Lucent Technologies
Bell Labs Innovations

APX 8000™/MAX TNT®

ATM Configuration Guide

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About This Guide

What is in this guide

This guide describes how to configure Asynchronous Transfer Mode (ATM) operations on an APX 8000™ or MAX TNT® unit for which you have obtained the Lucent Technologies ATM software license. To use this guide, you must have already installed the unit and connected a workstation to the controller's serial port. If you have not already finished those tasks, see the unit's hardware installation guide.

Note: This manual describes the full set of features for APX 8000 and MAX TNT units running True Access™ Operating System (TAOS) software version 9.0 or later. Some features might not be available with earlier versions or specialty loads of the software.

This manual hereafter refers to your product as a *TAOS unit*.

Warning: Before installing your TAOS unit, be sure to read the safety instructions in the *Edge Access Safety and Compliance Guide*. For information specific to your unit, see the "Safety-Related Electrical, Physical, and Environmental Information" appendix in your unit's hardware installation guide.

Documentation conventions

Following are all the special characters and typographical conventions used in this manual:

Convention	Meaning
`Monospace text`	Represents text that appears on your computer's screen, or that could appear on your computer's screen.
`Boldface monospace text`	Represents characters that you enter exactly as shown (unless the characters are also in ***`italics`***—see *Italics*, below). If you could enter the characters but are not specifically instructed to, they do not appear in boldface.
Italics	Represent variable information. Do not enter the words themselves in the command. Enter the information they represent. In ordinary text, italics are used for titles of publications, for some terms that would otherwise be in quotation marks, and to show emphasis.
[ ]	Square brackets indicate an optional argument you might add to a command. To include such an argument, type only the information inside the brackets. Do not type the brackets unless they appear in boldface.
|	Separates command choices that are mutually exclusive.

Convention	Meaning
>	Points to the next level in the path to a parameter or menu item. The item that follows the angle bracket is one of the options that appear when you select the item that precedes the angle bracket.
Key1-Key2	Represents a combination keystroke. To enter a combination keystroke, press the first key and hold it down while you press one or more other keys. Release all the keys at the same time. (For example, Ctrl-H means hold down the Control key and press the H key.)
Press Enter	Means press the Enter, or Return, key or its equivalent on your computer.
Note:	Introduces important additional information.
Caution:	Warns that a failure to follow the recommended procedure could result in loss of data or damage to equipment.
Warning:	Warns that a failure to take appropriate safety precautions could result in physical injury.
Warning:	Warns of danger of electric shock.

Documentation set

The APX 8000/MAX TNT documentation set consists of the following manuals.

- **Read me first:**
  - *Edge Access Safety and Compliance Guide*
    Contains important safety instructions and country-specific compliance information that you must read before installing a TAOS unit.
  - *TAOS Command-Line Interface Guide*
    Introduces the TAOS command-line environment and shows how to use the command-line interface effectively. This manual describes keyboard shortcuts and introduces commands, security levels, profile structure, and parameter types.
- **Installation and basic configuration:**
  - *APX 8000 Hardware Installation Guide*
    Shows how to install APX 8000 hardware and includes APX 8000 technical specifications.
  - *MAX TNT Hardware Installation Guide*
    Shows how to install MAX TNT hardware and includes technical specifications for these units.
  - *APX 8000/MAX TNT Physical Interface Configuration Guide*
    Shows how to configure the cards installed in a TAOS unit and their line attributes for such functions as framing, signaling, and channel usage. It also describes how calls are routed through the system and includes information about configuring the unit in a

Signaling System 7 (SS7) environment. This guide explains shelf controller redundancy for an APX 8000 unit.

- **Configuration:**
  - *APX 8000/MAX TNT ATM Configuration Guide (this manual)*
    Describes how to configure Asynchronous Transfer Mode (ATM) operations on a TAOS unit. This guide explains how to configure physical layer attributes and how to create permanent virtual circuit (PVC) and switched virtual circuit (SVC) ATM interfaces. It includes information about ATM direct and ATM-Frame Relay circuits.
  - *APX 8000/MAX TNT Frame Relay Configuration Guide*
    Describes how to configure Frame Relay operations on a TAOS unit. This guide explains physical layer configuration and restrictions and how to create permanent virtual circuit (PVC) and switched virtual circuit (SVC) interfaces. It includes information about Multilink Frame Relay (MFR) and link management, as well as Frame Relay and Frame Relay direct circuits.
  - *APX 8000/MAX TNT WAN, Routing, and Tunneling Configuration Guide*
    Shows how to configure LAN and WAN routing for analog and digital dial-in connections on a TAOS unit. This guide includes information about IP routing, Open Shortest Path First (OSPF) routing, Internet Group Management Protocol (IGMP) routing, multiprotocol routers, Virtual Routers (VRouters), and tunneling protocols.
  - *MultiVoice™ for APX 8000 and MAX TNT Configuration Guide*
    Shows how to configure the MultiVoice application to run on an APX 8000 or MAX TNT unit in both Signaling System 7 (SS7) and H.323 Voice over IP (VoIP) configurations.
- **RADIUS:** *TAOS RADIUS Guide and Reference*
  Describes how to set up a TAOS unit to use the Remote Authentication Dial-In User Service (RADIUS) server and contains a complete reference to RADIUS attributes.
- **Administration and troubleshooting:** *APX 8000/MAX TNT Administration Guide*
  Describes how to administer a TAOS unit, including how to monitor the system and cards, troubleshoot the unit, and configure the unit to use the Simple Network Management Protocol (SNMP).
- **Reference:**
  - *APX 8000/MAX TNT Reference*
    An alphabetic reference to all commands, profiles, and parameters supported on TAOS units.
  - *TAOS Glossary*
    Defines terms used in documentation for TAOS units.

Getting Started

1

Overview of ATM operations 1-1
Overview of ATM configuration 1-2
ATM management features 1-3
Where to go next 1-4

Overview of ATM operations

To configure ATM, you first configure the physical line used to connect to the ATM network. You can then define virtual circuits to be fowarded across the interface to another ATM device.

Physical interfaces that support ATM

An *interface* is a point of ingress (entrance) to or egress (exit) from the system. At the time of this writing, TAOS units support ATM operations on slot cards with the physical interface types shown in Table 1-1.

Table 1-1. Slot cards that support ATM

Slot card	APX 8000	MAX TNT
DS3-ATM (TNT-SL-UDS3-A)		√
DS3-ATM2 (APX8-SL-UDS3-A2-C)	√	√
E3-ATM (APX8-SL-UE3-A-C)	√	√
OC3-ATM (TNT-SL-OC3-F)	√	√

Both the first-generation DS3-ATM slot card (TNT-SL-UDS3-A) and the second-generation DS3-ATM2 slot card (APX8-SL-UDS3-A2-C) provide one unchannelized 44.736Mbps port. The first-generation card is not available for the APX 8000 platform.

