Asynchronous Transfer Mode Configuration Guide, Cisco IOS XE 17 (Cisco NCS 4200 Series)

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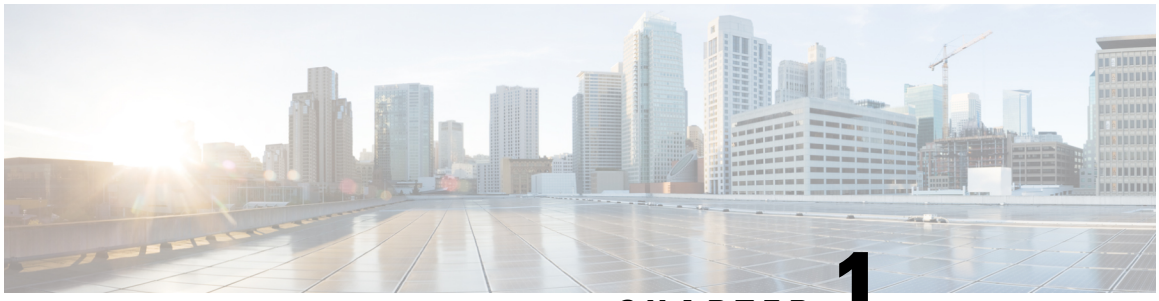

CHAPTER 1

Configuring ATM

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Information About Configuring ATM Interface

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.

Restrictions for Clear Channel ATM

- Operation, Administration, and Maintenance (OAM) is not supported.
- Access Circuit Redundancy (ACR) is not supported.
- Automatic Protection Switching (APS) is not supported.
- Optical Carrier level 12 (OC-12) mode is not supported.
- Clear Channel ATM is not supported for layer 3 on the routers.

Information About Clear Channel ATM

When the clear channel ATM feature is enabled, the entire payload rate over Synchronous Optical Network (SONET) or the Synchronous Digital Hierarchy (SDH) line is used as a single flow of cells or packets. An STS-3c/VC4 container is used to represent the OC-3/STM-1 concatenation types (OC-3 clear channels). Up to four OC-3/STM-1 are supported.

Clear channel ATM supports the following Layer 1 features:

- Framing configuration between SONET and SDH
- Local (diagnostic) and line (network) loopback
- Alarm detection and reporting capabilities
- System, local and line timing options

Effective Cisco IOS-XE Release 3.18, Clear Channel ATM on OC-3/STM-1 is supported on .

Clear channel ATM Pseudowire supports the following Layer 2 features:

- Permanent Virtual Path (PVP)

  For configuration examples, see the "Configuring Pseudowire, Time Division Multiplexing Configuration Guide" chapter.

- QoS experimental bits (Exp) marking on ATM Layer 2 interfaces

  For configuration examples, see the "Configuring Pseudowire, Time Division Multiplexing Configuration Guide chapter.

How to Configure ATM

This section explains how to configure ATM on T1, E1, OC-3, and OC-12 interfaces.

Configuring ATM on a T1 or E1 Controller

To configure ATM on a T1 or E1 controller, follow these steps:

SUMMARY STEPS

1. **configure terminal**
2. **card type** {**t1** | **e1**} *slot subslot*
3. **controller t1** *slot/subslot/port*
4. **framing esf**
5. **linecode b8zs**
6. **cablelength long** *db-loss-value*
7. **atm**
8. **exit**
9. **interface atm** *slot/subslot/port*

10. **no ip address**
11. **no atm enable-ilmi-trap**
12. **interface atm** *slot/subslot/port.subinterface* **point-to-point**
13. **pvc** *vpi/vci* **l2transport**
14. **encapsulation aal5**
15. **xconnect** *peer-router-id vcid* **encapsulation mpls**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**card type** {**t1** | **e1**} *slot subslot* **Example:** `Router(config)# card type t1 0 1`	Specifies the slot and subslot number of the T1 or E1 interface.
Step 3	**controller t1** *slot/subslot/port* **Example:** `Router(config)# controller t1 0/1/0`	Enters controller configuration mode to configure the T1 interface.
Step 4	**framing esf** **Example:** `Router(config-controller)# framing esf`	Selects the framing type as Extended Super Frame.
Step 5	**linecode b8zs** **Example:** `Router(config-controller)# linecode b8zs`	Selects the linecode type as binary 8-zero substitution (B8ZS).
Step 6	**cablelength long** *db-loss-value* **Example:** `Router(config-controller)# cablelength long 0db`	Number of decibels by which the transmit signal is decreased.
Step 7	**atm** **Example:** `Router(config-controller)# atm`	Configures the interface for ATM.
Step 8	**exit** **Example:** `Router(config-controller)# exit`	Enters global configuration mode.
Step 9	**interface atm** *slot/subslot/port* **Example:** `Router(config)# interface ATM 0/1/0`	Specifies the ATM interface.

	Command or Action	Purpose
Step 10	**no ip address** **Example:** `Router(config-if)# no ip address`	Removes the interface IP address.
Step 11	**no atm enable-ilmi-trap** **Example:** `Router(config-if)# atm enable-ilmi-trap`	Disables Integrated Local Management Interface traps.
Step 12	**interface atm** *slot/subslot/port.subinterface* **point-to-point** **Example:** `Router(config)# interface atm 0/1/1.1 point-to-point`	Enters subinterface configuration mode and creates a point-to-point subinterface.
Step 13	**pvc** *vpi/vci* **l2transport** **Example:** `Router(config-subif)# pvc 10/100 l2transport`	Assigns a VPI and virtual channel identifier (VCI).
Step 14	**encapsulation aal5** **Example:** `(cfg-if-atm-l2trans-pvc)# encapsulation aal5`	Sets the encapsulation type as aal5.
Step 15	**xconnect** *peer-router-id vcid* **encapsulation mpls** **Example:** `Router(cfg-if-atm-l2trans-pvc)# xconnect 10.1.2.3 1 encapsulation mpls`	Binds the attachment circuit to a pseudowire VC.

