates the specified bundle and enters bundle configuration mode. |

Applying Parameters to Individual VCs

Configuring a VC Bundle Member Directly

| Command | Purpose |
|---|---|
| Device(config-if-atm-member)# ubr <i>output-pcr [input-pcr]</i> | Configures the VC for unspecified bit rate (UBR) QoS and specifies the output peak cell rate (PCR) for it. |
| Device(config-if-atm-member)# ubr+ <i>output-pcr output-mcr [input-pcr]</i> <i>[input-mcr]</i> | Configures the VC for UBR QoS and specifies the output PCR and output minimum guaranteed cell rate for it. |
| Device(config-if-atm-member)# vbr-nrt <i>output-pcr output-scr output-mbs</i> <i>[input-pcr] [input-scr] [input-mbs]</i> | Configures the VC for variable bit rate nonreal-time (VBR-nrt) QoS and specifies the output PCR, output sustainable cell rate, and output maximum burst cell size for it. |
| Device(config-if-atm-member)# precedence [other range] | Configures the precedence levels for the VC. |
| Device(config-if-atm-member)# bump { implicit explicit <i>precedence-level</i> traffic } | Configures the bumping rules for the VC. |
| Device(config-if-atm-member)# protect { group vc } | Configures the VC to belong to the protected group of the bundle or to be an individually protected VC bundle member. |

Configuring VC Class Parameters to Apply to a VC Bundle Member

| Command | Purpose |
|---|--|
| Device(config-vc-class)# bump { implicit explicit <i>precedence-level</i> traffic } | <p>Specifies the bumping rules for the VC member to which the class is applied. These rules determine to which VC in the bundle traffic is directed when the carrier VC bundle member goes down.</p> <p>Note You can also add the following commands to a VC class to be used to configure a VC bundle member: ubr, ubr+, and vbr-nrt. When a VC is a member of a VC bundle, the following commands cannot be used in vc-class mode to configure the VC: encapsulation, protocol, inarp, and broadcast. These commands are useful only at the bundle level, not the bundle member level. Configuration for an individual VC overrides the collective configuration applied to all VC bundle members through application of a VC class to the bundle.</p> |

| Command | Purpose |
|--|--|
| Device (config-vc-class) # precedence <i>precedence</i> <i>min-threshold max-threshold</i> <i>mark-probability-denominator</i> | Defines precedence levels for the VC member to which the class is applied. |
| Device (config-vc-class) # protect { group vc } | Configures the VC as a member of the protected group of the bundle or as an individually protected VC. |

Applying a VC Class to a Discrete VC Bundle Member

| Command | Purpose |
|---|---|
| Device (config-if-atm-member) # class-vc <i>vc-class</i> <i>-name</i> | Assigns a VC class to a VC bundle member. |

Configuring a VC Not to Accept Bumped Traffic

| Command | Purpose |
|--|--|
| Device (config-if-atm-member) # no bump traffic | Configures the VC not to accept any bumped traffic that would otherwise be redirected to it. |

Monitoring and Maintaining VC Bundles and Their VC Members

| Command | Purpose |
|--|--|
| Device# show atm bundle <i>bundle-name</i> | Displays the bundle attributes assigned to each bundle VC member and the current working status of the VC members. |
| Device# show atm bundle <i>bundle-name</i> statistics [detail] | Displays statistics or detailed statistics on the specified bundle. |
| Device# show atm map | Displays a list of all configured ATM static maps to remote hosts on an ATM network and on ATM bundle maps. |
| Device# debug atm bundle errors | Displays information on bundle errors. |
| Device# debug atm bundle events | Displays a record of bundle events. |

Applying Bundle-Level Parameters

Configuring Bundle-Level Parameters

| Command | Purpose |
|--|--|
| <pre>Device(config-atm-bundle) # protocol <i>protocol</i> {<i>protocol-address</i> inarp} [[no] broadcast]</pre> | <p>Configures a static map or enables Inverse Address Resolution Protocol (Inverse ARP) or Inverse ARP broadcasts for the bundle.</p> <p>Note Bundle-level parameters can be applied either by assigning VC classes or by directly applying them to the bundle. Parameters applied through a VC class assigned to the bundle are superseded by those applied at the bundle level. Bundle-level parameters are superseded by parameters applied to an individual VC.</p> |
| <pre>Device(config-atm-bundle) # encapsulation <i>aal-encap</i></pre> | Configures the ATM adaptation layer (AAL) and encapsulation type for the bundle. |
| <pre>Device(config-atm-bundle) # inarp <i>minutes</i></pre> | Configures the Inverse ARP time period for all VC bundle members. |
| <pre>Device(config-atm-bundle) # broadcast</pre> | Enables broadcast forwarding for all VC bundle members. |
| <pre>Device(config-atm-bundle) # oam retry <i>up-count down-count retry</i> <i>frequency</i></pre> | Configures the VC bundle parameters related to operation, administration, and maintenance (OAM) management. |
| <pre>Device(config-atm-bundle) # oam-bundle [manage] [<i>frequency</i>]</pre> | Enables end-to-end F5 OAM loopback cell generation and OAM management for all VCs in the bundle. |

Configuring VC Class Parameters to Apply to a VC Bundle Member

| Command | Purpose |
|---|--|
| <pre>Device(config-vc-class) # bump {implicit explicit <i>precedence-level</i> traffic}</pre> | <p>Specifies the bumping rules for the VC member to which the class is applied. These rules determine to which VC in the bundle traffic is directed when the carrier VC bundle member goes down.</p> <p>Note You can also add the following commands to a VC class to be used to configure a VC bundle member: ubr, ubr+, and vbr-nrt. When a VC is a member of a VC bundle, the following commands cannot be used in vc-class mode to configure the VC: encapsulation, protocol, inarp, and broadcast. These commands are useful only at the bundle level, not the bundle member level. Configuration for an individual VC overrides the collective configuration applied to all VC bundle members through application of a VC class to the bundle.</p> |

| Command | Purpose |
|--|--|
| <pre>Device(config-vc-class)# precedence <i>precedence</i> <i>min-threshold max-threshold</i> <i>mark-probability-denominator</i></pre> | Defines precedence levels for the VC member to which the class is applied. |
| <pre>Device(config-vc-class)# protect {<i>group</i> <i>vc</i>}</pre> | Configures the VC as a member of the protected group of the bundle or as an individually protected VC. |

Attaching a Class to a Bundle

| Command | Purpose |
|--|---|
| <pre>(config-atm-bundle)# class-bundle <i>vc-class-name</i></pre> | <p>Configures a bundle with the bundle-level commands contained in the specified VC class.</p> <p>Note Parameters set through bundle-level commands contained in the VC class are applied to the bundle and all of its VC members. Bundle-level parameters applied through commands configured directly on the bundle supersede those applied through a VC class. Some bundle-level parameters applied through a VC class or directly to the bundle can be superseded by commands that you directly apply to individual VCs in bundle-vc configuration mode.</p> |

Committing a VC to a Bundle

| Command | Purpose |
|--|---|
| <pre>Device(config-atm-bundle)# pvc-bundle <i>pvc-name</i> [<i>vpi/</i>] [<i>vci</i>]</pre> | Adds the specified VC to the bundle and enters bundle-vc configuration mode in order to configure the specified VC bundle member. |

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.

Creating a Permanent Virtual Circuit

To use a permanent virtual circuit (PVC), configure the PVC in both the router and the ATM switch. PVCs remain active until the circuit is removed from either configuration. To create a PVC on the ATM interface

and enter interface ATM VC configuration mode, perform the following procedure beginning in global configuration mode:

SUMMARY STEPS

1. Device(config)# **interface atm** *slot/subslot/port.subinterface* [*.subinterface-number* {**multipoint** | **point-to-point**}]
2. (config-if)# **ipaddress***address mask*
3. Device(config-if)# **pvc** [*name*] *vpi /vci*
4. Device(config-if-atm-vc)# **protocol** *protocol* {*protocol-address* | **inarp**} [[**no**] **broadcast**]
5. Device(config-if-atm-vc)# **inarp** *minutes*
6. Device(config-if-atm-vc)# **encapsulation** {**aal5mux**|**aal5nlp**|**aal5snap**}
7. Device(config-if-atm-vc)# **end**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | Device(config)# interface atm <i>slot/subslot/port.subinterface</i> [<i>.subinterface-number</i> { multipoint point-to-point }] | Enters subinterface configuration mode for the specified port on the ATM Interface Module (IM), where: <ul style="list-style-type: none"> • <i>slot</i>—Specifies the chassis slot number where the SIP is installed. • <i>subslot</i>—Specifies the secondary slot of the SIP where the IM is installed. • <i>port</i>—Specifies the number of the individual interface port on an IM. • <i>subinterface</i>—Specifies the number of the subinterface. |
| Step 2 | (config-if)# ipaddress <i>address mask</i> | Assigns the specified IP address and subnet mask to the interface or subinterface. |
| Step 3 | Device(config-if)# pvc [<i>name</i>] <i>vpi /vci</i> | Configures a new ATM PVC by assigning its VPI/VCI numbers and enters ATM VC configuration mode. The valid values for <i>vpi /vci</i> are: <ul style="list-style-type: none"> • <i>name</i>—(Optional) An arbitrary string that identifies this PVC. • <i>vpi</i>—Specifies the VPI ID. The valid range is 0 to 255. • <i>vci</i>—Specifies the VCI ID. The valid range is 32 to 65535. Values 1 to 31 are reserved and should not be used, except for 5 for the QSAAL PVC and 16 for the ILMI PVC. ILMI is not supported. |

| | Command or Action | Purpose |
|---------------|---|---|
| | | <p>Note When using the pvc command, remember that the <i>vpi/vci</i> combination forms a unique identifier for the interface and all of its subinterfaces. If you specify a <i>vpi/vci</i> combination that has been used on another subinterface, the Cisco IOS software assumes that you want to modify that PVC's configuration and automatically switches to its parent subinterface.</p> |
| Step 4 | Device(config-if-atm-vc)# protocol <i>protocol</i> { <i>protocol-address</i> inarp } [[no] broadcast] Example: | Configures the PVC for a particular protocol and maps it to a specific <i>protocol-address</i> . <ul style="list-style-type: none"> • <i>protocol</i>—Typically set to ip or pppoe, but other values are possible. <p>Note PPP is not supported.</p> <ul style="list-style-type: none"> • <i>protocol-address</i>—Destination address or virtual interface template for this PVC (if appropriate for the <i>protocol</i>). • inarp—Specifies that the PVC uses Inverse ARP to determine its address. • [no] broadcast—(Optional) Specifies that this mapping should (or should not) be used for broadcast packets. |
| Step 5 | Device(config-if-atm-vc)# inarp <i>minutes</i> | (Optional) If using Inverse ARP, configures how often the PVC transmits Inverse ARP requests to confirm its address mapping. The valid range is 1 to 60 minutes, with a default of 15 minutes. |
| Step 6 | Device(config-if-atm-vc)# encapsulation { aal5mux aal5nlpid aal5snap } | (Optional) Configures the ATM adaptation layer (AAL) and encapsulation type, where: <ul style="list-style-type: none"> • aal5mux <i>protocol</i>—AAL and encapsulation type for multiplex (MUX)-type VCs. A protocol must be specified when you use this encapsulation type. Possible values for the <i>protocol</i> argument are as follows: <ul style="list-style-type: none"> • aal5nlpid —AAL and encapsulation type that allows ATM interfaces to interoperate with High-Speed Serial Interfaces (HSSIs) that are using an ATM data service unit (ADSU) and running ATM-Data Exchange Interface (DXI). Supported on ATM PVCs only. • aal5snap —AAL and encapsulation type that supports Inverse Address Resolution Protocol (ARP). Logical |

| | Command or Action | Purpose |
|---------------|--------------------------------------|---|
| | | link control/Subnetwork Access Protocol (LLC/SNAP) precedes the protocol datagram. This is the default. |
| Step 7 | Device(config-if-atm-vc)# end | Exits ATM VC configuration mode and returns to privileged EXEC mode. |

Creating a PVC on a Point-to-Point Subinterface

Use point-to-point subinterfaces to provide each pair of routers with its own subnet. When you create a PVC on a point-to-point subinterface, the router assumes it is the only point-to-point PVC that is configured on the subinterface, and it forwards all IP packets with a destination IP address in the same subnet to this VC. To configure a point-to-point PVC, perform the following procedure beginning in global configuration mode:

SUMMARY STEPS

1. Device(config)# **interface**atmslot/subslot/port.subinterface**point-to-point**
2. Device(config-subif)# **ipaddress**address mask
3. Device(config-subif)# **pvc** [name] vpi /vci
4. Device(config-if-atm-vc)# **protocol**protocol protocol-address [[no] broadcast]
5. Device(config-if-atm-vc)# **encapsulation** {aal5muxprotocol|aal5nlpid|aal5snap}
6. Device(config-if)# **end**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | Device(config)# interface atmslot/subslot/port.subinterface point-to-point | Creates the specified point-to-point subinterface on the given port on the specified ATM SPA, and enters subinterface configuration mode, where: <ul style="list-style-type: none"> • <i>slot</i>—Specifies the chassis slot number in the Cisco ASR 1000 Series Router where the SIP is installed. • <i>subslot</i>—Specifies the secondary slot of the SIP where the SPA is installed. • <i>port</i>—Specifies the number of the individual interface port on a SPA. • <i>subinterface</i>—Specifies the number of the subinterface. |
| Step 2 | Device(config-subif)# ipaddress address mask | Assigns the specified IP address and subnet mask to this subinterface. |
| Step 3 | Device(config-subif)# pvc [name] vpi /vci | Configures a new ATM PVC by assigning its VPI/VCI numbers and enters ATM VC configuration mode. The valid values for <i>vpi /vci</i> are: <ul style="list-style-type: none"> • <i>name</i>—(Optional) An arbitrary string that identifies this PVC. |

| | Command or Action | Purpose |
|---------------|--|---|
| | | <ul style="list-style-type: none"> • <i>vpi</i>—Specifies the VPI ID. The valid range is 0 to 255. • <i>vci</i>—Specifies the VCI ID. The valid range is 32 to 65535. Values 1 to 31 are reserved and should not be used, except for 5 for the QSAAL PVC and 16 for the ILMI PVC. ILMI is unsupported on the Cisco ASR 1000 Series Routers. <p>Note When using the pvc command, remember that the <i>vpi /vci</i> combination forms a unique identifier for the interface and all of its subinterfaces. If you specify a <i>vpi /vci</i> combination that has been used on another subinterface, the Cisco IOS XE software assumes that you want to modify that PVC's configuration and automatically switches to its parent subinterface.</p> |
| Step 4 | Device(config-if-atm-vc)# protocol <i>protocol protocol-address</i> [[no] broadcast] | <p>Configures the PVC for a particular protocol and maps it to a specific <i>protocol-address</i> .</p> <ul style="list-style-type: none"> • <i>protocol</i>—Typically set to ip or pppoe for point-to-point subinterfaces, but other values are possible. <p>Note PPP is not supported on the Cisco ASR 1000 Series Routers, and PPPoE is supported beginning in Cisco IOS XE Release 2.5.</p> <ul style="list-style-type: none"> • <i>protocol-address</i>—Destination address or virtual template interface for this PVC (as appropriate for the specified <i>protocol</i>). • [no] broadcast—(Optional) Specifies that this mapping should (or should not) be used for broadcast packets. <p>The protocol command also has an inarp option, but this option is not meaningful on point-to-point PVCs that use a manually configured address.</p> |
| Step 5 | Device(config-if-atm-vc)# encapsulation { aal5mux <i>protocol</i> aal5nlpid aal5snap } | <p>(Optional) Configures the ATM adaptation layer (AAL) and encapsulation type, where:</p> <ul style="list-style-type: none"> • aal5mux <i>protocol</i>—AAL and encapsulation type for multiplex (MUX)-type VCs. A protocol must be specified when you use this encapsulation type. • aal5nlpid —(IP only) AAL and encapsulation type that allows ATM interfaces to interoperate with High-Speed Serial Interfaces (HSSIs) that are using an ATM data service unit (ADSU) and running |

| | Command or Action | Purpose |
|---------------|-------------------------------|--|
| | | <p>ATM-Data Exchange Interface (DXI). Supported on ATM PVCs only.</p> <ul style="list-style-type: none"> • aal5snap—AAL and encapsulation type that supports Inverse Address Resolution Protocol (ARP). Logical link control/Subnetwork Access Protocol (LLC/SNAP) precedes the protocol datagram. This is the default. <p>Note Repeat Step 1 through Step 5 for each point-to-point subinterface to be configured on this ATM SPA.</p> |
| Step 6 | Device(config-if)# end | Exits interface configuration mode and returns to privileged EXEC mode. |

What to do next



Tip To verify the configuration and current status of all PVCs on a particular interface, you can also use the **show atmvcinterfaceatm** command.

Verifying a Multipoint PVC Configuration

To verify the configuration of a particular PVC, use the **show atm pvc** command:

```
Device# show atm pvc 1/120

ATM3/1/0.120: VCD: 1, VPI: 1, VCI: 120
UBR, PeakRate: 149760
AAL5-LLC/SNAP, etype:0x0, Flags: 0xC20, VCmode: 0x0
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
OAM VC status: Not Managed
ILMI VC status: Not Managed
InARP frequency: 15 minutes(s)
Transmit priority 3
InPkts: 1394964, OutPkts: 1395069, InBytes: 1833119, OutBytes: 1838799
InPRoc: 1, OutPRoc: 1, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 94964, OutAS: 95062
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
```



Note To verify the configuration and current status of all PVCs on a particular interface, you can also use the **show atm vc interface** command.

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, on page 31](#)".

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 <i>protocol protocol-address</i> [[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 <i>encap</i> | Configures the ATM adaptation layer (AAL) and encapsulation type. <ul style="list-style-type: none"> For a list of AAL types and encapsulations supported for the <i>aal-encap</i> argument, refer to the encapsulation aal5 command in the "ATM Commands" chapter of the <i>Cisco IOS Wide-Area Networking Command Reference</i>. 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.

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) # cbp <i>peak_cell_rate_KBPS</i> | Configures the Constant Bit Rate (CBR). |
| Router(config-if-atm-vc) # ubr <i>output-pcr</i> | Configures the Unspecified Bit Rate (UBR). |
| Router(config-if-atm-vc) # vbr-nrt <i>output-pcr output-scr output-mbs</i> | Configures the Variable Bit Rate-Non Real Time (VBR-NRT) QoS. |
| Router(config-if-atm-vc) # vbr-rt <i>peak-rate average-rate burst</i> | 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, on page 33](#)".

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: <ul style="list-style-type: none"> • Router(config)# interface atm <i>slot /0[. subinterface-number {multipoint point-to-point}]</i> • • Router(config)# interface atm <i>slot / port-adapter /0[. subinterface-number {multipoint point-to-point}]</i> Example: Example: Example: <pre>Router(config)# interface atm <i>number[. subinterface-number {multipoint point-to-point}]</i></pre> | Specifies the ATM interface using the appropriate format of the interface atm command. ¹ |
| Step 2 | Router(config-if)# pvc <i>[name]</i> <i>vpi / vci</i> | 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 <i>minutes</i> | (Optional) Adjusts the Inverse ARP time period. |

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, on page 33](#).

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. <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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. |
| 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. |

| Command or Action | Purpose |
|-------------------|---------|
|-------------------|---------|

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, on page 28](#)".

For an example of OAM loopback cell generation, see the section "[Configuring Loopback Cells Example, on page 34](#)".

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] <i>frequency</i> | 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 <i>up-count down-count retry-frequency</i> | (Optional) Specifies OAM management parameters for verifying connectivity of a PVC connection. This command is only supported if OAM management is enabled. <ul style="list-style-type: none"> • Use the <i>up-count</i> 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 <i>down-count</i> 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 <i>retry-frequency</i> 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 <i>frequency</i> (in seconds) specified using the oam-pvc command, then loopback cells are sent at the <i>retry-frequency</i> 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. |

Configuring a PVC on a Multipoint Subinterface

Creating a multipoint subinterface allows you to create a point-to-multipoint PVC that can be used as a broadcast PVC for all multicast requests. To create a PVC on a multipoint subinterface, use the following procedure beginning in global configuration mode:

SUMMARY STEPS

1. Router(config)# **interface atm slot/subslot/port.subinterface multipoint**
2. Router(config-subif)# **ip address address mask**
3. Router(config-subif)# **no ip directed-broadcast**
4. Router(config-subif)# **pvc [name] vpi /vci**
5. Router(config-if-atm-vc)# **protocol protocol {protocol-address | inarp} broadcast**
6. Router(config-if-atm-vc)# **inarp minutes**
7. Router(config-if-atm-vc)# **encapsulation {aal5muxprotocol|aal5nlpidaal5snap}**
8. Router(config-if-atm-vc)# **end**

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|---|
| Step 1 | Router(config)# interface atm slot/subslot/port.subinterface multipoint | Creates the specified point-to-multipoint subinterface on the given port on the specified ATM SPA, and enters subinterface configuration mode, where: <ul style="list-style-type: none"> • <i>slot</i>—Specifies the chassis slot number where the SIP is installed. • <i>subslot</i>—Specifies the secondary slot of the SIP where the SPA is installed. • <i>port</i>—Specifies the number of the individual interface port on a SPA. • <i>subinterface</i>—Specifies the number of the subinterface. |

| | Command or Action | Purpose |
|---------------|--|---|
| Step 2 | Router(config-subif)# ip address <i>address mask</i> | Assigns the specified IP address and subnet mask to this subinterface. |
| Step 3 | Router(config-subif)# no ip directed-broadcast | (Optional) Disables the forwarding of IP directed broadcasts, which are sometimes used in denial of service (DOS) attacks. |
| Step 4 | Router(config-subif)# pvc [<i>name</i>] <i>vpi /vci</i> | <p>Configures a new ATM PVC by assigning its VPI/VCI numbers and enters ATM VC configuration mode. The valid values for <i>vpi /vci</i> are:</p> <ul style="list-style-type: none"> • <i>name</i> —(Optional) An arbitrary string that identifies this PVC. • <i>vpi</i> —Specifies the VPI ID. The valid range is 0 to 255. • <i>vci</i> —Specifies the VCI ID. The valid range is 32 to 65535. Values 1 to 31 are reserved and should not be used, except for 5 for the QSAAL PVC and 16 for the ILMI PVC. ILMI is not supported. <p>Note When using the pvc command, remember that the <i>vpi /vci</i> combination forms a unique identifier for the interface and all of its subinterfaces. If you specify a <i>vpi /vci</i> combination that has been used on another subinterface, the Cisco IOS XE software assumes that you want to modify that PVC's configuration and automatically switches to its parent subinterface.</p> |
| Step 5 | Router(config-if-atm-vc)# protocol <i>protocol</i> { <i>protocol-address</i> inarp } broadcast | <p>Configures the PVC for a particular protocol and maps it to a specific <i>protocol-address</i>.</p> <ul style="list-style-type: none"> • <i>protocol</i> —Typically set to ipor pppoe, but other values are possible. <p>Note PPP is not supported</p> <ul style="list-style-type: none"> • <i>protocol-address</i> —Destination address or virtual template interface for this PVC (if appropriate for the <i>protocol</i>). • inarp —Specifies that the PVC uses Inverse ARP to determine its address. • broadcast — Specifies that this mapping should be used for multicast packets. |
| Step 6 | Router(config-if-atm-vc)# inarp <i>minutes</i> | (Optional) If using Inverse ARP, configures how often the PVC transmits Inverse ARP requests to confirm its address |

| | Command or Action | Purpose |
|---------------|---|---|
| | | mapping. The valid range is 1 to 60 minutes, with a default of 15 minutes. |
| Step 7 | Router(config-if-atm-vc)# encapsulation { <i>aal5mux</i> <i>protocol</i> <i>aal5nlpid</i> <i>aal5snap</i> } | <p>(Optional) Configures the ATM adaptation layer (AAL) and encapsulation type, where:</p> <ul style="list-style-type: none"> • aal5mux <i>protocol</i>—AAL and encapsulation type for multiplex (MUX)-type VCs. A protocol must be specified when you use this encapsulation type. • aal5nlpid—(IP only) AAL and encapsulation type that allows ATM interfaces to interoperate with High-Speed Serial Interfaces (HSSIs) that are using an ATM data service unit (ADSU) and running ATM-Data Exchange Interface (DXI). Supported on ATM PVCs only. • aal5snap—AAL and encapsulation type that supports Inverse Address Resolution Protocol (ARP). Logical link control/Subnetwork Access Protocol (LLC/SNAP) precedes the protocol datagram. This is the default. <p>Note Repeat Step 1 through Step 7 for each multipoint subinterface to be configured on this ATM SPA.</p> |
| Step 8 | Router(config-if-atm-vc)# end | Exits interface configuration mode and returns to privileged EXEC mode. |

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, on page 25](#)".

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 <i>vc-class-name</i> | <p>Applies a VC class to a PVC.</p> <ul style="list-style-type: none"> • The <i>vc-class-name</i> argument is the same as the <i>name</i> argument you specified when you created a VC class using the vc-class atm command. Refer to the section "Configuring VC Classes, on page 25" 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 PVC status information. The table "atmInterfaceExtTable" provides PVC status on an ATM interface. The table "atmCurrentlyFailingPvcTable" 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, on page 31](#)" 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 website at 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, on page 28](#)" 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, on page 34](#)".

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. |
| Step 2 | Do one of the following: <ul style="list-style-type: none"> • 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}] <p>Example:</p> <pre>Router(config)# interface atm number[. subinterface-number {multipoint point-to-point}]</pre> | 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, on page 31](#)" 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, on page 34](#)".

| Command | Purpose |
|---|--|
| Router (config) # vc-class atm <i>name</i> | Creates a VC class and enters vc-class configuration mode. |

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, on page 10](#)" and "[Configuring PVC Trap Support, on page 23](#)" for descriptions of how to configure these commands for PVCs.

For examples of creating VC classes, see the section "[Creating a VC Class Example, on page 34](#)".

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-vcvc-class-name**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|---|
| Step 1 | Router(config-if)# pvc [<i>name</i>] <i>vpi / vci</i> | Specifies an ATM PVC |
| Step 2 | Router(config-if-atm-vc)# class-vcvc-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

- 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}]**
- Router(config-if)# **class-int vc-class-name**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | Do one of the following: <ul style="list-style-type: none"> 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: <pre>Router(config)# interface atm number[. subinterface-number {multipoint point-to-point}</pre> | 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.