The E3-ATM slot card (APX8-SL-UE3-A-C) supports one unchannelized 34.368Mbps interface.

The OC3-ATM slot card (TNT-SL-OC3-F) provides one unchannelized 155Mbps port.

ATM virtual circuits

An *ATM virtual circuit* is the logical configuration that enables ATM data to be sent and received on a physical port. TAOS units support both permanent virtual circuits (PVCs) and switched virtual circuits (SVCs).

A PVC is a leased line connection that is always available.

An SVC is a point-to-point switched connection, which provides a lower-cost, usage-based alternative to ATM PVCs. Like other types of switched connections, SVCs can be initiated by a dial-in or a dial-out call, which can be made by the system on the basis of IP routing.

The TAOS unit can forward traffic onto a virtual circuit on the basis of IP routing, an ATM direct configuration, or an ATM-Frame Relay circuit configuration.

IP routing over ATM

For IP routing on an ATM interface, the system encapsulates the data as specified in RFC 1483, *Multiprotocol Encapsulation over ATM Adaptation Layer 5* (ATM-AAL5-CPCS-PDU encapsulation). With this type of connection, the TAOS unit uses ATM as a transport to an IP destination.

ATM direct

For ATM direct configurations, the system receives data from Point-to-Point Protocol (PPP) dial-in connections and redirects the data streams onto a specified ATM interface. For the system to route packets back from the ATM interface to the proper PPP dial-in interface, it must use IP routing.

ATM-Frame Relay circuits

TAOS units support ATM-Frame Relay circuits for exchanging traffic between an ATM PVC and a Frame Relay PVC, as defined in *FRF.8 Frame Relay ATM/PVC Service Interworking Implementation Agreement*. An ATM-Frame Relay circuit can be configured in translation mode or transparent mode.

Standard ATM-Frame Relay circuits have two end points. With virtual channel trunking, an ATM-Frame Relay circuit can have more than two end points, as long as multiple end points are designated as host links and only one end point (typically the ATM interface) is designated as a trunk link.

Overview of ATM configuration

Before you configure a TAOS unit for ATM, Lucent recommends creating a diagram that illustrates how the ATM access lines will interoperate with your current network configuration. Creating a comprehensive network diagram helps prevent problems during installation and configuration, and can help in troubleshooting any problems later.

After you have installed the required slot cards, you must complete the following configuration tasks:

1 Configure the physical ATM interface on each installed slot card.

For each installed card, the system creates an appropriate line profile. For example, the following command opens the line profile for a DS3-ATM card in slot 2:

```
admin> read ds3-atm { 1 2 1 }
DS3-ATM/{ shelf-1 slot-2 1 } read
```

2 Configure a virtual circuit to the end point that is reachable across the configured physical interface.

You can configure a permanent or switched virtual circuit. A PVC uses the dedicated bandwidth of the port. SVCs are established by ATM signaling only when the connection is needed.

3 Configure connections whose data streams will be directed onto the ATM virtual circuit for transport across the ATM network.

The connections can be directed to the ATM interface via IP routing or ATM direct, or as part of an ATM-Frame Relay circuit.

Note: TAOS configuration settings are stored in onboard flash memory, and must be backed up to a TFTP host whenever changes are made. For details about backing up and restoring the TAOS configuration, see the administration guide for your unit.

ATM management features

To enable you to configure the system and monitor its activity, TAOS units support profiles, commands, and status windows in the command-line interface. TAOS units also support Simple Network Management Protocol (SNMP) management, RADIUS profiles, and the ability to upload (back up) and download software and configuration files via the Trivial File Transfer Protocol (TFTP) or a serial connection.

For an introduction to the command-line interface and its shortcuts, see the *TAOS Command-Line Interface Guide*.

ATM-related commands

TAOS units provide the permission levels shown in Table 1-2 to control the management and configuration functions that are accessible in the command-line interface. For information about User profiles and other management features, see the administration guide for your unit. For details about the commands, see the *APX 8000/MAX TNT Reference*.

Table 1-2. ATM-related commands

Command	Permission level	Description
`AtmLines`	`( system )`	Displays ATM line information.
`atmsvcroute`	`( system )`	Displays an ATM SVC call-routing table.
`oamloop`	`( diagnostic )`	Sends ATM operation and maintenance (OAM) cells on an ATM interface. OAM F5 is supported on the first-generation ATM slot cards (TNT-SL-UDS3-A and TNT-SL-OC3-F).

SNMP support

In addition to configuring and monitoring ATM by means of the command-line interface, you can configure and manage the unit by using an SNMP management station such as the NavisAccess™ product. For information about using SNMP with TAOS units, see the *APX 8000/MAX TNT Administration Guide*.

RADIUS support

You can use RADIUS to store user profiles for ATM circuits and terminating connections. To use RADIUS, you must also configure the TAOS unit to communicate with the RADIUS server. In addition, the RADIUS server must be compliant with vendor-specific attributes (VSAs), as defined in RFC 2138, and the TAOS unit must be configured in VSA compatibility mode. Following are the relevant settings:

```
[in EXTERNAL-AUTH]
auth-type = radius

[in EXTERNAL-AUTH:rad-auth-client]
auth-radius-compat = vendor-specific
```

For details, see the *TAOS RADIUS Guide and Reference*.

Where to go next

When you have planned your network, you are ready to configure the TAOS unit. You can perform configuration tasks in any order you want. Table 1-3 shows where to look for the information you need.

Table 1-3. Where to go next

Task	Where to go for information
Install required slot cards	The hardware installation guide for your unit
Test lines and ports	*APX 8000/MAX TNT Administration Guide*
Configure ATM interfaces	Chapter 2, “Physical Interface Considerations”
Configure an ATM PVC	“Configuring ATM PVCs” on page 3-1
Configure an ATM SVC	“Configuring ATM SVCs” on page 3-5
Set up ATM direct	“Configuring ATM Direct” on page 4-1
Configure ATM-Frame Relay circuits	“ATM-Frame Relay translation-mode circuits” on page 5-1
Configure ATM virtual channel trunking	“ATM-Frame Relay virtual channel trunking” on page 5-8
Check details about parameters and commands	*APX 8000/MAX TNT Reference*

Table 1-3. Where to go next (continued)

Task	Where to go for information
Use SNMP with the unit	*APX 8000/MAX TNT Administration Guide*
Configure login permissions	
Back up the system configuration	

Physical Interface Considerations

2

DS3-ATM and DS3-ATM2 interfaces 2-1
E3-ATM interfaces. 2-2
OC3-ATM interfaces 2-2
Configurable VPI-VCI ranges 2-3
Traffic shaping on second-generation slot cards 2-4
Bit-rate control on first-generation slot cards 2-7

At the physical ATM interface layer, TAOS units support DS3, E3, and OC3 slot cards. The type of physical interface you choose determines the maximum speed of a virtual circuit. You can configure up to 15 traffic shapers on an interface. For details about physical interface configuration, see the *APX 8000/MAX TNT Physical Interface Configuration Guide*.