Configuring ATM on OC-3 IM with SDH Framing

To configure ATM on OC-3 interface module with SDH framing, perform these steps:

SUMMARY STEPS

1. **configure terminal**
2. **controller sonet** *slot/subslot/port*
3. **framing sdh**
4. **aug mapping au-4**
5. **au-4** *au-4-number* **tug-3** *tug-3-number*
6. **tug-2** *tug-2-number* **e1** *e1-line-number* **atm**
7. **interface ATM** *slot/subslot/port.au-4/tug-3/tug-2/e1.subint point-to-point*
8. **pvc** *vpi/vci* **l2transport**
9. **encapsulation aal5**
10. **xconnect** *remote-ip-address vc-id* **encapsulation mpls**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**controller sonet** *slot/subslot/port* **Example:** `Router(config)#controller sonet 0/1/0`	Enters controller configuration mode to configure SDH.
Step 3	**framing sdh** **Example:** `Router(config-controller)#framing sdh`	Specifies the framing type as SDH.
Step 4	**aug mapping au-4** **Example:** `Router(config-controller)#aug mapping au-4`	Configures the AUG to be derived from AU-4.
Step 5	**au-4** *au-4-number* **tug-3** *tug-3-number* **Example:** `Router(config-controller)#au-4 1 tug-3 1`	Specifies the Administrative Unit type 4 (AU-4) and Tributary Unit group type 3 (TUG-3) numbers.
Step 6	**tug-2** *tug-2-number* **e1** *e1-line-number* **atm** **Example:** `Router(config-ctrlr-tug3)# tug-2 1 e1 1 atm`	Creates an ATM group for the AU-4.
Step 7	**interface ATM** *slot/subslot/port.au-4/tug-3/tug-2/e1.subint* **point-to-point** **Example:** `Router(config)# interface ATM 0/1/0.1/1/1/1.1 point-to-point`	Specifies the ATM interface as the point-to-point interface type.
Step 8	**pvc** *vpi/vci* **l2transport** **Example:** `Router(config-subif)#pvc 10/100 l2transport`	Assigns a VPI and virtual channel identifier (VCI).
Step 9	**encapsulation aal5** **Example:** `Router(cfg-if-atm-vc)#encapsulation aal5`	Sets the PVC encapsulation type to AAL5.
Step 10	**xconnect** *remote-ip-address vc-id* **encapsulation mpls** **Example:** `Router(cfg-if-atm-vc)#xconnect 10.1.1.101 100 encapsulation mpls`	Binds the attachment circuit to the ATM interface to create a pseudowire.

Configuring ATM on OC-3 IM with SONET Framing

To configure ATM on OC-3 interface module with SONET framing, perform these steps:

SUMMARY STEPS

1. **configure terminal**
2. **controller sonet** *slot/subslot/port*
3. **framing sonet**
4. **sts-1** { **1 - 12** | **1 - 3** | **4 - 6** | **7 - 9** | **10 - 12**}
5. **vtg** *vtg_number* **t1** *t1_line_number* **atm**
6. **interface ATM** *slot/subslot/port.sts-1/vtg/t1* **.** *subint* **.** *point-to-point*
7. **pvc** *vpi/vci* **l2transport**
8. **encapsulation aal5**
9. **xconnect** *remote-ip-address vc-id* **encapsulation mpls**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**controller sonet** *slot/subslot/port* **Example:** `Router(config)#controller sonet 0/1/0`	Enters controller configuration mode to configure SONET.
Step 3	**framing sonet** **Example:** `Router(config-controller)# framing sonet`	Specifies the framing type as SONET.
Step 4	**sts-1** { **1 - 12**	**1 - 3**	**4 - 6**	**7 - 9**	**10 - 12**} **Example:** `Router(config-controller)# sts-1 1`	Configures the Synchronous Transport Signal (STS) (level)-1 in the SONET hierarchy. For OC-3 interfaces, this value is 1. **Note** The **1-12** value is supported only in OC-12 mode.
Step 5	**vtg** *vtg_number* **t1** *t1_line_number* **atm** **Example:** `Router(config-ctrlr-sts)# vtg 1 t1 1 atm`	Configures the T1 on the VTG . For SONET framing, values are 1 to 7
Step 6	**interface ATM** *slot/subslot/port.sts-1/vtg/t1 . subint . point-to-point* **Example:** `Router(config)# interface ATM 0/1/0.1/1/1.1 point-to-point`	Specifies the ATM interface as the point-to-point interface type.

	Command or Action	Purpose
Step 7	**pvc** *vpi*/*vci* **l2transport** **Example:** `Router(config-subif)#pvc 10/100 l2transport`	Assigns a VPI and virtual channel identifier (VCI).
Step 8	**encapsulation aal5** **Example:** `Router(cfg-if-atm-vc)#encapsulation aal5`	Sets the PVC encapsulation type to AAL5.
Step 9	**xconnect** *remote-ip-address vc-id* **encapsulation mpls** **Example:** `Router(cfg-if-atm-vc)#xconnect 10.1.1.101 100 encapsulation mpls`	Binds the attachment circuit to the ATM interface to create a pseudowire.

Enabling Configuring the ATM Interface on OC-3 IM

This section describes how to configure an ATM interface.

Perform the following task to enable the ATM interface:

SUMMARY STEPS

1. **configure terminal**
2. **interface atm** *slot*/*subslot*/*port.subport*
3. **no shutdown**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal**	Enters global configuration mode from the terminal.
Step 2	**interface atm** *slot*/*subslot*/*port.subport* **Example:** **interface atm** *0/5/0.1/1/1.1*	Specifies the ATM interface using the appropriate format of the **interface atm** command.
Step 3	**no shutdown**	Changes the shutdown state to up and enables the ATM interface, thereby beginning the segmentation and reassembly (SAR) operation on the interface. • The **no shutdown** command passes an **enable** command to the ATM interface, which then begins segmentation and reassembly (SAR) operations. It also causes the ATM interface to configure itself based on the previous configuration commands sent.

Configuring ATM Interface on TDM IMs

To configure ATM interface on TDM IMs, follow these steps:

SUMMARY STEPS

1. **configure terminal**
2. **card type** {**t1** | **e1**} *slot subslot*
3. **controller t1** *slot*/*subslot*/*port*
4. **atm**
5. **exit**
6. **interface atm** *slot*/*subslot*/*port.subinterface* **point-to-point**
7. **pvc** *vpi*/*vci* **l2transport**
8. **encapsulation aal5**
9. **xconnect** *peer-router-id vcid* **encapsulation mpls**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 2	**card type** {**t1** | **e1**} *slot subslot* **Example:** `Router(config)# card type t1 0 1`	Specifies the slot and subslot number of the T1 or E1 interface.
Step 3	**controller t1** *slot*/*subslot*/*port* **Example:** `Router(config)# controller t1 0/1/0`	Enters controller configuration mode to configure the T1 interface.
Step 4	**atm** **Example:** `Router(config-controller)# atm`	Configures the interface for ATM.
Step 5	**exit** **Example:** `Router(config-controller)# exit`	Enters global configuration mode.
Step 6	**interface atm** *slot*/*subslot*/*port.subinterface* **point-to-point** **Example:** `Router(config)# interface atm 0/1/1.1 point-to-point`	Enters subinterface configuration mode and creates a point-to-point subinterface.
Step 7	**pvc** *vpi*/*vci* **l2transport** **Example:**	Assigns a VPI and virtual channel identifier (VCI).