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

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: <ul style="list-style-type: none"> • Router(config)# interface atm slot /0[. subinterface-number {multipoint point-to-point}] • | Specifies the ATM interface using the appropriate format of the interface atm command. ⁴ |

| | Command or Action | Purpose |
|---------------|--|--|
| | <ul style="list-style-type: none"> • Router(config)# interface atm <i>slot / port-adapter</i> /0[. <i>subinterface-number</i> {multipoint point-to-point}] <p>Example:</p> <p>Example:</p> <p>Example:</p> <pre>Router(config)# Router(config)# interface atm number[. <i>subinterface-number</i> {multipoint point-to-point}]</pre> | |
| Step 2 | Router(config-if)# pvc [<i>name</i>] <i>vpi / vci</i> | Specifies the ATM PVC. |
| Step 3 | Router(config-if-atm-vc)# oam-pvc manage [<i>frequency</i>] | Enables OAM management on the PVC. |
| Step 4 | Router(config-if-atm-vc)# oam retry <i>up-count down-count</i> <i>retry-frequency</i> | <p>(Optional) Specifies OAM management parameters for re-establishing and removing a PVC connection.</p> <ul style="list-style-type: none"> • Use the <i>up-count</i> 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 <i>down-count</i> 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 <i>retry-frequency</i> 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 <i>frequency</i> (in seconds) specified using the oam-pvc command, then loopback cells are sent at the <i>retry-frequency</i> 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: <ul style="list-style-type: none"> • 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 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:

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

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 sections “Creating a PVC” and “Configuring PVC Traffic Parameters”.

```
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” and “Mapping a Protocol Address to a PVC”.

```
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
```

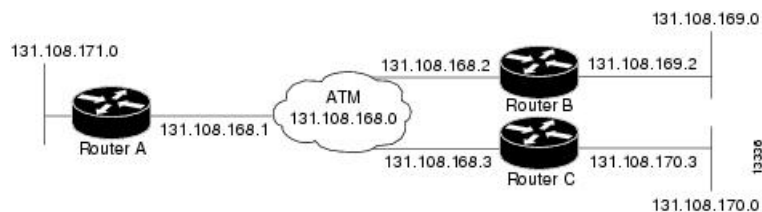
The following example is a typical ATM configuration for a PVC:

```
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” and “Mapping a Protocol Address to a PVC”.

Figure 3: 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 0/32
 protocol ip 131.108.168.1 broadcast
 exit
!
 pvc 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.

```

interface atm 2/0/0.1
 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

```

```

anccp 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, on page 18](#)".

```

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, on page 23](#)" 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, on page 25](#)" and "[Configuring VC Parameters, on page 26](#)".

```

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, on page 25](#)" and "[Configuring VC Parameters, on page 26](#)".

```

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, on page 25](#)" and "[Configuring VC Parameters, on page 26](#)".

```
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, on page 26](#)".

```
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, on page 28](#)".

```
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
```

Example Configuring a PVC Bundle

```

Device1:
interface ATM0/0/0.1 point-to-point
ip address 10.0.0.1 255.255.255.0
bundle test
  encapsulation aal5snap
  oam-bundle manage
  pvc-bundle 0/32
    vbr-rt 19000 15000 5000
    precedence 7
  pvc-bundle 1/33
   ubr 2480
    precedence 6
  pvc-bundle 1/34
   ubr 4890
    precedence 3-5
  pvc-bundle 1/35
!
Device2:

interface ATM0/1/0.1 point-to-point
ip address 10.0.0.2 255.255.255.0
bundle test
  encapsulation aal5snap
  oam-bundle manage
  pvc-bundle 0/32
    vbr-rt 19000 15000 5000
    precedence 7
  pvc-bundle 1/33
   ubr 2480
    precedence 6
  pvc-bundle 1/34
   ubr 4890
    precedence 3-5
  pvc-bundle 1/35
!

```

PVC on a Point-to-Point Subinterface Configuration Example

```

interface ATM5/0/0.9 point-to-point
mtu 4474
bandwidth 34000
ip vrf forwarding vrfexample
ip address 192.0.2.1 255.255.255.0
ip mtu 4470
pvc 11/105
 ubr 38
  oam-pvc manage
  encapsulation aal5snap
!
interface ATM5/0/0.11 point-to-point
mtu 4474
bandwidth 7000
ip address 192.0.2.2 255.255.255.0
ip mtu 4470
pvc 100/50
  cbr 7000
  encapsulation aal5snap

```

```
service-policy input Leased_Line_Ingress
max-reserved-bandwidth 100
```

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. |
| Router# show interfaces atm controller.port-channels.subinterface | Displays statistics for the ATM interface using the appropriate format of the show interfaces atm command. |

| Command | Purpose |
|------------------------------------|--|
| Router# show network-clocks | Displays the clock signal sources and priorities that you established on the router. |

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

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 | Cisco IOS Release 2.5.0 | |

| Feature Name | Releases | Feature Information |
|--------------|----------|---|
| | | <p>ATM supports two types of interfaces: point-to-point and multipoint.</p> <ul style="list-style-type: none"> • Point-to-point subinterface--With point-to-point subinterfaces, each pair of devices has its own subnet. If you put the PVC on a point-to-point subinterface, the device 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 devices 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. <p>ANCP needs to be enabled on ATM interface when message is sent from the DSLAM.</p> <p>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 atm interface</p> |

| Feature Name | Releases | Feature Information |
|----------------------------------|---------------------------|--|
| | | atm, show atm map, show atm pvc, show atm traffic, show atm vc, show network-clocks, ancp enable, ancp neighbor. |
| IP Multicast over ATM PVC Bundle | Cisco IOS Release XE 3.7S | ATM VC bundle management allows you to configure multiple VCs that have different QoS characteristics between any pair of ATM-connected devices. No new commands were introduced or modified. |

Additional References

Related Documents

| Related Topic | Document Title |
|--|--|
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |
| ATM commands | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |
| ATM SPAs | "Overview of ATM SPAs" in the <i>Cisco ASR 1000 Series Aggregation Services Routers SIP and SPA Software Configuration Guide</i> |
| Configuring IP to ATM class of service (CoS) | <ul style="list-style-type: none"> • "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 |
|--|--|
| <ul style="list-style-type: none"> • 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 |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | http://www.cisco.com/techsupport |



CHAPTER 3

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, on page 43](#)
- [Prerequisites for ATM Conditional Debug Support, on page 43](#)
- [Restrictions for ATM Conditional Debug Support, on page 44](#)
- [Information About ATM Conditional Debug Support, on page 44](#)
- [How to Configure ATM Conditional Debugging on ATM Interfaces, on page 44](#)
- [Configuration Examples for ATM Conditional Debug Support, on page 45](#)
- [Additional References, on page 46](#)
- [Feature Information for ATM Conditional Debug Support, on page 47](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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, on page 43](#) 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

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

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

Before you begin

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: <pre>Router> enable</pre> | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | debug atm [arp counters errors events oam packet state] Example: <pre>Router# debug atm state</pre> | Displays various ATM events. |
| Step 3 | debug condition interface <i>interface-type interface-number</i> [vc {vci vpi / vci}] Example: <pre>Router# debug condition interface ATM1/1/0 vc 10/100</pre> | 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

```

| Interface | VCD / Name | VPI | VCI | Type | Encaps | SC | Peak Kbps | Av/Min Kbps | Burst 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 <i>Cisco IOS Debug Command Reference</i> |
| ATM Overview | Overview of the ATM SPAs |
| ATM commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples. | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |

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 |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | 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 . |



CHAPTER 4

ATM Multilink PPP Support on Multiple VCs

The ATM Multilink PPP Support on Multiple VCs feature facilitates traffic load balancing on high-speed virtual circuits (VCs) using multilink PPP (MLP) over Frame Relay and ATM. It also facilitates traffic load balancing by using MLP to combine packet datagrams on high-speed VCs as a means of transporting both the voice and data traffic more efficiently.

- [Finding Feature Information, on page 49](#)
- [Restrictions for ATM Multilink PPP Support, on page 49](#)
- [Information About ATM Multilink PPP Support, on page 50](#)
- [How to Configure ATM Multilink PPP Support, on page 50](#)
- [Configuration Examples for ATM Multilink PPP Support, on page 59](#)
- [Additional References for ATM Multilink PPP Support on Multiple VCs, on page 60](#)
- [Feature Information for ATM Multilink PPP Support, on page 61](#)
- [Glossary, on page 62](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 Multilink PPP Support

The ATM Multilink PPP Support on Multiple VCs feature does not support the following commands and functionality. The configuration accepts these commands, but the commands have no effect:

- **ppp interleave**
- **ppp multilink fragment-delay**

The ATM Multilink PPP Support on Multiple VCs feature does not support the link fragmentation and interleaving (LFI) functionality.

Information About ATM Multilink PPP Support

ATM Multilink PPP Support Overview

Load balancing operates at Layer 2 or Layer 3 (the network layer) of the Open System Interconnection (OSI) reference model. Layer 3 load balancing is independent of any link-layer technologies. The ATM Multilink Point-to-Point Protocol (PPP) Support on Multiple VCs feature implements load balancing at Layer 2 and depends on having MLP enabled at the link layer.

The ATM MLP functionality keeps track of packet sequencing, and this functionality buffers any packets that arrive early. With this ability, ATM MLP preserves packet order across the entire bundle.

In addition to MLP, low latency queueing (LLQ) and class-based weighted fair queueing (CBWFQ) are used to prioritize and differentiate the voice and data packets. LLQ and CBWFQ help to ensure that the voice and data traffic receive the proper quality of service (QoS) treatment (such as the correct priority queue assignment) when the voice and data traffic are transmitted.

For more information about LLQ and CBWFQ, see the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Benefits of ATM Multilink PPP Support

Facilitates More Efficient Traffic Load Balancing

The ATM Multilink PPP Support on Multiple VCs feature supports the transport of real-time (voice) and other (data) traffic on Frame Relay and ATM VCs.

How to Configure ATM Multilink PPP Support

Defining the Service Policy Using the MQC

Perform this task to define the service policy using the MQC. The MQC allows you to create class maps and define service policies. Service policies are used to create classes and set match criteria for classifying traffic.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** *class-map-name* [**match-all**| **match-any**]
4. **match ip precedence** *ip-precedence-value* [*ip-precedence-value* *ip-precedence-value* *ip-precedence-value*]
5. **exit**
6. **policy-map** *policy-name*
7. **class-map** *class-map-name* [**match-all**| **match-any**]
8. **bandwidth** {*bandwidth-kbps* | **percent** *percent*}
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 | class-map <i>class-map-name</i> [match-all match-any] Example: Router(config)# class-map class1 | Specifies the name of the class map to be created and enters class-map configuration mode. If match-all or match-any value is not specified, traffic must match all the match criteria to be classified as part of the class map. |
| Step 4 | match ip precedence <i>ip-precedence-value</i> [<i>ip-precedence-value ip-precedence-value</i> <i>ip-precedence-value</i>] Example: Router(config-cmap)# match ip precedence 3 2 4 | Identifies IP precedence values as match criteria. |
| Step 5 | exit Example: Router(config-cmap)# exit | Exits class-map configuration mode. |
| Step 6 | policy-map <i>policy-name</i> Example: Router(config)# policy-map policy1 | Specifies the name of the policy map to be created and enters policy-map configuration mode. |
| Step 7 | class-map <i>class-map-name</i> [match-all match-any] Example: Router(config-pmp)# class class2 | Classifies traffic based on the class map specified and enters policy-map class configuration mode. |
| Step 8 | bandwidth { <i>bandwidth-kbps</i> percent <i>percent</i> } Example: Router (config-pmap-c)# bandwidth 45 | Specifies a minimum bandwidth guarantee to a traffic class in periods of congestion. • A minimum bandwidth guarantee can be specified in kbps or by a percentage of the overall available bandwidth. |
| Step 9 | end Example: | Exits class-map configuration mode. |

| | Command or Action | Purpose |
|--|--------------------------|---------|
| | Router(config-pmp) # end | |

Defining a Multilink MLP Bundle Interface

Perform this task to define a multilink MLP bundle interface. The purpose of a multilink bundle interface is to combine more than one permanent virtual circuit (PVC). All configurations for PPP over ATM links are placed into virtual templates, and the bundle parameters are placed into the multilink bundle.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask* [secondary]
5. **load-interval** *seconds*
6. **no cdp enable**
7. **service-policy output** *policy-name*
8. **ppp multilink**
9. **ppp multilink fragment disable**
10. **ppp multilink group** *group-number*
11. **end**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|---|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none">• Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | interface <i>type number</i> Example: Router(config)# interface multilink 34 | Configures an interface type and enters interface configuration mode. |
| Step 4 | ip address <i>ip-address mask</i> [secondary] Example: Router(config-if)# ip address 209.165.201.1 255.255.255.0 | Sets a primary or secondary IP address for an interface. |

| | Command or Action | Purpose |
|---------|--|---|
| Step 5 | load-interval <i>seconds</i> Example: Router(config-if)# load-interval 60 | Changes the length of time for which data is used to compute load statistics. |
| Step 6 | no cdp enable Example: Router(config-if)# no cdp enable | Disables Cisco Discovery Protocol (CDP) on an interface. |
| Step 7 | service-policy output <i>policy-name</i> Example: Router(config-if)# service-policy output policy1 | Attaches the specified policy map to the output interface. |
| Step 8 | ppp multilink Example: Router(config-if)# ppp multilink | Enables MLP on an interface. |
| Step 9 | ppp multilink fragment disable Example: Router(config-if)# ppp multilink fragment disable | Disables packet fragmentation. |
| Step 10 | ppp multilink group <i>group-number</i> Example: Router(config-if)# ppp multilink group 54 | Restricts a physical link to joining only a designated multilink-group interface. |
| Step 11 | end Example: Router(config-if)# end | Exits interface configuration mode. |

Defining the Virtual Templates for Member Links

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **no ip address**
5. **load-interval** *seconds*
6. **ppp multilink**

7. `ppp multilink group group-number`
8. `end`

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | interface type number Example: Device(config)# interface multilink 34 | Configures an interface type and enters interface configuration mode. |
| Step 4 | no ip address Example: Device(config-if)# no ip address | Removes existing IP addresses or disables IP processing. |
| Step 5 | load-interval seconds Example: Device(config-if)# load-interval 30 | Changes the length of time for which data is used to compute load statistics. |
| Step 6 | ppp multilink Example: Device(config-if)# ppp multilink | Enables MLP on the interface. |
| Step 7 | ppp multilink group group-number Example: Device(config-if)# ppp multilink-group 44 | Restricts a physical link to joining only a designated multilink-group interface. |
| Step 8 | end Example: Device(config-if)# end | Exits interface configuration mode. |

Defining the PVCs and Bundling Member Links

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
 - **interface atm slot /0**
 -
 -
 - **interface atm slot / port**
4. **no ip address**
5. **load interval seconds**
6. **atm ilmi-keepalive [seconds [retry[seconds]]]**
7. **pvc [name] vplvci**
8. **vbr-nrt output-pcr output-scr [output-mbs]**
9. **tx-ring-limit ring-limit**
10. **protocol ppp virtual-template number**
11. **end**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | Do one of the following: <ul style="list-style-type: none"> • interface atm slot /0 • • • interface atm slot / port Example: Device(config)# interface atm 2/0 Example: or Example: | Specifies the ATM interface type and enters interface configuration mode. |

| | Command or Action | Purpose |
|----------------|--|--|
| | Device(config)# interface atm 2/1 | |
| Step 4 | no ip address Example: Device(config-if)# no ip address | Removes an IP address or disables IP processing. |
| Step 5 | load interval <i>seconds</i> Example: Device(config-if)# load interval 30 | Changes the length of time for which data is used to compute load statistics. |
| Step 6 | atm ilmi-keepalive [<i>seconds</i> [<i>retry</i> [<i>seconds</i>]]] Example: Device(config-if)# atm ilmi-keepalive | Enables Interim Local Management Interface (ILMI) keepalives. |
| Step 7 | pvc [<i>name</i>] <i>vpi/vci</i> Example: Device(config-if)# pvc pvc1 0/56 | Creates an ATM PVC. Enters interface-ATM-VC configuration mode. |
| Step 8 | vbr-nrt <i>output-pcr output-scr</i> [<i>output-mbs</i>] Example: Device(config-if-atm-vc)# vbr-nrt 45 4 45 | Configures the variable bit rate (VBR)-non real time (NRT) QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size. |
| Step 9 | tx-ring-limit <i>ring-limit</i> Example: Device(config-if-atm-vc)# tx-ring-limit 3 | Limits the number of particles or packets that can be used on a transmission ring on an interface. <ul style="list-style-type: none"> • Use this command to tune the transmission ring to assign most of the packets to the Layer 3 queues. |
| Step 10 | protocol ppp virtual-template <i>number</i> Example: Device(config-if-atm-vc)# protocol ppp virtual-template 34 | Specifies that PPP is established over the ATM PVC using the configuration from the specified virtual template and enters interface configuration mode. |
| Step 11 | end Example: Device(config-if)# end | Exits interface configuration mode. |

Verifying ATM Multilink PPP Support

Perform this task to display information about ATM Multilink PPP Support on Multiple VCs:

SUMMARY STEPS

1. enable
2. show atm pvc
3. show frame-relay pvc [[interface *interface*] [*dldi*] [64-bit] | summary [all]]
4. show interfaces
5. show policy-map
6. show ppp multilink
7. show queueing

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|---|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | show atm pvc Example: Device# show atm pvc | Displays all ATM PVCs and traffic information. |
| Step 3 | show frame-relay pvc [[interface <i>interface</i>] [<i>dldi</i>] [64-bit] summary [all]] Example: Device# show frame-relay pvc 16 | Displays statistics about PVCs for Frame Relay interfaces. |
| Step 4 | show interfaces Example: Device# show interfaces | Displays interleaving statistics. <ul style="list-style-type: none"> • Interleaving data is displayed only if interleaving occurs. |
| Step 5 | show policy-map Example: Device# show policy-map | Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps. |
| Step 6 | show ppp multilink Example: Device# show ppp multilink | Displays bundle information for the MLP bundles and their PPP links in the Device. |
| Step 7 | show queueing Example: Device# show queueing | Lists all or selected configured queueing strategies. |

Monitoring ATM Multilink PPP Support

SUMMARY STEPS

1. enable
2. debug atm errors
3. debug atm events
4. debug ppp error
5. debug ppp multilink events
6. debug voice rtp

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|---|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | debug atm errors Example: Device# debug atm errors | Displays ATM errors. |
| Step 3 | debug atm events Example: Device# debug atm events | Displays ATM events. |
| Step 4 | debug ppp error Example: Device# debug ppp error | Displays information on traffic and exchanges in an internetwork implementing the PPP. |
| Step 5 | debug ppp multilink events Example: Device# debug ppp multilink events | Displays information about events affecting multilink groups. |
| Step 6 | debug voice rtp Example: Device# debug voice RTP | Displays information about the interleaving of voice and data packets. <ul style="list-style-type: none"> • The debug voice RTP command has memory overhead and should not be used when memory is scarce or when traffic is very high. |

Configuration Examples for ATM Multilink PPP Support

Defining the Service Policy Using MQC Example

The following example shows how to configure a service policy using the MQC:

```
Device> enable
Device# configure terminal
Device(config)# class-map match-all DATA
Device(config-cmap)# match ip precedence 0
Device(config-cmap)# class-map match-all VOICE
Device(config-cmap)# match access-group 100
Device(config-cmap)# policy-map CISCO
Device(config-pmap-c)# class VOICE
Device(config-pmap-c)# priority percent 70
Device(config-pmap-c)# class DATA
Device(config-pmap-c)# bandwidth percent 5
Device(config-pmap-c)# access-list 100 permit udp any any precedence critical
```

Defining a Multilink MLP Bundle Interface Example

The following example shows how to define a multilink bundle for the multilink interface:

```
Device> enable
Device# configure terminal
Device(config)# interface Multilink1
Device(config-if)# ip address 10.2.1.1 255.0.0.0
Device(config-if)# load-interval 30
Device(config-if)# no cdp enable
Device(config-if)# service-policy output CISCO
Device(config-if)# ppp multilink fragment disable
Device(config-if)# ppp multilink group 1
```

Defining Virtual Templates for Member Links Example

The following example shows how to define virtual templates for member links:

```
Device> enable
Device# configure terminal
Device(config)# interface Virtual-Template1
Device(config-if)# no ip address
Device(config-if)# load-interval 30
Device(config-if)# ppp multilink
Device(config-if)# ppp multilink group 1
Device(config-if)# interface Virtual-Template2
Device(config-if)# no ip address
Device(config-if)# load-interval 30
Device(config-if)# ppp multilink
Device(config-if)# ppp multilink group 1
```

Defining PVCs and Bundling Member Links Example

The following example shows how to define and configure PVCs as bundle members:

```

Device> enable
Device# configure terminal
Device(config)# interface atm 6/0
Device(config-if)# no ip address
Device(config-if)# load-interval 30
Device(config-if)# atm ilmi-keepalive
Device(config-if)# pvc 0/34

Device(config-if-atm-vc) # vbr-nrt 1536 1536
Device(config-if-atm-vc) # tx-ring-limit 5
Device(config-if-atm-vc) # protocol ppp Virtual-Template1
Device(config-if-atm-vc) # pvc 0/35

Device(config-if-atm-vc) # vbr-nrt 800 800
Device(config-if-atm-vc) # tx-ring-limit 3
Device(config-if-atm-vc) # protocol ppp Virtual-Template2
Device(config-if-atm-vc) # pvc 0/36
Device(config-if-atm-vc) # vbr-nrt 800 400 94
Device(config-if-atm-vc) # tx-ring-limit 5
Device(config-if-atm-vc) # protocol ppp Virtual-Template1
Device(config-if-atm-vc) # pvc 0/37
Device(config-if-atm-vc) # vbr-nrt 800 800
Device(config-if-atm-vc) # tx-ring-limit 3
Device(config-if-atm-vc) # protocol ppp Virtual-Template2
Device(config-if-atm-vc) # end

```

Additional References for ATM Multilink PPP Support on Multiple VCs

The following sections provide references related to the ATM Multilink PPP Support on Multiple VCs feature.

Related Documents

| Related Topic | Document Title |
|--|---|
| QoS configuration tasks | <i>Cisco IOS Quality of Service Solutions Configuration Guide</i> |
| QoS commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples | <i>Cisco IOS Quality of Service Solutions Command Reference</i> |
| WAN configuration tasks | <i>Cisco IOS Wide-Area Networking Configuration Guide</i> |
| WAN commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples | <i>Cisco IOS Wide-Area Networking Command Reference</i> |
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |

MIBs

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

RFCs

| RFC | Title |
|------------|--|
| RFC 1990 | <i>The PPP Multilink Protocol (MP)</i> |

Technical Assistance

| Description | Link |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | http://www.cisco.com/cisco/web/support/index.html |

Feature Information for ATM Multilink PPP 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 3: Feature Information for ATM Multilink PPP Support on Multiple VCs

| Feature Name | Releases | Feature Information |
|---|---|--|
| ATM Multilink PPP Support on Multiple VCs | 12.2(28)SB 12.2(13)T 12.2(33)SRE Cisco IOS Release XE 3.14S | The ATM Multilink PPP Support on Multiple VCs feature facilitates traffic load balancing on high-speed virtual circuits, using MLP over Frame Relay and ATM. It facilitates traffic load balancing by using MLP to combine packet datagrams on high-speed VCs, as a means for transporting both the voice and data traffic more efficiently. In Cisco IOS Release XE 3.14S, support for the ATM Multilink PPP Support on Multiple VCs feature was added on the 4451-X Integrated Services Router. |

Glossary

LFI --link fragmentation and interleaving. Method of fragmenting large packets and then queuing the fragments between small packets.

MLP --multilink PPP.

QoS --quality of service.

VC --virtual circuit.



CHAPTER 5

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, on page 63](#)
- [Prerequisites for the ATM OAM Ping Feature, on page 63](#)
- [Restrictions for the ATM OAM Ping Feature, on page 63](#)
- [Information About the ATM OAM Ping Feature, on page 64](#)
- [How to Use the ATM OAM Ping Feature, on page 64](#)
- [Configuration Examples for ATM OAM Ping, on page 66](#)
- [Additional References, on page 68](#)
- [Feature Information for ATM OAM Ping, on page 69](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 | <p>enable</p> <p>Example:</p> <pre>Router> enable</pre> | <p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | <p>ping atm interface atm <i>interface-number</i> <i>vpi-value</i> [<i>vci-value</i> [end-loopback[<i>repeat</i> [<i>timeout</i>]]] seg-loopback [<i>repeat</i> [<i>timeout</i>]]]</p> <p>Example:</p> <pre>ping atm interface atm 1/1/0.100 0 500</pre> <p>Example:</p> <pre>end-loopback 1 2</pre> <p>Example:</p> | <p>Displays a response to confirm the connectivity of a specific PVC for the ASR 1000 series router.</p> <ul style="list-style-type: none"> • atm <i>interface-number</i> --ATM interface name. • <i>vpi-value</i> --Virtual path identifier. Range: 0 to 255. • <i>vci-value</i> --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. • <i>repeat</i> --Number of ping packets that are sent to the destination. Range: 1 to 1000. Default: 5. • <i>timeout</i> --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 | <p>enable</p> <p>Example:</p> <pre>Router> enable</pre> | <p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | <p>ping</p> <p>Example:</p> | <p>Displays a response to confirm the connectivity of a specific PVC.</p> |

| | Command or Action | Purpose |
|--|---------------------|---------|
| | 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, Encapsz: 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, CPIDErrors: 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, CPIDErrors: 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 | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |
| 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 |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | http://www.cisco.com/techsupport |

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 4: Feature Information for ATM OAM Ping

| Feature Name | Releases | Feature Information |
|--------------|--------------------------|---|
| ATM OAM Ping | Cisco IOS XE Release 2.3 | <p>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.</p> <p>The following command was introduced or modified: ping atm interface atm.</p> |



CHAPTER 6

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, on page 71](#)
- [Prerequisites for ATM OAM Traffic Reduction, on page 71](#)
- [Restrictions for ATM OAM Traffic Reduction, on page 72](#)
- [Information About ATM OAM Traffic Reduction, on page 72](#)
- [How to Configure ATM OAM Traffic Reduction, on page 73](#)
- [Configuration Examples for ATM OAM Traffic Reduction, on page 76](#)
- [Additional References for ATM OAM Traffic Reduction, on page 78](#)
- [Feature Information for ATM OAM Traffic Reduction, on page 78](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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.

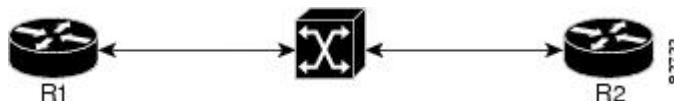
Information About ATM OAM Traffic Reduction

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 4: 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 <i>interface-number</i> . <i>subinterface-number</i> 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 | <p><code>pvc vpi / vci</code></p> <p>Example:</p> <pre>Router(config-if)# pvc 0/100</pre> | Assigns a name to an ATM PVC and enters ATM VC configuration mode. |
| Step 5 | <p><code>oam-pvc [frequency manage [frequency [auto-detect [optimum] keep-vc-up [seg aisrdi failure] loop-detection]]]</code></p> <p>Example:</p> <pre>Router(config-if-atm-vc)# oam-pvc manage auto-detect optimum</pre> | <p>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.</p> <ul style="list-style-type: none"> • 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 | <p><code>exit</code></p> <p>Example:</p> <pre>Router(config-if-atm-vc)# exit</pre> | <p>Exits the configuration mode.</p> <ul style="list-style-type: none"> • 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 | <p><code>enable</code></p> <p>Example:</p> | <p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted. |

| | Command or Action | Purpose |
|---------------|--|---|
| | Router> enable | |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | vc-class atm <i>vc-class-name</i> Example: Router(config)# vc-class atm word | Creates a VC class to an ATM VC bundle member. |
| Step 4 | oam-pvc [<i>frequency</i> manage [<i>frequency</i> [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. <ul style="list-style-type: none"> • 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 <i>interface-number . subinterface-number</i> Example: Router(config)# interface atm 1/1/2.100 | Configures an ATM interface and enters interface configuration mode. |
| Step 7 | class-int <i>vc-class-name</i> Example: Router(config-if)# class-int test | Assigns a VC class to an ATM main interface. |
| Step 8 | pvc <i>vpi / vci</i> 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: | Ends the configuration mode. <ul style="list-style-type: none"> • Enter the exit command for each command mode to exit. |

| | Command or Action | Purpose |
|--|---|---------|
| | Router(config-if)# exit Router(config)# 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. |
| 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 for ATM OAM Traffic Reduction

Related Documents

| Related Topic | Document Title |
|--------------------|---|
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |
| ATM commands | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |

MIBs

| MIB | MIBs Link |
|------|---|
| None | 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 |
|------|-------|
| None | -- |

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 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 5: Feature Information for ATM OAM Traffic Reduction

| Feature Name | Releases | Feature Information |
|---------------------------|---|--|
| ATM OAM Traffic Reduction | Cisco IOS XE Release 2.3S Cisco IOS XE Release 3.14S | <p>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.</p> <p>In Cisco IOS Release XE 3.14S, support for the ATM OAM Traffic Reduction feature was added on the 4451-X Integrated Services Router.</p> <p>The following commands were introduced or modified: oam-pvc show atm oam auto-detect show atm pvc</p> |



CHAPTER 7

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, on page 81](#)
- [Restrictions for Local Template-Based ATM Provisioning, on page 81](#)
- [Information About Local Template-Based ATM Provisioning, on page 81](#)
- [How to Configure Local Template-Based ATM Provisioning, on page 82](#)
- [Configuration Examples for Local Template-Based ATM Provisioning, on page 89](#)
- [Additional References, on page 90](#)
- [Feature Information for Local Template-Based ATM PVC Provisioning, on page 91](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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, autoprovioned 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, autoconfigured 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 autoconfiguration 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 Autoconfiguration in a VC Class

A VC class configured with ATM PVC autoconfiguration 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 autoconfiguration is assigned to an ATM interface, all PVCs on the interface will be autoconfigured.

To enable ATM PVC local autoconfiguration 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. <ul style="list-style-type: none"> • Enter your password if prompted. |

| | Command or Action | Purpose |
|--------|--|---|
| Step 2 | configure terminal Example: <pre>Router# configure terminal</pre> | Enters global configuration mode. |
| Step 3 | vc-class atm <i>vc-class-name</i> Example: <pre>Router(config)# vc-class atm auto-pppoe</pre> | 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: <pre>Router(config-vc-class)# create on-demand</pre> | Configures ATM PVC autoprovisioning, which enables a PVC or range of PVCs to be created automatically on demand. |
| Step 5 | idle-timeout <i>seconds</i> [<i>minimum-rate</i>] Example: <pre>Router(config-vc-class)# idle-timeout 300 10</pre> | (Optional) Configures the idle timeout parameter for tearing down ATM SVC connections or autoprovisioned ATM PVC connections. |
| Step 6 | end Example: <pre>Router(config-vc-class)# end</pre> | (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. |
| 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. <ul style="list-style-type: none"> • 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 | 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. |

| | Command or Action | Purpose |
|---------------|---|---|
| Step 7 | idle-timeout <i>seconds</i> [<i>minimum-rate</i>] 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. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | interface atm slot/subslot/port[. <i>subinterface</i>] Example: Router(config)# interface atm5/0 | Configures an ATM interface. |

| | Command or Action | Purpose |
|--------|--|---|
| Step 4 | atm autovc retry <i>interval</i> Example: Router(config-if)# atm autovc retry 60 | (Optional) Configures the interval at which the router will repeat the attempt to create auto provisioned PVCs after a failure of the initial creation attempt. |
| Step 5 | range [<i>range-name</i>] pvc <i>start-vpi / start-vci end-vpi / end-vci</i> 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 [<i>pvc-name</i>] [<i>vpi /vci</i>] 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 auto provisioning, which enables a PVC or range of PVCs to be created automatically on demand. |
| Step 8 | idle-timeout <i>seconds</i> [<i>minimum-rate</i>] Example: Router(config-if-atm-range-pvc)# idle-timeout 300 10 | (Optional) Configures the idle timeout parameter for tearing down ATM SVC connections or auto provisioned 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 Auto provisioning

To verify that ATM PVC local auto provisioning 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 auto provisioned 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 auto provisioning is configured on a specific PVC. If ATM PVC local auto provisioning 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 /
Interface Name          VPI  VCI  Type  Encaps  SC   Peak  Avg/Min  Burst  Sts
5/0.1     117            0   50  PVC-A SNAP   UBR  149760
5/0.1     118            0   51  PVC-A SNAP   UBR  149760
5/0.1     119            0   52  PVC-A SNAP   UBR  149760
```