TAOS first-generation and second-generation ATM slot cards provide different levels of support for traffic-shaper settings. The first-generation slot cards include DS3-ATM (TNT-SL-UDS3-A) and OC3-ATM (TNT-SL-OC3-F). Second-generation ATM slot cards currently include DS3-ATM2 (APX8-SL-UDS3-A2-C) and E3-ATM (APX8-SL-UE3-A-C).

DS3-ATM and DS3-ATM2 interfaces

DS3-ATM and DS3-ATM2 slot cards support one 44.736Mbps interface for connecting to an ATM switch. (The first-generation DS3-ATM card, model number TNT-SL-UDS3, is not supported on APX 8000 systems.) At a minimum, you must enable the line and specify a nailed group. TAOS uses the nailed group to route traffic to the interface.

You can also specify C-bit Physical Layer Convergence Protocol (PLCP) or C-bit ATM direct mapping (ADM) framing format. The same framing format must be used at both ends of the link.

Note: The effective line rate takes into account the framing overhead and the ATM cell header. The maximum effective line rate is 36.864Mbps for C-bit-PLCP framing and 40.038Mbps for C-bit-ADM framing.

For example, the following set of commands enables a DS3-ATM interface in slot 12 and assigns the nailed-group number 111:

```
admin> read ds3-atm {1 12 1}
DS3-ATM/{ shelf-1 12 1 } read

admin> set enabled = yes
```

```
admin> set line-config nailed-group = 111

admin> write
DS3-ATM/{ shelf-1 12 1 } written
```

This configuration uses the default framing, C-bit-PLCP. For details about physical interface settings for these slot cards, see the *APX 8000/MAX TNT Physical Interface Configuration Guide*.

E3-ATM interfaces

An E3-ATM slot card supports one 34.368Mbps interface for connecting to an ATM switch. At a minimum, you must enable the line and specify a nailed group. TAOS units use the nailed group to route traffic to the interface.

For example, the following set of commands enables an E3-ATM interface in slot 12 and assigns the nailed-group number 222:

```
admin> read e3-atm {1 12 1}
E3-ATM/{ shelf-1 12 1 } read

admin> set enabled = yes

admin> set line-config nailed-group = 222

admin> write
E3-ATM/{ shelf-1 12 1 } written
```

This configuration uses the default framing, G832-ADM. For details about physical interface settings for E3-ATM interfaces, see the *APX 8000/MAX TNT Physical Interface Configuration Guide*. For more information about framing and effective line rate, see “Framing and effective line rates” on page 2-7.

OC3-ATM interfaces

An OC3-ATM slot card supports one 155.52Mbps interface for connecting to one ATM switch. At a minimum, you must enable the line and specify a nailed group. TAOS units use the nailed group to direct traffic to the interface.

For example, the following set of commands enables an OC3-ATM interface in slot 7 and assigns the nailed-group number 333 to the interface:

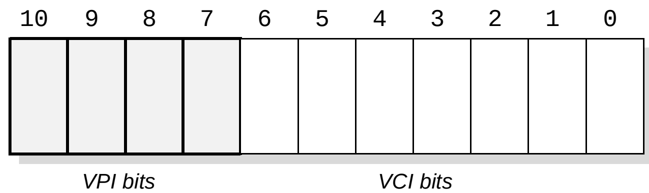
```
admin> read oc3-atm {1 7 1}
OC3-ATM/{ shelf-1 slot-7 1 } read

admin> set enabled = yes

admin> set line-config nailed-group = 333

admin> write
OC3-ATM/{ shelf-1 slot-7 1 } written
```

This configuration uses the default framing, synchronous digital hierarchy (SDH). For details about physical interface settings for OC3-ATM interfaces, see the *APX 8000/MAX TNT Physical Interface Configuration Guide*.

Configurable VPI-VCI ranges

The segmentation and reassembly (SAR) unit on a DS3-ATM, DS3-ATM2, E3-ATM, or OC3-ATM slot card supports a 16-bit virtual path identifier and virtual channel identifier (VPI-VCI) range. Figure 2-1 shows the 16-bit range configured with 4 bits for the VPI and 12 bits for the VCI (the default setting).

Figure 2-1. 16-bit VPI-VCI range



You can select the best combination of VPI and VCI bit sizes to fit the network provider's list of supported VPI-VCI pairs. The new values take effect as soon as you write the profile.

Overview of a port's VPI-VCI range settings

The `vpi-vci-range` parameter specifies the range of values for the VPI-VCI pair. The following examples show the default setting:

```
[in DS3-ATM/{ shelf-1 slot-3 1 }:line-config]
vpi-vci-range = 0-15/32-4095

[in E3-ATM/{ shelf-1 slot-7 1 }:line-config]
vpi-vci-range = 0-15/32-4095

[in OC3-ATM/{ shelf-1 slot-1 1 }:line-config]
vpi-vci-range = 0-15/32-4095
```

Parameter	Specifies
VPI-VCI-Range	Range of values in the virtual path identifier and virtual channel identifier (VPI-VCI) pair. The default setting of `0-15/32-4095` is the range of values that can be represented in a 4-bit VPI and 12-bit VCI. This setting is compatible with earlier releases. Following are the possible ranges and their relevant bit sizes:

Range	# Of VPI bits	# Of VCI bits
0-1/32-32767	1	15
0-3/32-16383	2	14
0-7/32-8191	3	13
0-15/32-4095	4	12
0-31/32-2047	5	11
0-63/32-1023	6	10
0-127/32-511	7	9
0-255/32-255	8	8

Example of setting a VPI-VCI range

The following commands configure an OC3-ATM interface in slot 12 to support VPI and VCI assignments of 8 bits each:

```
admin> read oc3-atm {1 12 1}
OC3-ATM/{ shelf-1 slot-12 1 } read

admin> set line-config vpi-vci-range = 0-255/32-255

admin> write
OC3-ATM/{ shelf-1 slot-12 1 } written
```

Traffic shaping on second-generation slot cards

The information in this section applies only to second-generation ATM slot cards, which currently include DS3-ATM2 (APX8-SL-UDS3-A2-C) and E3-ATM (APX8-SL-UE3-A-C). For information about using traffic-shaping settings on the first-generation slot cards, see “Bit-rate control on first-generation slot cards” on page 2-7.