	Command or Action	Purpose
	`Router(config-subif)# pvc 10/100 l2transport`	
Step 8	**encapsulation aal5** **Example:** `(cfg-if-atm-l2trans-pvc)# encapsulation aal5`	Sets the encapsulation type as aal5.
Step 9	**xconnect** *peer-router-id vcid* **encapsulation mpls** **Example:** `Router(cfg-if-atm-l2trans-pvc)# xconnect 10.1.2.3 1 encapsulation mpls`	Binds the attachment circuit to a pseudowire VC.

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-number* {**multipoint** | **point-to-point**}]
2. Device(config-if)# **pvc** [*name*] *vpi /vci*
3. Device(config-if-atm-vc)# **protocol** *protocol* {*protocol-address* | **inarp**} [[**no**] **broadcast**]
4. Device(config-if-atm-vc)# **inarp** *minutes*
5. Device(config-if-atm-vc)# **encapsulation** {**aal5snap**}
6. Device(config-if-atm-vc)# **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Device(config)# **interface atm** *slot/subslot/port* [**.***subinterface-number* {**multipoint**	**point-to-point**}]	Enters subinterface configuration mode for the specified port on the ATM Interface Module (IM), where: • *slot*—Specifies the chassis slot number where the SIP is installed.

	Command or Action	Purpose
		• *subslot*—Specifies the secondary slot of the SIP where the IM is installed. • *port*—Specifies the number of the individual interface port on an IM. • *subinterface*—Specifies the number of the subinterface.
Step 2	Device(config-if)# **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 *vpi* /*vci* are: • *name*—(Optional) An arbitrary string that identifies this PVC. • *vpi*—Specifies the VPI ID. The valid range is 0 to 255. • *vci*—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. **Note** When using the **pvc** command, remember that the *vpi* /*vci* combination forms a unique identifier for the interface and all of its subinterfaces. If you specify a *vpi* /*vci* 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.
Step 3	Device(config-if-atm-vc)# **protocol** *protocol* {*protocol-address* | **inarp**} [[**no**] **broadcast**] **Example:**	Configures the PVC for a particular protocol and maps it to a specific *protocol-address* . • *protocol*—Typically set to **ip**or **pppoe**, but other values are possible. **Note** PPP is not supported. • *protocol-address*—Destination address or virtual interface template for this PVC (if appropriate for the *protocol*). • **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.

	Command or Action	Purpose
Step 4	Device(config-if-atm-vc)# **inarp** *minutes*	(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 5	Device(config-if-atm-vc)# **encapsulation** {**aal5snap**}	(Optional) Configures the ATM adaptation layer (AAL) and encapsulation type.
Step 6	Device(config-if-atm-vc)# **end**	Exits ATM VC configuration mode and returns to privileged EXEC mode.

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 19".

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

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

Configuring the AAL and Encapsulation Type

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

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

Configuring PVC Traffic Parameters

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

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)# cbr peak_cell_rate_KBPS`	Configures the Constant Bit Rate (CBR).
`Router(config-if-atm-vc)# ubr output-pcr`	Configures the Unspecified Bit Rate (UBR).
`Router(config-if-atm-vc)# vbr-nrt output-pcr output-scr output-mbs`	Configures the Variable Bit Rate-Non Real Time (VBR-NRT) QOS.

Command	Purpose
`Router(config-if-atm-vc)# vbr-rt peak-rate average-rate burst`	Configures the real-time Variable Bit Rate (VBR). (Cisco MC3810 and Multiport T1/E1 ATM Network Module only.)

Enabling Inverse ARP

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

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

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

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

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

For an example of configuring Inverse ARP, see the section "*Example Enabling Inverse ARP* at the end of this chapter.

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

SUMMARY STEPS

1. **interface atm** *slot/subslot/port.subinterface* {**multipoint** | **point-to-point**}
2. **pvc** [*name*] *vpi* / *vci*
3. **encapsulation aal5snap**
4. **inarp** *minutes*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**interface atm** *slot/subslot/port.subinterface* {**multipoint** | **point-to-point**} **Example:** `Router(config)# interface atm 0/5/0.1/1/1/1.1 {multipoint | point-to-point}`	Specifies the ATM interface using the appropriate format of the **interface atm** command.[1]
Step 2	**pvc** [*name*] *vpi* / *vci*	Specifies an ATM PVC by name (optional) and VPI/VCI numbers.
Step 3	**encapsulation aal5snap**	Configures AAL5 LLC-SNAP encapsulation if it is not already configured.

	Command or Action	Purpose
Step 4	**inarp** *minutes*	(Optional) Adjusts the Inverse ARP time period.

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**{**aal5snap**}
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: • *slot* —Specifies the chassis slot number where the SIP is installed. • *subslot* —Specifies the secondary slot of the SIP where the SPA is installed. • *port* —Specifies the number of the individual interface port on a SPA.

	Command or Action	Purpose
		• *subinterface* —Specifies the number of the subinterface.
Step 2	Router(config-subif)# **ip address** *address mask*	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** [*name*] *vpi* /*vci*	Configures a new ATM PVC by assigning its VPI/VCI numbers and enters ATM VC configuration mode. The valid values for *vpi* /*vci* are: • *name* —(Optional) An arbitrary string that identifies this PVC. • *vpi* —Specifies the VPI ID. The valid range is 0 to 255. • *vci* —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. **Note** When using the **pvc** command, remember that the *vpi* /*vci* combination forms a unique identifier for the interface and all of its subinterfaces. If you specify a *vpi* /*vci* 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.
Step 5	Router(config-if-atm-vc)# **protocol** *protocol* {*protocol-address* | **inarp**} **broadcast**	Configures the PVC for a particular protocol and maps it to a specific *protocol-address* . • *protocol* —Typically set to **ip**or **pppoe**, but other values are possible. **Note** PPP is not supported • *protocol-address* —Destination address or virtual template interface for this PVC (if appropriate for the *protocol*). • **inarp** —Specifies that the PVC uses Inverse ARP to determine its address. • **broadcast** — Specifies that this mapping should be used for multicast packets.

	Command or Action	Purpose
Step 6	Router(config-if-atm-vc)# **inarp** *minutes*	(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 7	Router(config-if-atm-vc)# **encapsulation**{**aal5snap**}	(Optional) Configures the ATM adaptation layer (AAL) and encapsulation type. **Note** Repeat Step 1 through Step 7 for each multipoint subinterface to be configured on this ATM SPA.
Step 8	Router(config-if-atm-vc)# **end**	Exits interface configuration mode and returns to privileged EXEC mode.

