

# 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).


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## Prerequisites for ATM SNMP Trap and OAM Enhancements

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

To receive PVC failure notification and to allow access to PVC status tables on your router, you must have the Cisco extended ATM PVC trap MIB called CISCO-IETF-ATM2-PVCTRAP-MIB-EXTN.my compiled in your Network Management System (NMS) application. You can find this MIB at Cisco's MIB website: http://www.cisco.com/go/mibs.

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

# Restrictions for ATM SNMP Trap and OAM Enhancements

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

# Information About ATM SNMP Trap and OAM Enhancements

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

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

## ATM PVC Up Trap

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

## ATM PVC OAM Failure Trap

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

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

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

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

# Extended ATM PVC Traps

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

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

# ATM PVC High Watermark Trap

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

# Supported MIB Objects and Tables

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

- The table atmInterfaceExt2Table displays the status of ATM PVCs and is indexed by ifIndex. This table contains the following objects:
  - atmIntfCurrentlyDownToUpPVcls
  - atmIntfOAMFailedPVcls
  - atmIntfCurrentlyOAMFailingPVcls
- The table atmCurrentStatusChangePVclTable displays information about ATM PVCs that undergo an operational state change and is indexed by ifIndex, atmVclVpi, and atmVclVci. This table contains the following objects:
  - atmPVclStatusTransition
  - atmPVclStatusChangeStart
  - atmPVclStatusChangeEnd
- The table atmStatusChangePVclRangeTable displays information about ATM PVC ranges and is indexed by ifIndex, atmVclVpi, and rangeIndex. This table contains the following objects:

- atmPVclLowerRangeValue
- atmPVclHigherRangeValue
- atmPVclRangeStatusChangeStart
- atmPVclRangeStatusChangeEnd

- The ATM PVC Up Trap "atmIntfPvcUpTrap" contains the following objects:
  - ifIndex
  - atmIntfCurrentlyDownToUpPVcls
- The ATM PVC OAM Failure Trap atmIntfPvcOAMFailureTrap contains the following objects:
  - ifIndex
  - atmIntfOAMFailedPVcls
  - atmIntfCurrentlyOAMFailingPVcls

# ATM OAM AIS-RDI Monitoring

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

# Benefits of Configuring ATM SNMP Trap and OAM Enhancements

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

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

# How to Configure ATM SNMP Trap and OAM Enhancements

## Configuring Extended ATM PVC Trap Support

Perform this task to configure extended ATM PVC trap support.

### SUMMARY STEPS

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

### DETAILED STEPS

**Procedure**

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

| | Command or Action | Purpose |
|---|---|---|
| | | • **loopback** --(optional) Enables OAM failure loopback traps that are generated when an OAM loopback failure occurs. |
| **Step 4** | **end**<br>**Example:**<br>`Router(config)# end` | Exits global configuration mode and returns to privileged EXEC mode. |

# Configuring ATM PVC High Watermark Trap Support

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

### SUMMARY STEPS

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

### DETAILED STEPS

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface atm** *slot* / *subslot* / *port* **.** *subinterface-number* **point-to-point**<br>**Example:** | Configures the ATM interface. The command syntax is as follows:<br>• *slot/subslot/port* --Specifies a (physical) ATM interface (for example, 0/2/0). |

| | Command or Action | Purpose |
|---|---|---|
| | `Router(config)# interface atm 1/0/0.2 point-to-point` | • **.** *subinterface-number* --Specifies a subinterface number. A dot (.) must be used to separate the interface number from the subinterface number (for example, 0/2/0.1).<br>• **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**<br>**Example:**<br>`Router(config-if)# no atm enable-ilmi-trap` | Does not generate an Integrated Local Management Interface (ILMI) atmfVccChange trap when an ATM interface or subinterface is enabled or shut down. |
| **Step 5** | **exit**<br>**Example:**<br>`Router(config-if)# exit` | Exits interface configuration mode and enters global configuration mode. |
| **Step 6** | **rmon event** *number* **log trap** *community* **owner** *owner-name*<br>**Example:**<br>`Router(config)# rmon event 3 log trap public owner Test` | Creates RMON event, which is the prerequisite for generating a trap. |
| **Step 7** | **rmon alarm** *number variable interval* **absolute rising-threshold** *value* [*event-number*] **falling-threshold** *value* [*event-number*] **owner** *owner-name* **interface atm** *slot* / *subslot* / *port* **.** *subinterface-number* **trap**<br>**Example:**<br>`Router(config)# rmon alarm 1 ciscoAtmIfPVCs 4 absolute rising-threshold 5 1 falling-threshold 4 1 owner conf interface Atm3/0 trap` | Generates a trap when the number of configured PVCs in an interface and related subinterfaces exceed a preconfigured high watermark threshold. The **interface** keyword enables RMON to monitor the ciscoAtmIfPVCs object for the specific interface. The **trap**keyword enables RMON to include the interface name in the generated trap. |
| **Step 8** | **end**<br>**Example:**<br>`Router(config)# end` | Exits global configuration mode and returns to privileged EXEC mode. |