A TAOS unit with DS3-ATM2 or E3-ATM slot cards installed supports the following ATM service categories:

- Constant bit rate (CBR)
- Variable bit rate-non-real-time (VBR-NRT)
- Unspecified bit rate (UBR)

CBR is used for applications that do not tolerate delay (for example, voice or video transmission). It guarantees that a static amount of bandwidth—the maximum effective bit rate—is always available to the circuit. The source system can send cells at or below that bit rate without compromising the quality of service.

VBR-NRT is used for applications such as transaction processing, which can tolerate delay but not cell loss. The bandwidth must remain within the boundaries of the maximum effective bit rate, the maximum sustainable bit rate, and the maximum burst size.

UBR is the lowest level of service. In effect, it makes no service or bandwidth guarantees and does not enforce traffic management. UBR is used for applications such as telecommuting or background data transfer, which can tolerate delay.

For a detailed definition of the ATM service categories, see the *ATM Forum Traffic Management Specification Version 4.0*.

Overview of traffic-shaping settings

Each ATM interface supports up to 15 traffic shapers that define characteristics for different types of traffic. For example, voice traffic requires a constant amount of bandwidth and cannot tolerate delays, whereas file transfer can tolerate delay and variable bandwidth. Once you have specified the traffic shapers you need, you can apply a shaper to any number of virtual circuits.

Note: TAOS slot cards do not support “on the fly” traffic shaper configuration. If you modify a traffic shaper after it has been applied to virtual circuits, all virtual circuits must be restarted to use the new values.

Following are the parameters (shown with default values) that define traffic shaping on DS3-ATM2 and E3-ATM slot cards:

```
[in DS3-ATM/{ any-shelf any-slot 0 }:line-config:traffic-shapers[1]]
enabled = no
```

```
bit-rate = 1000
peak-rate = 1000
max-burst-size = 2
aggregate = no
priority = 0

[in E3-ATM/{ any-shelf any-slot 0 }:line-config:traffic-shapers[1]]
enabled = no
bit-rate = 1000
peak-rate = 1000
max-burst-size = 2
aggregate = no
priority = 0

[in CONNECTION/"":session-options]
traffic-shaper = 16
```

Parameter	**Specifies**
Enabled	Enable/disable the shaper for use.
Bit-Rate	Maximum sustainable effective bit rate in kilobits per second. The default is 1000 (1Mbps). This setting applies only to VBR traffic. For more information about this setting, see "Framing and effective line rates" on page 2-7.
Peak-Rate	Maximum effective bit rate allowed, in kilobits per second. The default is 1000 (1Mbps). For CBR traffic, this setting specifies the static bit rate. For VBR traffic, it is the upper boundary of the variable bit rate. For more information about this setting, see "Framing and effective line rates" on page 2-7.
Max-Burst-Size	Maximum burst size (MBS), which is the maximum number of cells that can be transmitted at the specified peak rate before the TAOS unit determines that the virtual circuit is exceeding the defined characteristics. The default is `2`. The valid range is from 2 through 255. This setting applies only to VBR traffic.
Aggregate	*Not supported on E3-ATM and DS3-ATM2 cards.* If a traffic shaper with this parameter set to `yes` is applied to more than one virtual circuit, each of the virtual circuits is allowed the full bandwidth defined in the shaper. For example, if the shaper specifies CBR service and a peak rate of 10000, and two virtual circuits apply the shaper, each circuit is allowed 10Mbps of bandwidth, for a total of 20Mbps. **Note:** TAOS does not verify that the aggregate rates of the multiple virtual circuits do not exceed the effective line rate.
Priority	ATM service category. The default value, 0 (zero), specifies CBR service. Other supported values are 1, for VBR-NRT service, and 2, for UBR service.
Traffic-Shaper	Number of a defined traffic shaper to apply to the virtual circuit. The default is shaper `16`, which is an internal shaper that is not configurable. Traffic shaper 16 specifies no bandwidth limitation.

Transmit resource sharing

The E3-ATM and DS3-ATM2 transmit buffers are separated into eight pools. The first seven pools are dedicated to traffic shapers 1 through 7. The remaining pool is shared among the remaining traffic shapers (shapers 8 through 15). When multiple virtual circuits share the same pool, the circuits compete for pool resources. This is an important point to remember when assigning a traffic shaper to multiple virtual circuits.

Note: A special pool is used for Operation, Administration, and Maintenance (OAM) cell traffic to ensure that OAM cells are not lost because of congestion. OAM cells are handled with priority 0.

Using traffic shapers 1 through 7

The first seven traffic shapers each have a dedicated pool. When you apply a traffic shaper from 1 through 7 to two virtual circuits, each virtual circuit applies the same settings and calculates the same transmit bandwidth limitation. For example, suppose traffic shaper 1 has the following settings:

```
[in DS3-ATM/{ shelf-1 trunk-module-1 1 }:line-config:traffic-shapers[1]]
enabled = yes
bit-rate = 1000
peak-rate = 15000
max-burst-size = 2
aggregate = no
priority = 0
```

And suppose that this traffic shaper is applied to two virtual circuits, as follows:

```
admin> read connection atmvc-1
CONNECTION/atmvc-1 read

admin> set session-options traffic-shaper = 1

admin> write
CONNECTION/atmvc-1 written

admin> read connection atmvc-2
CONNECTION/atmvc-1 read

admin> set session-options traffic-shaper = 1

admin> write
CONNECTION/atmvc-2 written
```

When traffic shaper 1 is applied to two virtual circuits, each virtual circuit has a maximum effective bit rate of 15Mbps. The bandwidth limitation works as expected when the traffic for each virtual circuit is below the bandwidth limit. However, if the traffic on one of the virtual circuits exceeds its bandwidth limit, that circuit can consume all the transmit buffers in the pool. This behavior deprives the other virtual circuit of transmit buffers and prevents it from reaching its bandwidth limit. The virtual circuit with the highest traffic has a statistically higher chance of obtaining pool resources. In the case where both virtual circuits exceed their limit by the same amount, they compete equally for resources, enabling each to attain its limit.

Using traffic shapers 8 through 15

When two virtual circuits are governed by different shapers using the common pool (for example, traffic shapers 8 and 9), the situation is further complicated by the fact that each virtual circuit can have a different bandwidth limit. For example, if traffic shaper 8 specifies 1Mbps and traffic shaper 9 specifies 7Mbps, the virtual circuits that use these shapers compete for the transmit buffers in the common pool used by traffic shapers 8 through 15.