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.

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

Command	Purpose
`Router(config-subif)# mtu bytes`	Sets the maximum MTU size on the subinterface. **Note** The MTU size can be changed for an ATM Layer 3 subinterface only.

How to Configure Clear Channel ATM

This section explains how to configure clear channel ATM on an OC-3 IM.

Configuring Clear Channel ATM on OC-3 IM with SONET Framing

To configure ATM on an OC-3 IM with SONET framing, perform these steps:

SUMMARY STEPS

1. **configure terminal**
2. **controller sonet** *slot/subslot/port*

3. **framing sonet**
4. **sts-1** *sts-identifier* **atm**
5. **interface ATM** *slot/subslot/port*:*sts-1-num*
6. **pvc** *vpi/vci* **l2transport**
7. **encapsulation aal5**
8. **xconnect** *remote-ip-address vc-id* **encapsulation mpls**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**controller sonet** *slot/subslot/port* **Example:** `Router(config)#controller sonet 0/1/0`	Enters controller configuration mode to configure SONET. • *slot/subslot/port*—Specifies the location of the controller. For OC-3, valid ports are from 0 to 3.
Step 3	**framing sonet** **Example:** `Router(config-controller)# framing sonet`	Specifies the framing type as SONET.
Step 4	**sts-1** *sts-identifier* **atm** **Example:** `Router(config-controller)# sts-1 1 - 3 atm`	Configures Synchronous Transport Signal (STS) (level)-1 in the SONET hierarchy. • **sts-1**— Specifies the SONET STS level. • *sts-identifier*—For OC-3, valid *sts-identifier* is from 1 to 3. • **atm**—Specifies clear channel ATM mode for STS.

Step 5	**interface ATM** *slot/subslot/port*:*sts-1-num*
	Example:
	(for main interface)
	`Router(config-controller)# interface ATM 0/1/0:1`
	(for sub-interface)
	`Router(config-controller)# interface ATM 0/1/0:1.1 point-to-point`
		Enters clear channel ATM mode.
		• *slot/subslot/port:sts-1-num*—Specifies the location of the clear channel ATM.

Step 6	**pvc** *vpi/vci* **l2transport** **Example:** `Router(config-subif)#pvc 10/100 l2transport`	Assigns a virtual path identifier (VPI) and virtual channel identifier (VCI). • *vpi/vci*—Specifies VPI and VCI. • **l2transport**—Specifies that the PVC is a switched PVC instead of a terminated PVC.

	Command or Action	Purpose
Step 7	**encapsulation aal5** **Example:** `Router(cfg-if-atm-l2trans-pvc)#encapsulation aal5`	Sets the PVC encapsulation type to AAL5.
Step 8	**xconnect** *remote-ip-address vc-id* **encapsulation mpls** **Example:** `Router(cfg-if-atm-l2trans-pvc)#xconnect 10.1.1.101 100 encapsulation mpls`	Binds the attachment circuit to the ATM interface to create a pseudowire.

Configuring Clear Channel ATM in OC-3 Mode with SDH Framing

To configure clear channel ATM in OC-3 mode with SDH framing, perform these steps:

SUMMARY STEPS

1. **configure terminal**
2. **controller sonet** *slot/subslot/port*
3. **framing sdh**
4. **aug mapping au-4**
5. **au-4** *au-4-number* **atm**
6. **interface ATM** *slot/subslot/port:au-4-num.subint point-to-point*
7. **pvc** *vpi/vci* **l2transport**
8. **encapsulation aal5**
9. **xconnect** *remote-ip-address vc-id* **encapsulation mpls**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**controller sonet** *slot/subslot/port* **Example:** `Router(config)#controller sonet 0/1/0`	Enters controller configuration mode to configure SDH. • *slot/subslot/port*—Specifies the location of the controller. For OC-3, valid ports are from 0 to 3.
Step 3	**framing sdh** **Example:** `Router(config-controller)#framing sdh`	Specifies the framing type as SDH.
Step 4	**aug mapping au-4** **Example:**	Configures the AUG to be derived from AU-4.

	Command or Action	Purpose
	`Router(config-controller)#aug mapping au-4`	
Step 5	**au-4** *au-4-number* **atm** **Example:** `Router(config-controller)#au-4 1 atm`	Specifies the Administrative Unit type 4 (AU-4) numbers and enters clear channel ATM mode.
Step 6	**interface ATM** *slot/subslot/port:au-4-num.subint point-to-point* **Example:** `Router(config-controller)# interface ATM ATM0/1/0:1.1 point-to-point`	Specifies the ATM interface as the point-to-point interface type.
Step 7	**pvc** *vpi/vci* **l2transport** **Example:** `Router(config-subif)#pvc 10/100 l2transport`	Assigns a virtual path identifier (VPI) and virtual channel identifier (VCI). • *vpi/vci*—Specifies VPI and VCI. • **l2transport**—Specifies that the PVC is a switched PVC instead of a terminated PVC.
Step 8	**encapsulation aal5** **Example:** `Router(cfg-if-atm-l2trans-pvc)#encapsulation aal5`	Sets the PVC encapsulation type to AAL5.
Step 9	**xconnect** *remote-ip-address vc-id* **encapsulation mpls** **Example:** `Router(cfg-if-atm-l2trans-pvc)#xconnect 10.1.1.101 100 encapsulation mpls`	Binds the attachment circuit to the ATM interface to create a pseudowire.

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:

Example: Configuring Supported ATM Interface Types

The following example shows how to configure main ATM interface:

```
enable
configure terminal
 interface atm 0/0/0
 no shutdown
```

Example Creating a PVC

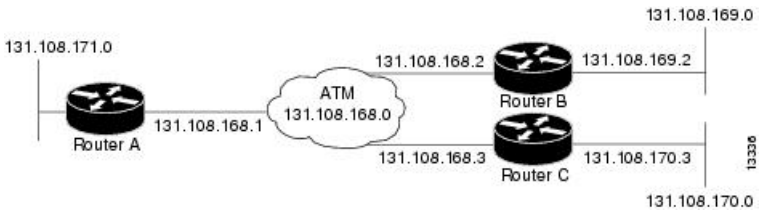
The following example shows how to create a PVC on an ATM main interface with AAL5 encapsulation configured and a VBR-NRT QOS specified.

```
interface 0/5/0.1/1/1/1 point-to-point
 pvc 1/40
 encapsulation aal5
 vbr-nrt 1000 500 50
 exit
```