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
InPProc: 0, OutPProc: 0, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
InPktDrops: 0, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0, LengthViolation: 0, CPICErrors: 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-Templat1
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. <ul style="list-style-type: none"> • 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 Auto provisioning on a PVC Example

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

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

ATM PVC Local Auto provisioning on an ATM PVC Range Example

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

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

ATM PVC Local Auto provisioning on a PVC Within a Range Example

The following example shows the configuration of local auto provisioning 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 | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |
| ATM PVC configuration | <i>Cisco IOS XE Asynchronous Transfer Mode Configuration Guide</i> |

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 | <i>Multiprotocol Encapsulation over ATM Adaptation Layer</i> |

Technical Assistance

| Description | Link |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | 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 6: 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 | <p>This feature was introduced on Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The Local Template-Based ATM Provisioning feature enables ATM permanent virtual circuits (PVCs) to be provisioned automatically as needed from a local configuration.</p> <p>The following commands were introduced or modified: atm autovc retry, create on-demand, debug atm autovc, idle-timeout.</p> |



CHAPTER 8

ATM PVC Range

In a digital subscriber line (DSL) environment, many applications require the configuration of a large number of ATM permanent virtual circuits (PVCs). The ATM PVC RangeSubinterface Grouping feature enables you to group a number of PVCs together into a PVC *range* in order to configure them all at once.

- [Finding Feature Information, on page 93](#)
- [Restrictions for ATM PVC Range, on page 93](#)
- [Information About Restrictions for ATM PVC Range, on page 93](#)
- [How to Configure ATM PVC Range, on page 94](#)
- [Configuration Examples for ATM PVC Range, on page 96](#)
- [Additional References, on page 97](#)
- [Feature Information for ATM PVC Range, on page 97](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 PVC Range

You cannot explicitly configure the individual point-to-point subinterfaces created by the PVC range on a point-to-point subinterface. All of the point-to-point subinterfaces in the range share the same configuration as the subinterface on which the PVC range is configured.

Information About Restrictions for ATM PVC Range

For applications that use multipoint subinterfaces, such as PPP over Ethernet and PPP over ATM, the PVC range is on a single multipoint subinterface.

A PVC range is defined by two VPI-VCI pairs. The two virtual path identifiers (VPIs) define a VPI range, and the two virtual channel identifiers (VCIs) define a VCI range. The number of PVCs in the PVC range equals the number of VPIs in the VPI range multiplied by the number of VCIs in the VCI range.

Once the PVC range is defined, you can configure the range by using the existing interface-ATM-VC configuration commands that are also supported in PVC range configuration mode. The **shutdown** PVC range command can be used to deactivate the range without deleting the configuration.

The ATM PVC Range feature also introduces the **pvc-in-range** command, which allows you to explicitly configure an individual PVC within the defined range of PVCs on a multipoint subinterface. The **shutdown** PVC-in-range command allows you to deactivate an individual PVC within a range.



Note You cannot explicitly configure the individual point-to-point subinterfaces created by the PVC range on a point-to-point subinterface. All of the point-to-point subinterfaces in the range share the same configuration as the subinterface on which the PVC range is configured.

Benefits of ATM PVC Range

Saving Time

Configuring a range of PVCs is faster than configuring each PVC individually.

Saving NVRAM

A range of PVCs takes up less NVRAM on network service routers than a large number of individually configured PVCs.

Speeding Boot-Up

The parser can parse one configuration command instead of many, thus speeding bootup time.

How to Configure ATM PVC Range

Configuring an ATM PVC Range



Note For point-to-point subinterfaces, subinterface numbering begins with the subinterface on which the PVC range is configured and increases sequentially through the range.

To configure an ATM PVC range, use the following commands beginning in global configuration mode

SUMMARY STEPS

1. Router(config)# **interface atm** *slot/port.subinterface-number* {**point-to-point** | **multipoint**}
2. Router(config-subif)# **range** [*range-name*] **pvc** *start-vpi/start-vci end-vpi/end-vci*
3. Router(config-if-atm-range)# **exit**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | Router(config)# interface atm <i>slot/port.subinterface-number</i> { point-to-point multipoint } | Configures an ATM subinterface and enters subinterface configuration mode. |
| Step 2 | Router(config-subif)# range [<i>range-name</i>] pvc <i>start-vpi/start-vci end-vpi/end-vci</i> | Defines a range of PVCs and enables PVC range configuration mode. The number of PVCs in a range can be calculated using the following formula: <ul style="list-style-type: none"> • number of PVCs = (<i>end-vpi</i> - <i>start-vpi</i> + 1) x (<i>end-vci</i> - <i>start-vci</i> + 1). • The <i>start-vpi</i> argument may be omitted if it is zero. The <i>end_vpi</i> argument may be omitted, but if it is omitted, it is assigned the value of <i>start-vpi</i>. The <i>end-vpi</i> and <i>end-vci</i> arguments are always greater than or equal to <i>start-vpi</i> and <i>start-vci</i>, respectively. |
| Step 3 | Router(config-if-atm-range)# exit | Exits PVC range configuration mode. |

Deactivating a PVC Range

To deactivate a PVC range, use the following command in PVC range configuration mode:

| Command | Purpose |
|---|--------------------------|
| Router (config-if-atm-range) # shutdown | Deactivates a PVC range. |

Configuring an Individual PVC Within a PVC Range

To configure an individual PVC within a PVC range on a multipoint subinterface, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Router(config)# **interface atm** *slot/port.subinterface-number* **multipoint**
2. Router(config-subif)# **range** [*range-name*] **pvc** *start-vpi/start-vci end-vpi/end-vci*
3. Router(config-if-atm-range)# **pvc-in-range** [*pvc-name*] [*vpi/vci*]
4. Router(cfg-if-atm-range-pvc)# **exit**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | Router(config)# interface atm <i>slot/port.subinterface-number multipoint</i> | Configures an ATM interface. |
| Step 2 | Router(config-subif)# range [<i>range-name</i>] pvc <i>start-vpi/start-vci end-vpi/end-vci</i> | Defines a range of PVCs and enables PVC range configuration mode. |
| Step 3 | Router(config-if-atm-range)# pvc-in-range [<i>pvc-name</i>] [<i>vpi/vci</i>] | Defines an individual PVC within a PVC range, and enables PVC-in-range configuration mode. |
| Step 4 | Router(cfg-if-atm-range-pvc)# exit | Exits PVC-in-range configuration mode. |

Deactivating an Individual PVC Within a PVC Range

To deactivate an individual PVC within a range, use the following command in PVC-in-range configuration mode:

| Command | Purpose |
|--|---|
| Router (cfg-if-atm-range-pvc) # shutdown | Deactivates an individual PVC within a range. |

Verifying an ATM PVC Range

To verify ATM PVC range configuration, use the following EXEC command:

| Command | Purpose |
|---|--|
| Router# show atm pvc [<i>vpi/vci name interface</i>] atm <i>interface-number</i>] | Displays ATM PVCs and traffic information. |

Configuration Examples for ATM PVC Range

ATM PVC Range on a Multipoint Subinterface Example

In the following example, a PVC range called "range-pppoa-1" is created with a total of 500 PVCs in the range. PVC parameters are configured for the range, including the assignment of a VC class called "classA."

```
Router(config)# interface atm 6/0.110 multipoint
Router(config-subif)# range range-pppoa-1 pvc 100 4/199
Router(config-if-atm-range)# class-range classA
Router(config-if-atm-range)#ubr 1000
Router(config-if-atm-range)# encapsulation aal5snap
Router(config-if-atm-range)# protocol ppp virtual-template 2
```

Individual PVC Within a PVC Range Configuration Example

In the following example, "pvcl" within the PVC range called "range1" is deactivated.

```
Router(config)# interface atm 6/0.110 multipoint
Router(config-subif)# range range1 pvc 100 4/199
Router(config-if-atm-range)# class-range classA
Router(config-if-atm-range)# pvc-in-range pvcl 3/104
Router(cfg-if-atm-range-pvc)# shutdown
```

Additional References

Related Documents

| Related Topic | Document Title |
|-----------------|--|
| Configuring ATM | "Configuring ATM" chapter in the <i>Cisco IOS Asynchronous Transfer Mode Configuration Guide</i> |

Technical Assistance

| Description | Link |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | http://www.cisco.com/techsupport |