Framing and effective line rates

TAOS checks that the `peak-rate` and `bit-rate` values of a specific shaper do not exceed the effective line rate. However, the aggregate rates of the virtual circuits using the shaper are not checked.

Traffic shapers are precise to within 4%.

Table 2-1 shows the effective line rates for DS3-ATM2 and E3-ATM slot cards with the supported framing formats. Effective line rate indicates the usable bandwidth after framing and ATM cell headers have been taken into account.

Table 2-1. Framing and effective line rate

Slot card	Framing	Effective line rate	ATM cells per second
DS3-ATM2	C-bit-ADM	40,037Kbps	104,265
	C-bit-PLCP	36,864Kbps	96,000
E3-ATM	G751-ADM	30,474Kbps	79,360
	G751-PLCP	27,648Kbps	72,000
	G832-ADM	30,720Kbps	80,000

The minimum shaper value is 1Kbps. If the `peak-rate` or `bit-rate` parameters specifies a value that is less than the minimum shaper value, the system logs a warning message.

Disabled traffic shapers

If a shaper is disabled and a virtual circuit has that shaper applied, or when the shaper #16 is used by a Connection profile, the virtual circuit has a CBR QoS with a peak rate equal to the maximum line bandwidth. This virtual circuit shares the common transmit pool.

Bit-rate control on first-generation slot cards

The information in this section applies only to the first-generation ATM slot cards: DS3-ATM (TNT-SL-UDS3-A) and OC3-ATM (TNT-SL-OC3-F). For information about traffic shaping on the second-generation slot cards, see “Traffic shaping on second-generation slot cards” on page 2-4.

Overview of bit-rate control settings

Following are the parameters (shown with default values) that define bandwidth control on DS3-ATM and OC3-ATM slot cards:

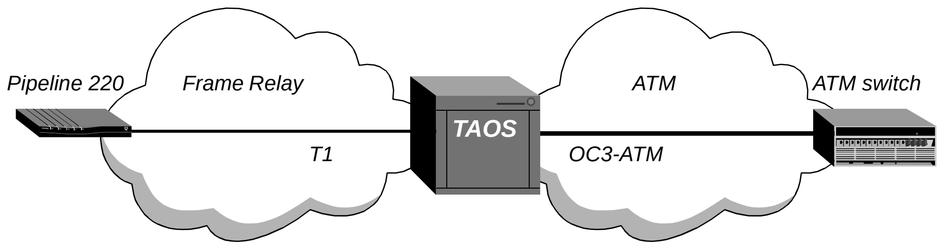
```
[in DS3-ATM/{ any-shelf any-slot 0 }:line-config:traffic-shapers[1]]
enabled = no
bit-rate = 1000
peak-rate = 1000
max-burst-size = 2
aggregate = no
priority = 0
[in OC3-ATM/{ any-shelf any-slot 0 }:line-config:traffic-shapers[1]]
enabled = no
bit-rate = 1000
peak-rate = 1000
max-burst-size = 2
aggregate = no
priority = 0
[in CONNECTION/"":session-options]
traffic-shaper = 16
```

Parameter	Specifies
Enabled	Enable/disable the shaper for use.
Bit-Rate	Average bit rate in kilobits per second. The default is 1000 (1Mbps). For DS3-ATM interfaces, the valid range is from 0 through 37920. For OC3-ATM, the valid range is from 0 through 135631.
Peak-Rate	Maximum effective bit rate in kilobits per second. The default is 1000 (1Mbps). The maximum effective DS3-ATM bit rate is 36.864Mbps for C-bit-PLCP framing and 40.038Mbps for C-bit-ADM framing. For OC3-ATM, the valid range is from 0 through 135631.
Max-Burst-Size	Maximum burst size (MBS), which is the maximum number of cells that can be transmitted at the specified peak rate before the TAOS unit determines that the virtual circuit is exceeding the defined characteristics. The default is 2. The valid range is from 2 through 255.
Aggregate	Enable/disable aggregation of the `bit-rate` values of multiple virtual circuits using this shaper. With a setting of `no` (the default), aggregation is not used. With a setting of `yes`, and if *N* virtual circuits are using this shaper, the throughput of each virtual circuits is `bit-rate`/*N*.
Priority	Priority of this shaper relative to other shapers on this interface. The valid range is from 0 (zero), the default, through 15. Zero specifies the highest priority, and 15 specifies the lowest.
Traffic-Shaper	Number of a defined traffic shaper to apply to the virtual circuit. The default is shaper `16`, which is an internal shaper that is not configurable. Traffic shaper 16 specifies no bandwidth limitation.

Typical bit-rate control configuration

In the example shown in Figure 2-2, the TAOS unit has an OC3-ATM interface to an ATM switch, a Frame Relay data link interface to a Pipeline® 220 unit, and an ATM-Frame Relay circuit between the two interfaces.

Figure 2-2. Typical setup using bit-rate control



To show how traffic shapers control bit rates for connections, both sides of the circuit configuration are shown in this example. If you need background information about ATM-Frame Relay circuit configuration, see Chapter 5, "Configuring ATM-Frame Relay Circuits."

The following set of commands defines a Frame Relay data link to the Pipeline 220 unit on a nailed T1 line (nailed group 999), which has a line rate of approximately 1.5Mbps:

```
admin> new frame ut1-p220
FRAME-RELAY/ut1-p220 read

admin> set active = yes

admin> set nailed-up-group = 999

admin> set link-type = nni

admin> write
FRAME-RELAY/ut1-p220 written
```

The following set of commands configures the OC3-ATM interface and defines a traffic shaper that limits the bit rate to less than 500Kbps:

```
admin> read oc3-atm {1 3 1}
OC3-ATM/{ shelf-1 slot-3 1 } read

admin> set name = atm-switch

admin> set enabled = yes

admin> set line-config nailed-group = 111

admin> set line-config traffic-shapers 1 enabled = yes

admin> set line-config traffic-shapers 1 bit-rate = 500

admin> write
OC3-ATM/{ shelf-1 slot-3 1 } written
```

The following set of commands specifies the circuit between the Frame Relay and ATM interfaces, and applies the traffic shaper to the ATM interface:

```
admin> new conn p220
CONNECTION/p220 read

admin> set active = yes

admin> set encapsulation-protocol = frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set telco-options call-type = ft1

admin> set fr-options frame-relay-profile = fr-switch

admin> set fr-options dlci = 100
```

```
admin> set fr-options circuit-name = atmfr-1

admin> write
CONNECTION/p220 written

admin> new conn switch-1
CONNECTION/switch-1 read

admin> set active = yes

admin> set encapsulation-protocol = atm-frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set fr-options circuit-name = atmfr-1

admin> set telco-options call-type = ft1

admin> set telco-options nailed-groups = 111

admin> set session-options traffic-shaper = 1

admin> set atm-options vpi = 100

admin> set atm-options vci = 132

admin> write
CONNECTION/switch-1 written
```

Because the traffic shaper in the OC3-ATM profile in this example does not enable aggregation (the default setting), the actual transfer rate across the virtual circuit to the switch is approximately 480Kbps, which is what the shaper permits.