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 1: Fully Meshed ATM Configuration Example



Router A

```
ip routing
!
interface atm 0/5/0.1/1/1/1
 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 0/5/0.1/1/1/1.1
 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 0/5/0.1/1/1/1.1
 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
```

PVC on a Point-to-Point Subinterface Configuration Example

```
interface ATM 0/0/0.9 point-to-point
mtu 4470
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 ATM 0/0/0.11 point-to-point
mtu 4470
bandwidth 7000
ip address 192.0.2.2 255.255.255.0
ip mtu 4470
pvc 100/50
cbr 7000
encapsulation aal5snap
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.[2]

`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 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.
`Router# show network-clocks synchronization`	Displays the clock signal sources and priorities that you established on the router.

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

Additional References

Related Documents

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

Standards

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

MIBs

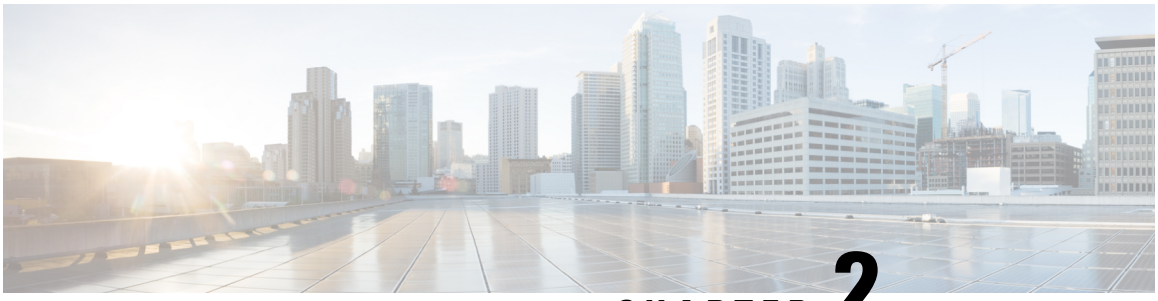
MIB	MIBs Link
• Cisco PVC trap MIB - CISCO-IETF-ATM2-PVCTRAP-MIB	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

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

Technical Assistance

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



CHAPTER 2

Information About AAL5 L3 Termination

When ATM feature is enabled, IMs can be deployed for ATM service that delivers high-performance interconnectivity, metro, and intra-point of presence (POP) applications between service POPs for IP/Multiprotocol Label Switching (IP/MPLS) transport (Figure 1).

AAL5 L3 termination can also be deployed at customer premises equipment (CPE) to provide the data component for the service provider networks. The ATM service allows service providers to effectively manage the bandwidth at the edges of the network while implementing value-added Layer 3 service.

Restrictions for AAL5 L3 Termination

- Main interface cannot be configured as layer 3 Asynchronous Transfer Mode (ATM) interface. Therefore you cannot create layer 3 Permanent Virtual Circuits (PVC) under main interface.
- Point-to-multipoint sub-interface is *not* supported.
- Quadrature Amplitude Modulation (QAM) is *not* supported on ATM L3 Interface.
- Operations, administration, and maintenance (OAM) is *not* supported on ATM L3 interface.
- You *cannot* swap from layer 2 transport ATM to layer 3 ATM interface without deleting ATM sub-interface.
- ATM layer 3 Permanent Virtual Path (PVP) is *not* supported.
- Inverse Multiplexing for ATM is *not* supported.
- ATM adaptation layer 5 Subnetwork Access Protocol SNAP (AAL5SNAP) protocol is supported. AAL0 is *not* supported.
- ATM L3 QoS is *not* supported.
- One port of an interface module (IM) supports only one interface configuration. For example, one OC-3 port can support one of the following configurations and not a combination of configurations:
  - CEM (CESoP or SAToP)
  - ATM
  - IMA
  - DS3

Different interface configurations can be configured on different ports of the same IM.

- Half-duplex VRF is *not* supported on this router.

Scale Supported for AAL5 L3 Termination

- IMs:
  - A900-IMA16D: The 16 port T1/E1 card supports a maximum of 350 virtual circuits (VCs per port and on the T1/E1).
  - A900-IMA40S: Only 900 VCs can be configured per OC3 IM. 500 VCs are supported in per port on the OC-3 IM.
- Up to 4000 layer 3 interfaces, including Serial interfaces, can be configured.

How to Configure AAL5 L3 Termination

Configuring Layer 3 Terminated VCs

A VC is a point-to-point connection between two ATM devices. A VC is established for each ATM end node with which the router communicates. The characteristics of the VC are established when it is created and include the following for the time-division multiplexing (TDM) IMs:

- AAL mode
- Encapsulation type logical link controller (LLC)/SNAP

PVCs configured on the router remain active until the circuit is removed from the configuration. All virtual circuit characteristics apply to PVCs. When a PVC is configured, all configuration options are passed to the TDM IMs. These PVCs are written to the nonvolatile RAM (NVRAM) as part of the configuration and are used when the Cisco IOS image is reloaded.

When you create a PVC, you create a virtual circuit descriptor (VCD) and attach it to the VPI and VCI. The VCD tells the card which VPI/VCI to use for a particular packet. The TDM IM card requires this feature to manage the packets for transmission. The number chosen for the VCD is independent of the virtual path identifier/virtual channel identifier (VPI/VCI) used.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. controller {**t1** | **e1**} *slot/bay/port*
4. **atm**
5. **interface atm** *interface-number* [*.subinterface-number* **point-to-point**]
6. **ip address** *ip-addressip-address-mask*
7. **pvc [name]** *vpi* | *vci*
8. **encapsulation aal5snap**
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	controller {**t1** | **e1**} *slot/bay/port* **Example:** `Router(config)# controller t1 0/1/0`	Specifies the controller that you want to configure. • **t1**—Specifies the T1 controller. • **e1**—Specifies the E1 controller. • *slot*—Chassis slot number, which is always 0. • *bay*—Card interface bay number in a slot. The range is from 0 to 5. • *port*—Port or interface number. The range is from 0 to 7 for Gigabit Ethernet.
Step 4	**atm** **Example:** `Router(config-controller)# atm`	Provisions an interface to function with ATM capabilities.
Step 5	**interface atm** *interface-number* [*.subinterface-number* **point-to-point**] **Example:** OC-3 interface `Router(config-controller)# interface atm0/1/0.10 point-to-point`	Specifies an ATM point-to-point sub-interface. • *interface-number* —Specifies a (physical) ATM interface. • *subinterface-number*—(Optional) Specifies a subinterface number for OC-3 interface. A dot (.) must be used to separate the interface-number from the subinterface-number (for example 2/0.1). • **point-to-point**—(Optional) Specifies point-to-point as the interface type for which a subinterface is to be created.
Step 6	**ip address** *ip-addressip-address-mask* **Example:** `Router(config-subif)# ip-address 192.168.0.1 255.255.255.0`	Configures an IP address on the sub-interface. • *ip-address*—Specifies a the IP address. • *ip-address-mask*— Specifies a the IP address mask.
Step 7	**pvc [name]** *vpi* / *vci*	Configures the PVC.

	Command or Action	Purpose