# Enabling OAM Management

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

### SUMMARY STEPS

1. **enable**

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

## DETAILED STEPS

### Procedure

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

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

# Enabling OAM AIS-RDI Monitoring

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

### SUMMARY STEPS

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

### DETAILED STEPS

**Procedure**

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **interface atm** *slot* / *subslot* / *port* [**.** *subinterface-number* {**multipoint** \| **point-to-point**}]<br>**Example:**<br>`Router(config)# interface atm 2/0/0` | Specifies the ATM interface and enters interface configuration mode. |
| **Step 4** | **pvc** [*name*] *vpi* / *vci*<br>**Example:**<br>`Router(config-if)# pvc 0/400` | Enables the PVC and enters ATM VC configuration mode. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 5** | **oam ais-rdi** [*down-count* [*up-count*]]<br>**Example:**<br>`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**<br>**Example:**<br>`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

#### Procedure

**show atm vc**

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

**Example:**

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

# Configuration Examples for ATM SNMP Traps and OAM Enhancements

## Example Configuring Extended ATM PVC Trap Support

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

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

## Examples Extended ATM PVC Trap Output

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

### Extended ATM PVC Failure Trap Output

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

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

### Extended ATM PVC Up Trap Output

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

```
00:31:29:SNMP:Queuing packet to 1.1.1.1
00:31:29:SNMP:V2 Trap, reqid 2, errstat 0, erridx 0
sysUpTime.0 = 188990
snmpTrapOID.0 = atmIntfPvcUpTrap
ifEntry.1.19 = 19
atmIntfCurrentlyDownToUpPVcls.2 = 3
atmPVclLowerRangeValue.19.1.2 = 102
atmPVclHigherRangeValue.19.1.2 = 103
atmPVclRangeStatusChangeStart.19.1.2 = 186005
atmPVclRangeStatusChangeEnd.19.1.2 = 186053
atmPVclStatusTransition.19.1.100 = 1
atmPVclStatusChangeStart.19.1.100 = 185990
atmPVclStatusChangeEnd.19.1.100 = 185990
00:31:30:SNMP:Packet sent via UDP to 1.1.1.1
```

# Example Enabling OAM AIS-RDI Monitoring

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

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

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

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

# Additional References

### Related Documents

| Related Topic | Document Title |
|---|---|
| ATM commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples | *Cisco IOS Asynchronous Transfer Mode Command Reference* |
| SNMP commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples | *Cisco IOS Network Management Command Reference* |

| Related Topic | Document Title |
|---|---|
| Overview of ATM SPAs | "Configuring ATM" |

### Standards

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

### MIBs

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

### Technical Assistance

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

# Feature Information for ATM SNMP Trap and OAM Enhancements

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

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

*Table 1: Feature Information for Configuring ATM SNMP Trap and OAM Enhancements*

| Feature Name | Releases | Feature Information |
|---|---|---|
| ATM SNMP Trap and OAM Enhancements | Cisco IOS XE Release 2.3 Cisco IOS XE Release 3.2S | The feature provides enhancements to the Simple Network Management Protocol (SNMP) notifications for ATM permanent virtual circuits (PVCs) and to Operation, Administration, and Maintenance (OAM) functionality.<br>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.<br>The following commands were introduced or modified: **oam-pvc manage**, **rmon alarm, snmp-server enable traps atm pvc extension**. |
| ATM OAM AIS-RDI Monitoring | Cisco IOS XE Release 2.3 | The ATM OAM AIS-RDI Monitoring feature extends the existing ATM virtual circuit OAM functionality to include monitoring of the AIS-RDI.<br>The following commands were introduced or modified: **oam ais-rdi**. |

# 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.