Note: If two virtual circuits are configured on the OC3-ATM interface, both using a shaper that specifies a bit rate of 500Kbps with `aggregate` set to `yes`, each virtual circuit uses a transfer rate of about half the specified bit rate, or 240Kbps.

Configuring ATM Virtual Circuits

3

Configuring ATM PVCs 3-1

Configuring ATM SVCs 3-5

ATM virtual circuits (VCs) are bidirectional data paths between two end points. The connection between the two end points can include a number of hops in between.

A virtual circuit can be a permanent virtual circuit (PVC) or switched virtual circuit (SVC).

A physical interface can support multiple virtual circuits. Each virtual circuit requires a VPI-VCI pair. For PVCs, you configure a VPI-VCI pair manually in Connection or RADIUS profiles. For SVCs, the network assigns a VPI-VCI pair for the duration of the circuit.

Configuring ATM PVCs

A PVC uses nailed bandwidth specified in the physical interface profile. Nailed PVCs are established on the basis of an exchange of signaling and the occurrence of a number of events.

OAM loopback for PVC fault management

TAOS units can detect the failure of an ATM PVC on an ATM interface by using Operation, Administration, and Maintenance (OAM) F5 loopback. When it detects failure, the system clears the PVC, puts the interface in an inactive state, and attempts to reestablish the nailed connection.

Note: This features is currently available only on the first-generation ATM cards (TNT-SL-UDS3-A and TNT-SL-OC3-F).

Overview of settings for PVC configuration

A TAOS unit can forward data traffic onto an ATM PVC on the basis of IP routing, an ATM-Frame Relay circuit configuration, or an ATM direct configuration. This section describes the basic PVC setup using only IP routing. For information about ATM direct, see Chapter 4, “Configuring ATM Direct.” For details about configuring circuits, see Chapter 5, “Configuring ATM-Frame Relay Circuits.”

Connection profile settings for a PVC

Following are the Connection profile parameters (shown with default settings) relevant to defining a PVC:

```
[in CONNECTION/""]
station* = ""
encapsulation-protocol = mpp

[in CONNECTION/"":ip-options]
remote-address = 0.0.0.0/0

[in CONNECTION/"":atm-options]
atm1483type = aal5-llc
vpi = 0
vci = 32
vc-fault-management = none
vc-max-loopback-cell-loss = 1

[in CONNECTION/"":telco-options]
call-type = off
```

Parameter	Specifies
Station	Name of the far-end switch.
Encapsulation-Protocol	Encapsulation protocol to use on the interface. Must be set to `atm` for ATM PVCs.
Remote-Address	Destination IP address, which lies at the end of a PVC whose first hop is known by the specified VPI-VCI pair.
ATM1483type	Method of multiplexing Layer 3 packets into ATM cells. Valid values are `aal5-llc` and `aal5-vc`, which are defined in RFC 1483, *Multiprotocol Encapsulation over ATM Adaptation Layer 5*. The AAL5-LLC encapsulation method multiplexes multiple protocols on a single ATM virtual circuit. Each protocol is identified in the 802.2 Logical Link Control (LLC) header of the packet. This is the default method for ATM connections and is recommended for PVCs. The AAL5-virtual circuits method carries each protocol on a separate ATM virtual circuit, multiplexing the circuits rather than the individual protocols. This method is sometimes used in private networks, in which virtual circuit creation is very economical.
VPI	VPI for the connection. Be sure to use a VPI that is within the valid range for the physical interface. A VPI-VCI assignment that is not compatible with the port's configuration causes the connection to fail with an error message.
VCI	VCI for the connection. Be sure to use a VCI that is within the valid range for the physical interface. A VPI-VCI assignment that is not compatible with the port's configuration causes the connection to fail with an error message.

Parameter	Specifies
VC-Fault-Management	Virtual circuit fault management type. When the parameter is set to `none` (the default), no fault management is performed on the virtual circuit. If the parameter is set to `segment-loopback`, the system sends an OAM F5 segment loopback cell to the remote device every 5 seconds. If the parameter is set to `end-to-end-loopback`, the system sends an OAM F5 end-to-end loopback cell to the remote device every 5 seconds.
VC-Max-Loopback-Cell-Loss	Number of consecutive loopback cells that can be lost before the system clears the connection. When a PVC is cleared, the interface is in an inactive state until the system can reestablish the connection. The default is `1`.
Call-Type	Type of nailed call. Set this parameter to `ft1` for PVCs.

RADIUS attribute-value pairs for a PVC

The following attribute-value pairs can be used to define a `permconn` pseudo-user profile for an ATM PVC:

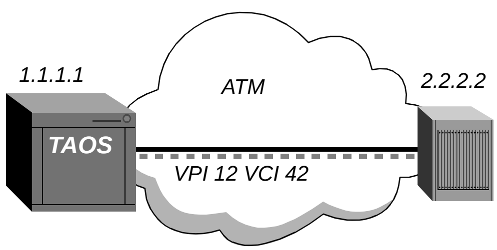
RADIUS attribute	Value
User-Name (1)	Name of the far-end device.
Framed-Protocol (7)	Encapsulation protocol to use for the connection. This attribute must be set to `ATM-1483` for terminating ATM connections. This setting corresponds to ATM Adaptation Layer 5 (AAL5) encapsulation as defined in RFC 1483.
Ascend-Route-IP (228)	Enable/disable IP routing for the interface. Set the attribute to `Router-IP-Yes` (the default) to enable IP routing for PVCs that do not rely on an ATM-Frame Relay circuit or ATM direct configuration for data transfer.
Framed-IP-Address (8)	IP address of the far-end device.
Framed-IP-Netmask (9)	Subnet mask of the far-end device address.
Ascend-ATM-Group (64)	Nailed-group number of the physical interface used by the connection.
Ascend-ATM-Vpi (94)	VPI for the connection. Be sure to use a VPI that is within the valid range for the physical interface. A VPI-VCI assignment that is not compatible with the port's configuration causes the connection to fail with an error message.
Ascend-ATM-Vci (95)	VCI for the connection. Be sure to use a VCI that is within the valid range for the physical interface. A VPI-VCI assignment that is not compatible with the port's configuration causes the connection to fail with an error message.