Feature Information for ATM PVC Range

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 PVC Range and RBE Subinterface Grouping

| Feature Name | Releases | Feature Information |
|---------------|------------------------------------|--|
| ATM PVC Range | 12.1(5)T 12.2(28)SB XE 2.5.0 | <p>The ATM PVC Range Subinterface Grouping feature enables you to group a number of PVCs together into a PVC range in order to configure them all at once.</p> <p>In 12.1(5)T, this feature was introduced on the Cisco 7200.</p> <p>The following commands were introduced or modified: class-range, oam-range, pvc-in-range, range pvc, shutdown(PVC-in-range), shutdown(pvc-range).</p> |



CHAPTER 9

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, on page 99](#)
- [Prerequisites for ATM SNMP Trap and OAM Enhancements, on page 99](#)
- [Restrictions for ATM SNMP Trap and OAM Enhancements, on page 100](#)
- [Information About ATM SNMP Trap and OAM Enhancements, on page 100](#)
- [How to Configure ATM SNMP Trap and OAM Enhancements, on page 103](#)
- [Configuration Examples for ATM SNMP Traps and OAM Enhancements, on page 108](#)
- [Additional References, on page 110](#)
- [Feature Information for ATM SNMP Trap and OAM Enhancements, on page 111](#)
- [Glossary, on page 112](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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.mib 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 `atmStatusChangePvcRangeTable` or `atmCurrentStatusChangePvcTable` 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 `atmCurrentStatusChangePvcTable` 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:
 - `atmPvcStatusTransition`

- 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[aisrldi|loopback]}`
4. `end`

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|---|
| Step 1 | enable Example: <pre>Router> enable</pre> | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: <pre>Router# configure terminal</pre> | Enters global configuration mode. |
| Step 3 | snmp-server enable traps atm pvc extension {up down oam failure[aisrldi loopback]} Example: <pre>Router(config)# snmp-server enable traps atm pvc extension oam failure loopback</pre> | Enables the sending of extended ATM PVC traps. The keywords are as follows: <ul style="list-style-type: none"> • 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. • aisrldi --(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. |

| | Command or Action | Purpose |
|---------------|---|--|
| Step 4 | end Example: <pre>Router(config)# end</pre> | 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-ilm-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: <pre>Router> enable</pre> | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: <pre>Router# configure terminal</pre> | Enters global configuration mode. |
| Step 3 | interface atm slot / subslot / port . subinterface-number point-to-point Example: <pre>Router(config)# interface atm 1/0/0.2 point-to-point</pre> | Configures the ATM interface. The command syntax is as follows: <ul style="list-style-type: none"> • <i>slot/subslot/port</i> --Specifies a (physical) ATM interface (for example, 0/2/0). • <i>. subinterface-number</i> --Specifies a subinterface number. A dot (.) must be used to separate the interface number from the subinterface number (for example, 0/2/0.1). |

| | Command or Action | Purpose |
|---------------|--|---|
| | | <ul style="list-style-type: none"> • 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: <pre>Router(config-if)# no atm enable-ilmi-trap</pre> | Does not generate an Integrated Local Management Interface (ILMI) atmVccChange trap when an ATM interface or subinterface is enabled or shut down. |
| Step 5 | exit Example: <pre>Router(config-if)# exit</pre> | Exits interface configuration mode and enters global configuration mode. |
| Step 6 | rmon event number log trap community owner owner-name Example: <pre>Router(config)# rmon event 3 log trap public owner Test</pre> | 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: <pre>Router(config)# rmon alarm 1 ciscoAtmIfPVCs 4 absolute rising-threshold 5 1 falling-threshold 4 1 owner conf interface Atm3/0 trap</pre> | 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: <pre>Router(config)# end</pre> | 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. <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • <i>slot/subslot/port</i> --Specifies a (physical) ATM interface (for example, 0/2/0). • <i>. subinterface-number</i> --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 privileged 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. |
| 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 /
Interface Name          VPI  VCI Type  Encaps  SC      Peak Av/Min Burst
Kbps   Kbps Cells St
0/2/0    oam                    0    5 PVC   SNAP    UBR     0      0      0      IN
0/2/0    7                      0   10 PVC   SNAP    UBR     0      0      0      IN
0/2/0    2                      0   40 PVC   SNAP    UBR     0      0      0      IN
0/2/0    1                      0   100 PVC  SNAP    UBR     0      0      0      IN
0/2/0    name                   1    1 PVC   SNAP    UBR     0      0      0      IN
0/2/0    4                      2   200 PVC  SNAP    UBR     0      0      0      IN
0/2/0    vpi/vci                3   100 PVC  SNAP    UBR     0      0      0      IN
0/2/0    8                      4   100 PVC  SNAP    UBR     0      0      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 | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |
| SNMP commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples | <i>Cisco IOS Network Management Command Reference</i> |
| Overview of ATM SPAs | "Configuring ATM" |

Standards

| Standard | Title |
|----------|-------|
| None | -- |

MIBs

| MIB | MIBs Link |
|---|--|
| <ul style="list-style-type: none"> • CISCO-ATM-IF-MIB • CISCO-ATM-PVC-MIB • CISCO-ATM-PVCTRAP-EXTN-MIB • CISCO-IETF-ATM2-PVCTRAP-MIB-EXTN | <p>To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p>http://www.cisco.com/go/mibs</p> |

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 8: 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 | <p>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.</p> <p>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.</p> <p>The following commands were introduced or modified: oam-pvc manage, rmon alarm, snmp-server enable traps atm pvc extension.</p> |
| ATM OAM AIS-RDI Monitoring | Cisco IOS XE Release 2.3 | <p>The ATM OAM AIS-RDI Monitoring feature extends the existing ATM virtual circuit OAM functionality to include monitoring of the AIS-RDI.</p> <p>The following commands were introduced or modified: oam ais-rdi.</p> |

Glossary

LFI --link fragmentation and interleaving. Method of fragmenting large packets and then queueing the fragments between small packets.

MLP --multilink PPP.

QoS --quality of service.

VC --virtual circuit.



CHAPTER 10

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, on page 113](#)
- [Prerequisites for ATM PVC F5 OAM Recovery Traps, on page 113](#)
- [Restrictions for ATM PVC F5 OAM Recovery Traps, on page 114](#)
- [Information About ATM PVC F5 OAM Recovery Traps, on page 114](#)
- [How to Configure F5 OAM Recovery Traps for ATM PVCs, on page 115](#)
- [Configuration Examples for ATM PVC F5 OAM Recovery Traps, on page 117](#)
- [Additional References, on page 119](#)
- [Feature Information for ATM PVC F5 OAM Recovery Traps, on page 120](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | interface atm number Example: Router(config)# interface atm 0 | Specifies an interface for configuration and enters interface configuration mode. |
| Step 4 | ip address ip-address mask Example: Router(config-if)# ip address 10.0.0.3 255.255.255.0 | Sets a primary or secondary IP address for an interface. |
| Step 5 | pvc [name] vpi / vci Example: Router(config-if)# pvc 0/40 | Creates an ATM PVC and enters ATM virtual circuit configuration mode. |
| Step 6 | oam-pvc manage [keep-vc-up [end aisrdi failure seg aisrdi failure]] | Configures ATM OAM management. |

| | Command or Action | Purpose |
|--|--|---------|
| | Example: <pre>Router(config-if-atm-vc)# oam-pvc manage</pre> | |

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 [aisrldi | loopback]}`

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|--|--|
| Step 1 | enable Example: <pre>Router> enable</pre> | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: <pre>Router# configure terminal</pre> | Enters global configuration mode. |
| Step 3 | snmp-server enable traps atm pvc extension {up down oam failure [aisrldi loopback]} Example: <pre>Router(config)# snmp-server enable traps atm pvc extension oam failure aisrldi</pre> | Enables ATM OAM F5 AIS/RDI failure and recovery traps and ATM OAM F5 end-to-end loopback failure and recovery traps. |

Troubleshooting Tips

To troubleshoot PPP sessions establishment, use the following commands:

- `debug ppp authentication`
- `debug ppp negotiation`

To troubleshoot the establishment of PPP sessions that are authenticated by a RADIUS or TACACS server, use the following commands:

- `debug aaa authentication`
- `debug aaa authorization`



Caution Use **debug** commands with extreme caution because they are CPU-intensive and can seriously impact your network.

Configuration Examples for ATM PVC F5 OAM Recovery Traps

Enabling OAM PVC Management 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 /
Interface Name          VPI  VCI Type  Encaps  SC      Peak Av/Min Burst
0/3/0.100 pvc100      0    100 PVC    SNAP    UBR    Kbps  Kbps  Cells  St
                                         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
```

ATM OAM Failure Loopback Notification Example

```

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 /
Interface Name          VPI  VCI Type  Encaps  SC      Peak Av/Min Burst
0/3/0.100 pvc100             0   100 PVC   SNAP    UBR    149760          St
                                                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 Loopback 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 /
Interface Name          VPI   VCI Type   Encaps   SC      Peak Av/Min Burst
0/3/0.100 pvc100          0    100 PVC    SNAP     UBR    149760      Kbps Kbps Cells St
                                                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 /
Interface Name          VPI   VCI Type   Encaps   SC      Peak Av/Min Burst
0/3/0.100 pvc100          0    100 PVC    SNAP     UBR    149760      Kbps Kbps Cells St
                                                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 | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |

Standards

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

MIBs

| MIBs | MIBs Link |
|--|--|
| <ul style="list-style-type: none"> 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 |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | 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 9: 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 | <p>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.</p> <p>The following command was introduced: snmp-server enable traps atm pvc extension.</p> |



CHAPTER 11

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, on page 123](#)
- [Information About ATM VP Average Traffic Rate, on page 123](#)
- [How to Display ATM VP Average Traffic Rates, on page 124](#)
- [Configuration Examples for ATM VP Average Traffic Rates, on page 124](#)
- [Additional References, on page 124](#)
- [Feature Information for ATM VP Average Traffic Rate, on page 125](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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

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. <ul style="list-style-type: none"> (Optional) <i>vpi</i> 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

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 | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |

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 |
|---|---|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | 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 10: Feature Information for ATM VP Average Traffic Rate

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



CHAPTER 12

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, on page 127](#)
- [Restrictions for ATM Hierarchical Shaping, on page 128](#)
- [Information About ATM Hierarchical Shaping, on page 128](#)
- [How to Configure ATM Hierarchical Shaping, on page 128](#)
- [Configuration Examples for ATM Hierarchical Shaping, on page 130](#)
- [Additional References, on page 130](#)
- [Feature Information for ATM Hierarchical Shaping, on page 131](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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. Unspecified Bit Rate + (UBR+)
4. Variable Bit Rate Non Real-Time (VBR-nRT)
5. 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 all the above ATM traffic service categories.

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* {**multipoint** | **point-to-point**}]

4. `pvc vpi / vci`
5. `exit`
6. `ubr output-pcr`
7. `exit`
8. `create on-demand`

DETAILED STEPS

| | Command or Action | Purpose |
|--------|---|---|
| Step 1 | enable Example: <pre>Router> enable</pre> | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: <pre>Router# configure terminal</pre> | Enters global configuration mode. |
| Step 3 | interface atm interface-number [. subinterface-number {multipoint point-to-point}] Example: <pre>Router(config)# interface atm 0/3/2.1 point-to-point</pre> | Configure an ATM interface and enters subinterface configuration mode. |
| Step 4 | pvc vpi / vci Example: <pre>Router(config-subif)# pvc 2/200</pre> | Creates or assigns a name to an ATM PVC and enters ATM virtual circuit configuration mode. |
| Step 5 | exit Example: <pre>Router(config-if-atm-vc)# exit</pre> | Exits ATM virtual circuit configuration mode and returns to subinterface configuration mode. |
| Step 6 | ubr output-pcr Example: <pre>Router(config-if-atm-vc)# ubr</pre> | 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 7 | exit Example: <pre>Router(config-if-atm-vc)# exit</pre> | Exits ATM virtual circuit configuration mode and returns to subinterface configuration mode. |

| | Command or Action | Purpose |
|---------------|--|--|
| Step 8 | 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. |

Configuration Examples for ATM Hierarchical Shaping

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 | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |

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.

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 11: 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. |



CHAPTER 13

Autosense for ATM PVCs and MUX SNAP Encapsulation

The PPPoA/PPPoE Autosense for ATM PVCs feature enables a router to distinguish between incoming PPP over ATM (PPPoA) and PPP over Ethernet (PPPoE) over ATM sessions and to create virtual access based on demand for both PPP types.

The Autosense of MUX/SNAP Encapsulation and PPPoA/PPPoE on ATM PVCs feature enhances PPPoA/PPPoE autosense functionality by providing autosense support on multiplexer (MUX) and Subnetwork Access Protocol (SNAP)-encapsulated ATM permanent virtual circuits (PVCs).

- [Finding Feature Information, on page 133](#)
- [Restrictions for Autosense, on page 133](#)
- [Information About Autosense, on page 134](#)
- [How to Configure PPPoA PPPoE Autosense on ATM PVCs, on page 134](#)
- [Configuration Examples for Autosense for ATM PVCs, on page 139](#)
- [Additional References, on page 140](#)
- [Feature Information for Autosense for ATM PVCs and MUX SNAP Encapsulation, on page 141](#)
- [Glossary, on page 142](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 Autosense

- Do not use this feature on a router that initiates PPPoA sessions.
- PPPoA does not support static IP assignments within virtual templates.
- The PPPoE autosense is supported only for SNAP-encapsulated sessions.

- This feature supports ATM PVCs. Switched virtual circuits (SVCs) are not supported.