	Example: `Router(config-subif)# pvc 10/100`	• **name**—(Optional) The name of the PVC or map. The name can be up to 15 characters long. • *vpi*—ATM network virtual path identifier (VPI) for this PVC. The absence of the "/" and a vpi value defaults the vpi value to 0. A value that is out of range is interpreted as a string and is treated as the connection ID. • *vci*—ATM network virtual channel identifier (VCI) for this PVC. This value ranges from 0 to 1 less than the maximum value set for this interface by the atm vc-per-vp. command. Typically, lower values 0 to 31 are reserved for specific traffic (for example, F4 OAM, SVC signalling, ILMI, and so on) and should *not* be used. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has local significance only. A value that is out of range causes an unrecognized command error message. The arguments vpi and vci cannot both be set to 0; if one is 0, the other cannot be 0.
Step 8	**encapsulation aal5snap** **Example:** `Router(config-if-atm-vc)# encapsulation aal5snap`	Specifies AAL5 SNAP for ATM encapsulation on the PVC.
Step 9	**end** **Example:** `Router(config-if-atm-vc)# end`	Returns to privileged EXEC mode.

Configuring Layer2 QoS on the ATM Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. controller {**t1** | **e1***slot/bay/port*}
4. **atm**
5. **interface***interface-number* **atm** [.*subinterface-number* **point-to-point**]
6. **ip address ip-address ip-address-mask**
7. **pvc [name]** *vpi* | *vci*
8. Do one of the following:
   - **ubr***output-pcr* [*input-pcr*]

- **cbr***rate*
- **vbr-rt** *peak-rate average-rate burst*
- **vbr-nrt** *output-pcr output-scr output-maxburstsize*
- **ubr+***output-pcr output-mcr* [*input-pcr*] [*input-mcr*]

9. **encapsulation aal5snap**
10. **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	controller {**t1** | **e1***slot/bay/port*} **Example:** `Router(config)# controller t1 0/1/0`	Specifies the controller that you want to configure. • **t1**—Specifies the T1 controller. • **e1**—Specifies the E1 controller. • *slot*—Chassis slot number, which is always 0. • *bay*—Card interface bay number in a slot. The range is from 0 to 5. • *port*—Port or interface number. The range is from 0 to 7 for Gigabit Ethernet.
Step 4	**atm** **Example:** `Router(config-controller)# atm`	Provisions an interface to function with ATM capabilities.
Step 5	**interface***interface-number* **atm** [.*subinterface-number* **point-to-point**] **Example:** `Router(config-controller)# interface atm0/1/0.10 point-to-point`	Specifies an ATM point-to-point sub-interface. • *interface-number*—Specifies a (physical) ATM interface. • *subinterface-number*—(Optional) Specifies a subinterface number. A dot (.) must be used to separate the interface-number from the subinterface-number (for example 2/0.1). •

	Command or Action	Purpose
		• **point-to-point**—(Optional) Specifies point-to-point as the interface type for which a subinterface is to be created.
Step 6	**ip address ip-address ip-address-mask** **Example:** `Router(config-subif)# ip-address 192.168.0.1 255.255.255.0`	Configures an IP address on the sub-interface.
Step 7	**pvc [name]** *vpi* | *vci* **Example:** `Router(config-subif)# pvc 10/100`	Configures the PVC. • **name**—(Optional) The name of the PVC or map. The name can be up to 15 characters long. • *vpi*—ATM network virtual path identifier (VPI) for this PVC. The absence of the "/" and a vpi value defaults the vpi value to 0. A value that is out of range is interpreted as a string and is treated as the connection ID. • *vci*—ATM network virtual channel identifier (VCI) for this PVC. This value ranges from 0 to 1 less than the maximum value set for this interface by the atm vc-per-vp command. Typically, lower values 0 to 31 are reserved for specific traffic (for example, F4 OAM, SVC signalling, ILMI, and so on) and should not be used. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has local significance only. A value that is out of range causes an unrecognized command error message. The arguments vpi and vci cannot both be set to 0; if one is 0, the other cannot be 0.
Step 8	Do one of the following: • **ubr***output-pcr* [*input-pcr*] • **cbr***rate* • **vbr-rt** *peak-rate average-rate burst* • **vbr-nrt** *output-pcr output-scr output-maxburstsize* • **ubr+***output-pcr output-mcr* [*input-pcr*] [*input-mcr*] **Example:** `Router(config-subif)# ubr 100` **Example:**	• Configure unspecified bit rate (UBR) quality of service (QoS) and specify the output peak cell rate (PCR) for an ATM permanent virtual circuit (PVC), PVC range. • *output-pcr*—Output peak cell rate (PCR) in kilobytes per second (kbps). • *input-pcr*—(Optional for SVCs only) The input PCR in kbps. If this value is omitted, the value of input-pcrargument will equal the value of output-pcr argument.

	Command or Action	Purpose

	`Router(config-subif)# cbr 1000`
	Example:
	`Router(config-subif)# vbr-rt 1000 600 20`
	Example:
	`Router(config-subif)# vbr-rt 1500 1000 10`
	Example:
	`Router(config-subif)# ubr+ 1000 100`
		• Configure the constant bit rate (CBR) for the ATM circuit emulation service (CES) for an ATM permanent virtual circuit (PVC).
		  • *rate*—Constant bit rate (also known as the average cell rate) for ATM CES.
		• Configures the real-time variable bit rate (VBR) for VoATM voice connections.
		  • *peak-rate*—Peak information rate (PIR) for the voice connection, in kilobytes per second (kbps). If it does not exceed your carrier's line rate, set it to the line rate. Range is from 56 to 10000.
		  • *average-rate*—Average information rate (AIR) for the voice connection, in kbps.
		  • *burst*—Burst size, in number of cells.
		• Configures the variable bit rate-nonreal time (VBR-NRT) quality of service (QoS) for an ATM permanent virtual circuit (PVC).
		  • *output-pcr*—output PCR, in kilobytes per second (kbps).
		  • *output-scr*—Output SCR, in kbps.
		  • *output-maxburstsize*—The output maximum burst cell size, expressed in number of cells.
		• Configures unspecified bit rate (UBR) quality of service (QoS) for an ATM permanent virtual circuit (PVC).
		  • *output-pcr*—Output peak cell rate (PCR) in kbps.
		  • *output-mcr*—Output minimum guaranteed cell rate in kbps.
		  • *input-pcr*—(Optional for SVCs only) The input PCR in kbps.
		  • *input-mcr*—(Optional for SVCs only) The input minimum guaranteed cell rate in kbps.

Step 9	**encapsulation aal5snap** **Example:** `Router(config-if-atm-vc)# encapsulation aal5snap`	Specifies AAL5 SNAP for ATM encapsulation on the PVC.

	Command or Action	Purpose
Step 10	**end** **Example:** `Router(config-if-atm-vc)# end`	Returns to privileged EXEC mode.

Configuring Protocol IP Broadcast on ATM L3 Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. controller {**t1** | **e1**} *slot/bay/port*
4. **atm**
5. **interface** *interface-number* **atm** [.*subinterface-number* **point-to-point**]
6. **ip address***ip-address ip-address-mask*