RADIUS attribute	Value
Ascend-ATM-Fault-Management (14)	Virtual circuit fault management type. When the attribute is set to `VC-No-Loopback` (0), which is the default, no fault management is performed on the virtual circuits. If the parameter is set to `VC-Segment-Loopback` (1), the system sends an OAM F5 segment loopback cell to the remote device every 5 seconds. If the parameter is set to `VC-End-To-End-Loopback` (2), the system sends an OAM F5 end-to-end loopback cell to the remote device every 5 seconds.
Ascend-ATM-Loopback-Cell-Loss (15	Number of consecutive loopback cells that can be lost before the system clears the connection. When a PVC is cleared, the interface is in an inactive state until the system can reestablish the connection. The default is `1`.

Typical PVC configuration

A connection to a remote ATM switch is shown in Figure 3-1.

Figure 3-1. Typical ATM permanent virtual circuit (PVC)



The following commands configure the physical interface in this example, which is a DS3-ATM interface:

```
admin> read ds3-atm { 1 2 1 }
DS3-ATM/{ 1 2 1 } read

admin> set name = atm-sf

admin> set enabled = yes

admin> set line-config nailed-group = 101

admin> write
DS3-ATM/{ shelf-1 slot-2 1 } written
```

The following commands configure the ATM PVC with end-to-end loopback fault management:

```
admin> new connection atmswitch
CONNECTION/atmswitch read

admin> set active = yes

admin> set encapsulation-protocol = atm

admin> set ip-options remote-address = 2.2.2.2/24

admin> set telco-options call-type = ft1

admin> set telco-options nailed-groups = 101
```

```
admin> set atm-options vpi = 12
admin> set atm-options vci = 42
admin> set atm-options vc-fault-management = end-to-end-loopback
admin> set atm-options vc-max-loopback-cell-loss = 5
admin> write
CONNECTION/atmswitch written
```

With these fault-management settings, the system establishes the nailed connection and sends an OAM F5 end-to-end loopback cell every 5 seconds. If it does not receive the loopback cell back for 5 consecutive intervals (25 seconds), the system clears the PVC, puts the interface in an inactive state, and attempts to reestablish the nailed connection.

Following is a comparable RADIUS profile:

```
permconn-sys-1 Password = "ascend"
    Service-Type = Outbound,
    Framed-Protocol = ATM-1483,
    User-Name = "atmswitch",
    Ascend-Route-IP = Route-IP-Yes,
    Framed-IP-Address = 2.2.2.2,
    Framed-IP-Netmask = 255.255.255.0,
    Ascend-ATM-Group = 101,
    Ascend-ATM-Vpi = 12,
    Ascend-ATM-Vci = 42,
    Ascend-ATM-Fault-Management = VC-End-To-End-Loopback,
    Ascend-ATM-Loopback-Cell-Loss = 5
```

Note: When IP routing is enabled, the unit creates a route for this destination. You can choose to add static routes to other subnets or to enable RIP updates to or from the router across ATM. The usual considerations for IP routing connections apply (see the *APX 8000/MAX TNT WAN, Routing, and Tunneling Configuration Guide*).

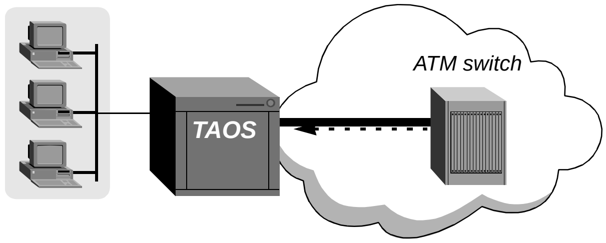
Configuring ATM SVCs

An *interface* is a point of ingress (entrance) to or egress (exit) from the system. An *ATM interface* is the logical configuration that enables ATM data to be sent and received.

TAOS units support switched virtual circuit (SVC) services on ATM interfaces. An SVC is a point-to-point switched connection, which provides a lower-cost, usage-based alternative to ATM PVCs. Like other types of switched connections, SVCs can be initiated by a dial-in or a dial-out call, which can be made by the system on the basis of IP routing.

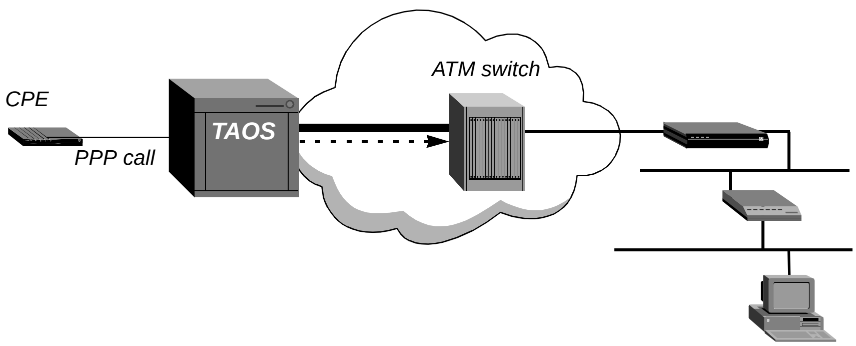
A dial-in ATM SVC terminates locally. The TAOS unit receives the call on an ATM interface. To enable the system to authenticate inbound SVCs, you must enable ATM SVCs in the Answer-Defaults profile. An example of a terminating SVC is shown in Figure 3-2.

Figure 3-2. Terminating SVC



A dial-out ATM SVC is initiated as an outbound call on an ATM interface, either due to an explicit dial-out or on the basis of IP routing. Figure 3-3 shows a Pipeline unit dialing into a TAOS unit using PPP or some other type of encapsulation. The TAOS unit establishes the inbound call and then dials out on an ATM interface on the basis of IP routing, just as it would for another type of switched dial-out call.

Figure 3-3. Dial-out SVC



Unlike permanent virtual circuits (PVCs), which require nailed connections, SVCs are on-demand connections and must use ATM end point addresses to identify the interface and route to it. To set up an SVC, you must configure SVC options, including an ATM address, in these locations:

- ATM-Interface profile, for a logical ATM interface associated with a physical ATM port
- Connection profile, used to establish the switched connection on an ATM interface

With the current software version, the system creates a static call route for an ATM address in each ATM-Interface profile. You can choose to configure the static call route explicitly using the ATMSVC-Route profile.

Current SVC limitations

With the current software version, the ATM SVC implementation is subject to the following limitations:

- Because the Interim Local Management Interface (ILMI) is not implemented, dynamic address registration is not supported. Therefore, each ATM interface must be configured with a full SVC address.
- Only one ATM logical interface is supported for each ATM physical interface.