Information About Autosense

PPPoA PPPoE Autosense

PPPoA/PPPoE autosense enables a router to distinguish between incoming PPPoA and PPPoE over ATM sessions and to create virtual access based on demand for both PPP types.

Autosense of MUX SNAP Encapsulation on ATM PVCs

The Autosense of MUX/SNAP Encapsulation on ATM PVCs feature enables the PVC encapsulation type to be autosensed by the router. The router determines the encapsulation type of a PVC by looking at the encapsulation type of the first incoming packet. If the PVC encapsulation type is changed while the PPPoA or PPPoE session on the network access server (NAS) is still up, the incoming packet is dropped, the encapsulation type is reset to autosense, and all sessions are removed from the PVC. The next incoming packet will then determine the new encapsulation type of the PVC.

Benefits of Autosense of PPPoA PPPoE for MUX SNAP Encapsulation

The Autosense of PPPoA/PPPoE for MUX or SNAP Encapsulation feature provides resource allocation on demand. For each PVC configured for both PPPoA and PPPoE, certain resources (including one virtual-access interface) are allocated upon configuration, regardless of the existence of a PPPoA or PPPoE session on that PVC. With the Autosense of MUX/SNAP Encapsulation and PPPoA/PPPoE on ATM PVCs feature, resources are allocated for PPPoA and PPPoE sessions only when a client initiates a session, thus reducing overhead on the network access server (NAS).

This feature also saves configuration time by eliminating the need to specify the encapsulation type when ATM PVCs are being provisioned and by eliminating the need to manually provision ATM PVCs each time the encapsulation type changes.

How to Configure PPPoA PPPoE Autosense on ATM PVCs

Configuring PPPoA PPPoE Autosense on a PVC

Perform this task to configure PPPoA/PPPoE Autosense on a PVC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *number* [*. subinterface-number* {**multipoint** | **point-to-point**}]
4. **pvc** [*name*] *vpi / vci*
5. **encapsulation aal5autoppv virtual-template** *number*

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 <i>number</i> [<i>. subinterface-number</i> { multipoint point-to-point }] Example: Router(config)# interface atm 2/2/0.2 multipoint | Specifies the ATM interface and optional subinterface and enters subinterface configuration mode. |
| Step 4 | pvc [<i>name</i>] <i>vpi</i> / <i>vci</i> Example: Router(config-subif)# pvc pvc1 45/54 | Configures a PVC on the ATM interface or subinterface and enters ATM VC configuration mode. |
| Step 5 | encapsulation aal5autopp virtual-template <i>number</i> Example: Router(config-if-atm-vc)# encapsulation aal5autopp virtual-template 3 | Configures PPPoA/PPPoE autosense on the PVC. • Also specifies the virtual template interface to use to clone the new virtual-access interfaces for PPP sessions on this PVC. |
| Step 6 | end Example: Router(config-if-atm-vc)# end | Ends the session and enters privileged EXEC mode. |

Configuring PPPoA PPPoE Autosense on a VC Class



Note Virtual-access interfaces for PPPoE sessions are cloned from the virtual template interface specified in the virtual private dialup network (VPDN) group.

Perform this task to configure PPPoA/PPPoE autosense on a VC class.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vc-class atm** *vc-class-name*
4. **encapsulation aal5autopp** **virtual-template** *number*
5. **exit**
6. **interface atm** *number* [*.subinterface-number* {**multipoint** | **point-to-point**}]
7. **class-int** *vc-class-name*
8. **end**
9. **show running-config**

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 <i>vc-class-name</i> Example: Router(config)# vc-class atm vc1 | Creates and names a map class and enters VC class configuration mode. |
| Step 4 | encapsulation aal5autopp virtual-template <i>number</i> Example: Router(config-vc-class)# encapsulation aal5autopp virtual-template 4 | Configures PPPoA/PPPoE autosense. • Also specifies the virtual template interface to use to clone the new virtual-access interfaces for PPP sessions on this PVC. |
| Step 5 | exit Example: Router(config-vc-class)# exit | Returns to global configuration mode. |
| Step 6 | interface atm <i>number</i> [<i>.subinterface-number</i> { multipoint point-to-point }] Example: Router(config)# interface atm 2/2/0.2 multipoint | Specifies the ATM interface and enters subinterface configuration mode. |

| | Command or Action | Purpose |
|--------|--|---|
| Step 7 | class-int <i>vc-class-name</i> Example: <pre>Router(config-subif)# class-int vcl</pre> | Applies the VC class to all VCs on the ATM interface or subinterface. |
| Step 8 | end Example: <pre>Router(config-subif)# end</pre> | Ends the session and enters privileged EXEC mode. |
| Step 9 | show running-config Example: <pre>Router# show running-config</pre> | Verifies whether the PPPoA/PPPoE autosense configuration is successful. |

Troubleshooting Tips

To troubleshoot PPP sessions establishment, use the following commands:

- **debug ppp authentication**
- **debug ppp negotiation**

To troubleshoot the establishment of PPP sessions that are authenticated by a RADIUS or TACACS server, use the following commands:

- **debug aaa authentication**
- **debug aaa authorization**



Caution

Use **debug** commands with extreme caution because they are CPU-intensive and can seriously impact your network.

Monitoring and Maintaining PPPoA PPPoE Autosense for ATM PVCs

Perform this task to monitor and maintain PPPoA/PPPoE autosense for ATM PVCs. The **show** commands can be used in any order.

SUMMARY STEPS

1. **enable**
2. **show atm pvc** [*ppp*]
3. **show caller**
4. **show interface virtual-access** *interface-number*
5. **show user**
6. **show vpdn**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | enable Example: <pre>Router> enable</pre> | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | show atm pvc [ppp] Example: <pre>Router# show atm pvc ppp</pre> | Checks that the PVC contains the PPPoA session after the client at the other end of the PVC has initiated a PPPoA session. |
| Step 3 | show caller Example: <pre>Router# show caller</pre> | Displays caller information. <ul style="list-style-type: none"> • Use this command to: <ul style="list-style-type: none"> • Display individual users and consumed resources on the NAS. • Inspect active call statistics for large pools of connections. (The debug commands produce too much output and tax the CPU too heavily.) • Display the absolute and idle times for each user. The current values for both of these settings are displayed on the tty line and the asynchronous interface. Users that have been idle for unacceptably long periods of time can be easily identified. You can use this information to define timeout policies and multiple grades of services for different users. |
| Step 4 | show interface virtual-access <i>interface-number</i> Example: <pre>Router# show interface virtual-access 1</pre> | Displays information about the virtual-access interface, link control protocol, protocol states, and interface statistics. <ul style="list-style-type: none"> • The status of the virtual-access interface should read: Virtual-Access3 is up, line protocol is up |
| Step 5 | show user Example: <pre>Router# show user</pre> | Displays information about the active lines on the router. |
| Step 6 | show vpdn Example: <pre>Router# show vpdn</pre> | Displays basic information about all active VPDN tunnels. |

Configuration Examples for Autosense for ATM PVCs

Example PPPoA PPPoE Autosense on an ATM PVC

The following example shows how to configure the NAS with PPPoA/PPPoE autosense on PVC 30/33:

```
! Configure PPP Autosense
!
interface atm 0/0/0.33 multipoint
 pvc 30/33
  encapsulation aal5autopp virtual-template 1
  protocol pppoe
!
interface virtual-template 1
 ip unnumbered fastethernet 0/0/0
 ip route-cache cef
!
interface fastethernet 0/0/0
 ip address 10.1.1.1 255.255.255.0
!
```

Example PPPoA PPPoE Autosense on a VC Class

The following example shows how to configure the NAS with PPPoA/PPPoE autosense on the VC class called MyClass. The MyClass VC class applies PPPoA/PPPoE autosense to all PVCs on the ATM 0/0/0.99 interface.

```
! Configure PPP Autosense
!
vc-class atm MyClass
 encapsulation aal5autopp virtual-template 1
!
interface atm 0/0/0.99 multipoint
 class-int MyClass
 no ip directed-broadcast
 pvc 20/40
 pvc 30/33
 protocol pppoe
!
interface virtual-template 1
 ip unnumbered fastethernet 0/0/0
 ip route-cache cef
!
interface fastethernet 0/0/0
 ip address 10.1.1.1 255.255.255.0
!
```

Example PPPoA PPPoE Autosense on Multiple VC Classes and Virtual Templates

The following example shows how to handle PPPoA and PPPoE sessions separately using two virtual templates:

```
interface atm 0/0/0.3 multipoint
```

```

no ip directed-broadcast
class-int pppauto
!
interface atm 0/0/0.9 multipoint
ip address 10.16.40.1 255.255.0.0
no ip directed-broadcast
!
interface virtual-template 1
ip unnumbered atm 0/0/0.9
ip route-cache cef
no ip directed-broadcast
peer default ip address pool pool-1
ppp authentication pap
!
interface virtual-template 2
ip unnumbered atm 0/0/0.9
ip route-cache cef
no ip directed-broadcast
peer default ip address pool pool-2
ppp authentication chap
!
interface fastethernet 0/0/0
ip address 10.1.1.1 255.255.255.0
!
vc-class atm pppauto
encapsulation aal5autoppp virtual-template 2
!

```



Note Whenever possible, configure PPPoA and PPPoE to use the same virtual template. Using separate virtual templates leads to the inefficient use of virtual access because the maximum number of virtual-access interfaces will have to be precloned twice: once for PPPoE and once for PPPoA. If PPPoA and PPPoE use the same virtual template, the maximum number of virtual-access interfaces can be precloned once and used for PPPoA and PPPoE as needed.

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. | <i>Cisco IOS Asynchronous Transfer Mode Command Reference</i> |
| WAN commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples. | <i>Cisco IOS Wide-Area Networking Command Reference</i> |

Standards

| Standard | Title |
|----------|-------|
| None | -- |

MIBs

| MIB | MIBs Link |
|------|---|
| None | 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 |
|------|-------|
| None | -- |

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 Autosense for ATM PVCs and MUX SNAP Encapsulation

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 12: Feature Information for Autosense of MUX/SNAP Encapsulation and PPPoA/PPPoE on ATM PVCs

| Feature Name | Releases | Feature Information |
|---|---------------------------|---|
| PPPoA/PPPoE Autosense for ATM PVCs | Cisco IOS XE Release 3.3S | The PPPoA/PPPoE Autosense for ATM PVCs feature enables a router to distinguish between incoming PPP over ATM (PPPoA) and PPP over Ethernet (PPPoE) over ATM sessions and to create virtual access based on demand for both PPP types. |
| Autosense of MUX/SNAP Encapsulation and PPPoA/PPPoE on ATM PVCs | Cisco IOS XE Release 3.3S | The Autosense of MUX/SNAP Encapsulation and PPPoA/PPPoE on ATM PVCs feature enhances PPP over ATM (PPPoA)/PPP over Ethernet (PPPoE) autosense functionality by providing autosense support on MUX- and SNAP-encapsulated ATM permanent virtual circuits (PVCs). The following command was introduced or modified: encapsulation aal5autopp virtual-template. |

Glossary

cloning --Creating and configuring a virtual-access interface by applying a specific virtual template interface. The template is the source of the generic user information and router-dependent information. The result of cloning is a virtual-access interface configured with all the commands in the template.

LCP --Link Control Protocol. Protocol that establishes, configures, and tests data-link connections for use by PPP.

NAS --network access server. A device providing local network access to users across a remote access network such as the public switched telephone network (PSTN).

PPP --Point-to-Point Protocol. A protocol that encapsulates network layer protocol information over point-to-point links. PPP is defined in RFC 1661.

PPPoA --PPP over ATM.

PPPoE --PPP over Ethernet.

precloning --Cloning a specified number of virtual-access interfaces from a virtual template at system startup or when the command is configured.

PVC --permanent virtual circuit (or connection). Virtual circuit that is permanently established. PVCs save bandwidth associated with circuit establishment and teardown in situations where certain virtual circuits must exist all the time. In ATM terminology, called a permanent virtual connection.

VC --virtual channel. Logical circuit created to ensure reliable communication between two network devices. A VC is defined by a VPI/VCI pair and can be either permanent (PVC) or switched (SVC).

virtual-access interface --Instance of a unique virtual interface that is created dynamically and exists temporarily. Virtual-access interfaces can be created and configured differently by different applications, such as virtual profiles and virtual private dialup networks. Virtual-access interfaces are cloned from virtual template interfaces.

virtual template interface --A logical interface configured with generic configuration information for a specific purpose or configuration common to specific users, plus router-dependent information. The template takes the form of a list of Cisco IOS interface commands that are applied to virtual-access interfaces, as needed.

VPDN --virtual private dialup network. A system that permits dial-in networks to exist remotely from home networks, while giving the appearance of being directly connected.



CHAPTER 14

N:1 PVC Mapping to PWE with Nonunique VPIs

The N:1 PVC Mapping to PseudoWire Emulation (PWE) with Nonunique virtual path identifiers (VPIs) feature maps one or more ATM permanent virtual circuits (PVCs) to a single pseudowire (PW). There are two modes of AAL0 encapsulation, N:1 and 1:1 mapping. In N:1 mapping, multiple unrelated virtual path identifier/virtual channel identifier (VPI/VCI) are carried over a single Multiprotocol Label Switching (MPLS) PW. This is an efficient mapping method because less resources are used from the MPLS network. In 1:1 mapping, a single VPI/VCI is carried over a single MPLS PW. Benefits of this feature include the following:

- Aggregate quality of service (QoS) can be applied to related PVCs.
- Bandwidth is conserved with the reduction in the number of pseudowires that are used.
- [Finding Feature Information, on page 145](#)
- [Restrictions for N:1 PVC Mapping to PWE with Nonunique VPIs, on page 145](#)
- [Information About N:1 PVC Mapping to PWE with Nonunique VPIs, on page 146](#)
- [How to Configure N:1 PVC Mapping to PWE with Nonunique VPIs, on page 146](#)
- [Configuration Examples for N:1 PVC Mapping to PWE with Nonunique VPIs, on page 151](#)
- [Additional References, on page 152](#)
- [Feature Information for N:1 PVC Mapping to PWE with Nonunique VPIs, on page 153](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 N:1 PVC Mapping to PWE with Nonunique VPIs

- N:1 permanent virtual circuits (PVC) mapping configuration is supported only on multipoint subinterfaces; it is not supported on main interfaces or point-to-point subinterfaces.
- N:1 PVC mapping mode is not supported on Access Circuit Redundancy subinterfaces.