7. **pvc** [*name*] *vpi*|*vci*
8. **protocol ip** *protocol-address* **broadcast**
9. **encapsulation aal5snap**
10. **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	controller {**t1**	**e1**} *slot/bay/port* **Example:** `Router(config)# controller t1 0/1/0`	Specifies the controller that you want to configure. • **t1**—Specifies the T1 controller. • **e1**—Specifies the E1 controller. • *slot*—Chassis slot number, which is always 0. • *bay*—Card interface bay number in a slot. The range is from 0 to 5. • *port*—Port or interface number. The range is from 0 to 7 for Gigabit Ethernet.

	Command or Action	Purpose
Step 4	**atm** **Example:** `Router(config-controller)# atm`	Provisions an interface to function with ATM capabilities.
Step 5	**interface** *interface-number* **atm** [.*subinterface-number* **point-to-point**] **Example:** `Router(config-controller)# interface atm 0/1/0.10 point-to-point`	Specifies an ATM point-to-point sub-interface. • *interface-number*—Specifies a (physical) ATM interface. • *subinterface-number*—(Optional) Specifies a subinterface number. A dot (.) must be used to separate the interface-number from the subinterface-number (for example 2/0.1). • • **point-to-point**—(Optional) Specifies point-to-point as the interface type for which a subinterface is to be created.
Step 6	**ip address***ip-address ip-address-mask* **Example:** `Router(config-subif)# ip-address 192.168.0.1 255.255.255.0`	Configures an IP address on the sub-interface.
Step 7	**pvc** [*name*] *vpi*|*vci* **Example:** `Router(config-subif)# pvc 10/100`	Configures the PVC. • **name**—(Optional) The name of the PVC or map. The name can be up to 15 characters long. • *vpi*—ATM network virtual path identifier (VPI) for this PVC. The absence of the "/" and a vpi value defaults the vpi value to 0. A value that is out of range is interpreted as a string and is treated as the connection ID. • *vci*—ATM network virtual channel identifier (VCI) for this PVC. This value ranges from 0 to 1 less than the maximum value set for this interface by the atm vc-per-vp command. Typically, lower values 0 to 31 are reserved for specific traffic (for example, F4 OAM, SVC signalling, ILMI, and so on) and should not be used. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has local significance only. A value that is out of range causes an "unrecognized command" error message. The arguments vpi and vci cannot both be set to 0; if one is 0, the other cannot be 0.

	Command or Action	Purpose
Step 8	**protocol ip** *protocol-address* **broadcast** **Example:** `Router(config-subif)# protocol ip 192.168.0.2 broadcast`	Configures a static map for an ATM permanent virtual circuit (PVC), switched virtual circuit (SVC), or virtual circuit (VC) class. • *protocol-address*—remote end circuit IP being mapped to same PVC.
Step 9	**encapsulation aal5snap** **Example:** `Router(config-if-atm-vc)# encapsulation aal5snap`	Specifies AAL5 SNAP for ATM encapsulation on the PVC.
Step 10	**end** **Example:** `Router(config-if-atm-vc)# end`	Returns to privileged EXEC mode.

Configuring VRF Enabled ATM L3 Interface

Virtual Routing and Forwarding (VRF) is an IP technology that allows multiple instances of a routing table to exist in the same router at the same time. VRF can be enabled on ATM L3 interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. controller {**t1** | **e1**} *slot/bay/port*
4. **atm**
5. **interface** *interface-number***atm** [.*subinterface-number* **point-to-point**]
6. **ip vrf forwarding** *vrf-name*
7. **ip address***ip-address ip-address-mask*
8. **no atm enable-ilmi-trap**
9. **pvc [name]***vpi* | *vci*
10. **encapsulation aal5snap**
11. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	controller {**t1** | **e1**} *slot/bay/port* **Example:** `Router(config)# controller t1 0/1/0`	Specifies the controller that you want to configure. • **t1**—Specifies the T1 controller. • **e1**—Specifies the E1 controller. • *slot*—Chassis slot number, which is always 0. • *bay*—Card interface bay number in a slot. The range is from 0 to 5. • *port*—Port or interface number. The range is from 0 to 7 for Gigabit Ethernet.
Step 4	**atm** **Example:** `Router(config-controller)# atm`	Provisions an interface to function with ATM capabilities.
Step 5	**interface** *interface-number***atm** [.*subinterface-number* **point-to-point**] **Example:** `Router(config-controller)# interface atm0/1/0.10 point-to-point`	Specifies an ATM point-to-point sub-interface. • *interface-number*—Specifies a (physical) ATM interface. • *subinterface-number*—(Optional) Specifies a subinterface number. A dot (.) must be used to separate the interface-number from the subinterface-number (for example 2/0.1). • • **point-to-point**—(Optional) Specifies point-to-point as the interface type for which a subinterface is to be created.
Step 6	**ip vrf forwarding** *vrf-name* **Example:** `Router(config-controller)# ip vrf forwarding VPN_A`	Associates a Virtual Private Network (VPN) routing and forwarding (VRF) instance with an interface or subinterface • *vrf-name*—Associates the interface with the specified VRF.
Step 7	**ip address***ip-address ip-address-mask* **Example:** `Router(config-subif)# ip-address 192.168.0.1 255.255.255.0`	Configures an IP address on the sub-interface.

	Command or Action	Purpose
Step 8	**no atm enable-ilmi-trap** **Example:** `Router(config-subif)# no atm enable-ilmi-trap`	Disables the ILMI traps.
Step 9	**pvc [name]***vpi* | *vci* **Example:** `Router(config-subif)# pvc 10/100`	Configures the PVC. • **name**—(Optional) The name of the PVC or map. The name can be up to 15 characters long. • *vpi*—ATM network virtual path identifier (VPI) for this PVC. The absence of the "/" and a vpi value defaults the vpi value to 0. A value that is out of range is interpreted as a string and is treated as the connection ID. • *vci*—ATM network virtual channel identifier (VCI) for this PVC. This value ranges from 0 to 1 less than the maximum value set for this interface by the atm vc-per-vp command. Typically, lower values 0 to 31 are reserved for specific traffic (for example, F4 OAM, SVC signalling, ILMI, and so on) and should not be used. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has local significance only. A value that is out of range causes an unrecognized command error message. The arguments vpi and vci cannot both be set to 0; if one is 0, the other cannot be 0.
Step 10	**encapsulation aal5snap** **Example:** `Router(config-if-atm-vc)# encapsulation aal5snap`	Specifies AAL5 SNAP for ATM encapsulation on the PVC.
Step 11	**end** **Example:** `Router(config-if-atm-vc)# end`	Returns to privileged EXEC mode.

Configuration Examples for AAL5 L3 Termination

Example: Configuring SONET mode on OC-3 IM

```
Router(config)# controller sonet 3/1/0
Router(config-controller)# framing sonet
Router(config-controller)# sts-1 1
Router(config-ctrlr-sts)# vtg 1 t1 1 atm
Router(config)# interface ATM3/1/0.1/1/1.1 point-to-point
Router(config-subif)# ip address 192.0.1.5 255.255.255.0
Router(config-subif)# pvc 10/100
Router(cfg-if-atm-vc)# encapsulation aal5snap
Router(cfg-if-atm-vc)#
```

Example: Configuring SDH mode on OC-3 IM

```
Router(config)# controller sdh 0/1/0
Router(config-controller)# framing sdh
Router(config-controller)# aug mapping au-4
Router(config-controller)# au-4 1 tug-3 1
Router(config-ctrlr-tug3)# tug-2 1 e1 1 atm
Router(config)# interface ATM0/0/0.1/1/1/1.2 point-to-point
Router(config-subif)# ip address 192.0.2.3 255.255.255.0
Router(config-subif)# pvc 10/100
Router(cfg-if-atm-vc)# encapsulation aal5snap
Router(cfg-if-atm-vc)#
```

Example: Configuring Layer2 QoS

```
interface ATM0/3/2.1/1/1.101 point-to-point

pvc 20/101
  ubr 100
  encapsulation aal5snap
   !
End
interface ATM1/1/0.1/1/1.102 point-to-point
ip address 192.0.2.1 255.255.255.0

pvc 20/102
  cbr 1000
  encapsulation aal5snap
interface ATM1/1/0.1/1/1.102 point-to-point
ip address 192.0.2.1 255.255.255.0

pvc 20/102
  vbr-rt 1000 600 20
  encapsulation aal5snap
interface ATM1/1/0.1/1/1.102 point-to-point
ip address 192.0.2.1 255.255.255.0

pvc 20/102
  vbr-nrt 1500 1000 10
  encapsulation aal5snap
```

```
interface ATM1/1/0.1/1/1.102 point-to-point
ip address 192.0.2.1 255.255.255.0

pvc 20/102
  ubr+ 1000 100
  encapsulation aal5snap
```

Example: Configuring Protocol IP Broadcast in the Layer3 ATM Interface

```
interface ATM0/3/2.1/1/1.200 point-to-point
ip address 192.168.1.2 255.255.255.0
no atm enable-ilmi-trap
pvc 200/10
  protocol ip 192.168.1.2 broadcast ----------(remote end IP)
!
End
```

Example: Configuring VRF Enabled ATM L3 Interface

```
ip vrf VPN_A
rd 100:1
route-target export 100:1
route-target import 100:1
interface ATM0/3/2.1/1/1.200 point-to-point
ip vrf forwarding VPN_A
ip address 10.0.0.1 255.255.255.0
no atm enable-ilmi-trap
pvc 200/10
 !
End
Router# ping vrf VPN_A 11.12.13.14 -------(Remote end IP)
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:
!!!!!
```

Verifying AAL5 L3 Termination

- Use the **show atm pvc** command to display all ATM PVCs and traffic information:

  OC-3 Interface

```
Router# show atm pvc
Keys:  C = ATM0/4/0.1/1/1, B = ATM0/4/2.1/1/1,
           VCD /                                          Peak Av/Min Burst
Interface  Name         VPI   VCI Type    Encaps     SC     Kbps   Kbps Cells St
C.1        1            180   181 PVC     SNAP       UBR    1536              UP
B.1        1            180   181 PVC     AAL5       UBR    1536              UP
```

- Use the **show interfaces ATM** command to display information about the ATM interface:

  OC-3 Interface

```
Router# show interfaces ATM0/4/0.1/1/1.1
ATM0/4/0.1/1/1.1 is up, line protocol is up
  Hardware is A900-IMA4OS, address is 0022.bddd.d4c0 (bia 0022.bddd.d4c0)
```

```
Internet address is 192.168.0.1/24
MTU 4470 bytes, BW 1536 Kbit/sec, DLY 100 usec,
   reliability 255/255, txload 129/255, rxload 129/255
Encapsulation ATM
Keepalive not supported
   13551261 packets input, 731768094 bytes
   13551227 packets output, 731766258 bytes
   0 OAM cells input, 0 OAM cells output
AAL5 CRC errors : 0
AAL5 SAR Timeouts : 0
AAL5 Oversized SDUs : 0
AAL5 length violation : 0
Last clearing of "show interface" counters never
```

- Use the **show atm pvc interface atm interface-number** command to display all PVCs on the specified interface or sub-interface:

```
Router# show atm pvc interface atm 0/4/0.1/1/1.1
Key:  C = ATM0/4/0.1/1/1
           VCD /                                          Peak Av/Min Burst
Interface  Name         VPI   VCI Type    Encaps     SC    Kbps   Kbps Cells St
C.1        1            180   181 PVC     SNAP       UBR   1536              UP
```

- Use the **show atm map** command to display the protocol IP broadcast on the ATM interface:

```
Router# show atm map
Map list ATM0/3/2.1/1/1.200pvcC8000A : PERMANENT
ip 191.168.1.14 maps to VC 5, VPI 200, VCI 10, ATM0/3/2.1/1/1.200
        , broadcast
```

Additional References

Related Documents

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

MIBs

MIB	MIBs Link
• Cisco PVC trap MIB - CISCO-IETF-ATM2-PVCTRAP-MIB	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