- Preconfigured PVCs cannot exist on the multipoint subinterface on which you want to configure N:1 PVC mapping.
- An attachment circuit that has been bound to a pseudowire cannot be removed unless all Layer 2 virtual circuits (VCs) have been removed.
- Layer 3 PVCs cannot be configured on N:1 subinterfaces.
- Cell packing values configured under a VC class attached to the PVC, main interface, or subinterface will not be inherited by N:1 PVCs.
- Operation, Administration, and Maintenance (OAM) functionality is not supported on N:1 Layer 2 PVCs. OAM cells coming from the customer edge (CE) network will be treated as normal data traffic and will traverse through the pseudowire.
- Only ATM adaptation layer type 0 (AAL0) encapsulation is supported for N:1 PVCs.
- The service policy configuration can be configured only at the subinterface level for N:1 PVCs.

Information About N:1 PVC Mapping to PWE with Nonunique VPIs

N:1 PVC Mapping to PWE with Nonunique VPIs Feature Description

To transport ATM cells over Multiprotocol Label Switching (MPLS), a VC is established between the provider edge (PE) routers on both ends of the MPLS backbone. With the N:1 permanent virtual circuit (PVC) Mapping to PseudoWire Emulation (PWE) with Nonunique VPIs feature, multiple PVCs irrespective of their Virtual Path Identifiers (VPIs), are transported over a single pseudowire configured on a subinterface. (“N:1” refers to the number of PVCs transported over one pseudowire). ATM cells are packed together in a single frame and sent over the single pseudowire. The ATM cell header information is packed together with the cell payload on a per-cell basis in the packets so that packets received at the egress end are unpacked and the ATM cells are mapped to the respective PVCs.

In N:1 PVC mapping mode, the device can pack cells only from a single PVC in an MPLS packet to transmit over a pseudowire; cells from multiple PVCs cannot be packed in a single MPLS packet and mapped to a single pseudowire for transmission. However, if a device receives an MPLS packet that is packed with cells from multiple PVCs, then those cells will be unpacked and sent to the respective PVCs.

How to Configure N:1 PVC Mapping to PWE with Nonunique VPIs

Configuring N:1 PVC Mapping to PWE with Nonunique VPIs

SUMMARY STEPS

1. `enable`

2. **configure terminal**
3. **interface atm** *slot/subslot/port*
4. **atm mcpt-timers** *timer1 timer2 timer3*
5. **exit**
6. **configure terminal**
7. **interface atm** *slot/subslot/port.subslot* **multipoint**
8. **no ip address**
9. **atm enable-ilmi-trap**
10. **cell-packing** *maxcells* **mcpt-timer** *timer-number*
11. **xconnect** *peer-ipaddress* *vc-id* **encapsulation** **mpls**
12. **pvc** *vpilvci* **l2transport**
13. Repeat Step 12 for the number of PVCs that you want to configure.
14. **end**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|---|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | interface atm <i>slot/subslot/port</i> Example: Device(config)# interface atm 9/1/1 | Enables the ATM interface and enters interface configuration mode. |
| Step 4 | atm mcpt-timers <i>timer1 timer2 timer3</i> Example: Device(config-if)# atm mcpt-timers 100 200 300 | Sets the Maximum Cell Packing Timeout (MCPT) values in microseconds. <ul style="list-style-type: none"> • The MCPT timer sets the time for which the device waits for the raw cells (AAL0 encapsulation) to be packed into a single packet for punting to the pseudowire. |
| Step 5 | exit Example: Device(config-if)# exit | Exits interface configuration mode. |
| Step 6 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |

| | Command or Action | Purpose |
|----------------|--|--|
| Step 7 | interface atm <i>slot/subslot/port.subslot</i> multipoint Example: Device(config)# interface atm 9/1/1.1 multipoint | Enters subinterface configuration mode and creates a multipoint subinterface on the given port on the specified ATM Shared Port Adapter (SPA). |
| Step 8 | no ip address Example: Device(config-subif)# no ip address | Removes the interface IP address. |
| Step 9 | atm enable-ilmi-trap Example: Device(config-subif)# atm enable-ilmi-trap | Generates an Integrated Local Management Interface (ILMI) atmVccChange trap when an ATM interface or subinterface is enabled or shut down. |
| Step 10 | cell-packing <i>maxcells</i> mcpt-timer <i>timer-number</i> Example: Device(config-subif)# cell-packing 20 mcpt-timer 2 | Enables ATM over MPLS to pack multiple ATM cells into each MPLS packet within the MCPT timing. |
| Step 11 | xconnect <i>peer-ipaddress</i> <i>vc-id</i> encapsulation mpls Example: Device(config-subif)# xconnect 10.1.1.1 100 encapsulation mpls | (Optional) Enables the attachment circuit and specifies the IP address of the peer, a VC ID, and the data encapsulation method. |
| Step 12 | pvc <i>vpi/vci</i> l2transport Example: Device(config-subif)# pvc 10/100 l2transport | Assigns a VPI and virtual channel identifier (VCI). |
| Step 13 | Repeat Step 12 for the number of PVCs that you want to configure. | — |
| Step 14 | end Example: Device(config-subif)# end | Exits subinterface configuration mode and returns to privileged EXEC mode. |

Configuring N:1 PVC Mapping to PWE with Nonunique VPIs using the commands associated with the L2VPN Protocol-Based CLIs feature

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm *slot/subslot/port***
4. **atm mcpt-timers *timer1 timer2 timer3***
5. **exit**

6. **configure terminal**
7. **interface atm** *slot/subslot/port.subslot* **multipoint**
8. **no ip address**
9. **atm enable-ilmi-trap**
10. **cell-packing** *maxcells* **mcpt-timer** *timer-number*
11. **end**
12. **interface pseudowire** *number*
13. **encapsulation mpls**
14. **neighbor** *peer-address vcid-value*
15. **exit**
16. **l2vpn xconnect context** *context-name*
17. **member pseudowire** *interface-number*
18. **member gigabitethernet** *interface-number*
19. **end**
20. **pvc** *vpi/vci* **l2transport**
21. Repeat Step 12 for the number of PVCs that you want to configure.
22. **end**

DETAILED STEPS

| | Command or Action | Purpose |
|---------------|---|--|
| Step 1 | enable Example: Device> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 3 | interface atm <i>slot/subslot/port</i> Example: Device(config)# interface atm 9/1/1 | Enables the ATM interface and enters interface configuration mode. |
| Step 4 | atm mcpt-timers <i>timer1 timer2 timer3</i> Example: Device(config-if)# atm mcpt-timers 100 200 300 | Sets the Maximum Cell Packing Timeout (MCPT) values in microseconds. <ul style="list-style-type: none"> • The MCPT timer sets the time for which the device waits for the raw cells (AAL0 encapsulation) to be packed into a single packet for punting to the pseudowire. |
| Step 5 | exit Example: Device(config-if)# exit | Exits interface configuration mode. |

| | Command or Action | Purpose |
|----------------|--|--|
| Step 6 | configure terminal Example: Device# configure terminal | Enters global configuration mode. |
| Step 7 | interface atm slot/subslot/port.subslot multipoint Example: Device(config)# interface atm 9/1/1.1 multipoint | Enters subinterface configuration mode and creates a multipoint subinterface on the given port on the specified ATM Shared Port Adapter (SPA). |
| Step 8 | no ip address Example: Device(config-subif)# no ip address | Removes the interface IP address. |
| Step 9 | atm enable-ilmi-trap Example: Device(config-subif)# atm enable-ilmi-trap | Generates an Integrated Local Management Interface (ILMI) atmVccChange trap when an ATM interface or subinterface is enabled or shut down. |
| Step 10 | cell-packing maxcells mcpt-timer timer-number Example: Device(config-subif)# cell-packing 20 mcpt-timer 2 | Enables ATM over MPLS to pack multiple ATM cells into each MPLS packet within the MCPT timing. |
| Step 11 | end Example: Router(config-subif)# end | Exits to privileged EXEC mode. |
| Step 12 | interface pseudowire number Example: Router(config)# interface pseudowire 100 | Specifies the pseudowire interface and enters interface configuration mode. |
| Step 13 | encapsulation mpls Example: Router(config-if)# encapsulation mpls | Specifies that Multiprotocol Label Switching (MPLS) is used as the data encapsulation method. |
| Step 14 | neighbor peer-address vcid-value Example: Router(config-if)# neighbor 10.1.1.1 100 | Specifies the peer IP address and virtual circuit (VC) ID value of the Layer 2 VPN (L2VPN) pseudowire. |
| Step 15 | exit Example: Router(config-if)# exit | Exits interface configuration mode. |

| | Command or Action | Purpose |
|---------|--|---|
| Step 16 | l2vpn xconnect context <i>context-name</i> Example: Router(config)# l2vpn xconnect context con1 | Creates a Layer 2 VPN (L2VPN) cross connect context and enters xconnect configuration mode. |
| Step 17 | member pseudowire <i>interface-number</i> Example: Router(config-xconnect)# member pseudowire 100 | Specifies a member pseudowire to form a Layer 2 VPN (L2VPN) cross connect. |
| Step 18 | member gigabitethernet <i>interface-number</i> Example: Router(config-xconnect)# member GigabitEthernet0/0/0.1 | Specifies the location of the Gigabit Ethernet member interface. |
| Step 19 | end Example: Router(config-xconnect)# end | Exits to privileged EXEC mode. |
| Step 20 | pvc <i>vpi/vci</i> l2transport Example: Device(config-subif)# pvc 10/100 l2transport | Assigns a VPI and virtual channel identifier (VCI). |
| Step 21 | Repeat Step 12 for the number of PVCs that you want to configure. | — |
| Step 22 | end Example: Device(config-subif)# end | Exits subinterface configuration mode and returns to privileged EXEC mode. |

Configuration Examples for N:1 PVC Mapping to PWE with Nonunique VPIs

Example: Configuring N:1 PVC Mapping to PWE with Nonunique VPIs

The following example shows how to configure the N:1 ATM permanent virtual circuit (PVC) mapping to pseudowires with non unique virtual path identifiers (VPIs):

```
Device> enable
Device# configure terminal
Device(config)# interface atm 9/1/1
Device(config-if)# atm mcpt-timers 500 5000 50000
```

```

Device(config-if) # exit
Device# configure terminal
Device(config) # interface atm 9/1/1.1 multipoint
Device(config-subif) # no ip address
Device(config-subif) # atm enable-ilmi-trap
Device(config-subif) # cell packing 20 mcpt-timer 2
Device(config-subif) # xconnect 10.1.1.1 100 encapsulation mpls
Device(config-subif) # pvc 10/100 l2transport
Device(config-subif) # pvc 11/122 l2transport
Device(config-subif) # pvc 19/231 l2transport
Device(config-subif) # end

```

Example: Configuring N:1 PVC Mapping to PWE with Nonunique VPIs using the commands associated with the L2VPN Protocol-Based CLIs feature

The following example shows how to configure the N:1 ATM permanent virtual circuit (PVC) mapping to pseudowires with non unique virtual path identifiers (VPIs):

```

Device> enable
Device# configure terminal
Device(config) # interface atm 9/1/1
Device(config-if) # atm mcpt-timers 500 5000 50000
Device(config-if) # exit
Device(config) # configure terminal
Device(config) # interface atm 9/1/1.1 multipoint
Device(config-subif) # no ip address
Device(config-subif) # atm enable-ilmi-trap
Device(config-subif) # cell packing 20 mcpt-timer 2
Device(config-subif) # exit
Device(config) # interface pseudowire 100
Device(config-if) # encapsulation mpls
Device(config-if) # neighbor 10.1.1.1 100
Device(config-if) # pvc 10/100 l2transport
Device(config-if) # pvc 11/122 l2transport
Device(config-if) # pvc 19/231 l2transport
Device(config-if) # exit
Device(config) # l2vpn xconnect context A
Router(config-xconnect) # member pseudowire 100
Device(config-xconnect) # member atm 9/1/1
Device(config-xconnect) # end

```

Additional References

Related Documents

| Related Topic | Document Title |
|--------------------|--|
| Cisco IOS commands | Master Command List |
| ATM commands | Asynchronous Transfer Mode Command Reference |

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 N:1 PVC Mapping to PWE with Nonunique VPIs

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 13: Feature Information for N:1 PVC Mapping to PWE with Nonunique VPIs

| Feature Name | Releases | Feature Information |
|--|---------------------------|--|
| N:1 PVC Mapping to PWE with Nonunique VPIs | Cisco IOS XE Release 3.7S | <p>The N:1 PVC Mapping to PWE with Nonunique VPIs feature maps one or more ATM PVCs to a single pseudowire. In Cisco IOS XE Release 3.7S, support was added for Cisco ASR 903 Routers.</p> <p>The following command was introduced by this feature: show atm cell-packaging .</p> |