Address formats for ATM interfaces

The ATM end point address assigned to an ATM interface can be an ATM end system address (AESA) format or native E.164 address. AESA addresses are required for IP over ATM.

AESA formats

ATM end system addresses are 20-byte, 40-digit hexadecimal numbers. The first 13 bytes are the *address prefix*, or network portion of the address, and the last 7 bytes are the host portion.

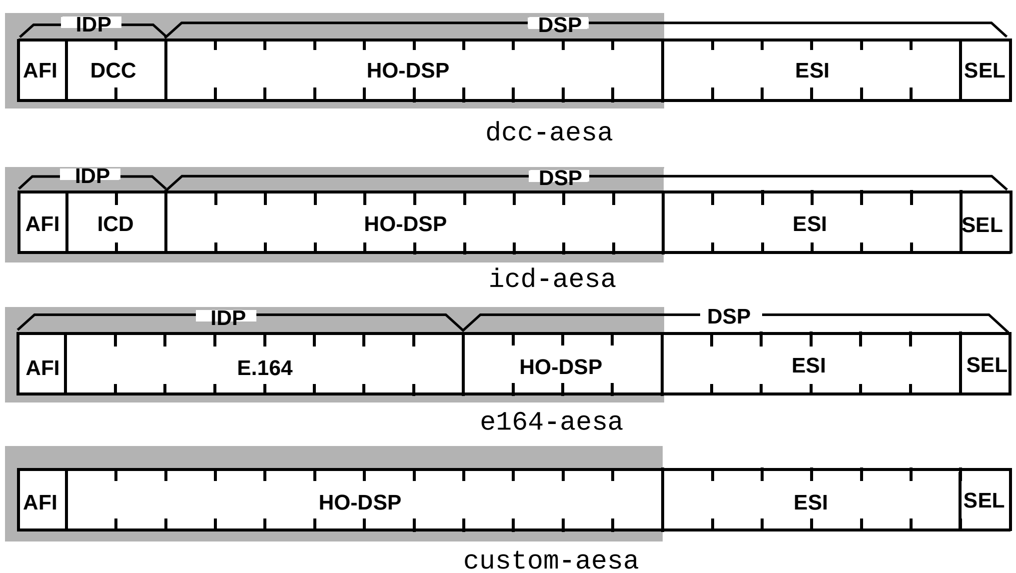
Depending on the AESA format chosen, the contents of each byte of the address varies, as shown in Figure 3-4. The supported AESA formats divide the address into the initial domain part (IDP), which defines the type of address and the regulatory authority responsible for allocating and assigning the domain-specific part, and the domain-specific part (DSP).

AESAs use one of the following formats:

AESA format	Description
`dcc-aesa`	Data Country Code (DCC) is specified in the address, identifying the country in which the address is registered. Country codes are standardized and defined in ISO Reference 3166.
`icd-aesa`	International Code Designator (ICD) is specified in the address, identifying an international organization. The British Standards Organization administers these values.
`e164-aesa`	E.164 address is specified using the international format.
`custom-aesa`	Custom authority and format identifier (AFI) and byte order.

Figure 3-4 shows how each format divides the 20-byte address into subfields. The shaded portion represents the address prefix, which is always the first 13 bytes. The end system identifier (ESI) and selector (SEL) subfields follow.

Figure 3-4. Subfields in the AESA address formats



For details about subfields in each format, see “Assigning an AESA format address” on page 3-9.

Native E.164 address format

Native E.164 addresses are regular ISDN numbers, including telephone numbers. E.164 addresses can contain up to 15 ASCII digits. For example, standard 10-digit United States telephone numbers, such as 508-555-1234, are native E.164 addresses.

Overview of configuring a physical ATM port

The line profile for a physical ATM port (for example, a DS3-ATM profile) requires no special configuration to support SVCs. For information about configuring the physical ports, see Chapter 2, “Physical Interface Considerations.”

Overview of SVC options on a logical ATM interface

Following are the parameters (shown with default settings) for configuring a logical ATM SVC interface on a configured physical ATM port:

```
[in ATM-INTERFACE/{ { any-shelf any-slot 0 } 0 }]
interface-address* = { { any-shelf any-slot 0 } 0 }
name = ""
```

```
[in ATM-INTERFACE/{ { any-shelf any-slot 0 } 0 }:svc-options]
enabled = no
atm-protocol = uni-3.1
atm-address = { undefined "" { undefined { "" "" } { "" "" "" } } }
insert-calling-party-addr = yes
q93b-options = { 2 1 4000 30000 0 4000 4000 120000 4000 }
qsaal-options = { 64 4 25 67 1000 0 0 0 15000 }
```

Parameter	Specifies
Interface-Address	Interface address. This parameter includes the physical interface address (the shelf number, slot number, and item number of a port) and the logical-item number of the interface. Because only one ATM interface per physical ATM line is supported with the current software version, a logical-item value other than zero is not supported.
Name	Name of the ATM interface. The name can consist of up to 15 characters. The name is optional, and is used for informational purposes only.
Enabled	Enable/disable SVC signaling. If SVC signaling is enabled, a signaling PVC is created on the link to carry out SVC signaling and handle control messages. Signaling layers Q.93B and Q.SAAL are also initialized and enabled.
ATM-Protocol	ATM signaling protocol. The current implementation supports user-to-network interface (UNI) 3.0 and UNI 3.1 protocols for SVCs. UNI 3.1 is selected as the factory default.
ATM-Address	AESA or E.164 address assigned to the interface.

Parameter	Specifies
Insert-Calling-Party-Addr	Enable/disable insertion of the calling-party address in outbound calls. If set to `yes` (the default), the system includes the calling party address on outbound calls. If set to `no`, the system does not include the calling party address on outbound calls.
Q93B-Options	Q.93B layer settings. For more information, see “Configuring the Q.93B layer” on page 3-11.
QSAAL-Options	Q.SAAL layer settings. For more information, see “Configuring the Q.SAAL layer” on page 3-12.

Assigning a native E.164 address

Following are the relevant parameters for assigning a native E.164 format ATM address, shown with default settings:

```
[in ATM-INTERFACE/{{ any-shelf any-slot 0 }0}:svc-options:atm-address]
numbering-plan = undefined
e164-native-address = ""
svc-address-info = ""
```

Parameter	Specifies
Numbering-Plan	Type of SVC address. The default value is `undefined`, which indicates that an address has not been configured on the interface. To specify an E.164 address, set this parameter to `isdn`. To specify an AESA address, set it to `aesa`. The `unknown` and `x121` values are currently unsupported and have the same effect as the default `undefined`.
E164-Native-Address	SVC address in native E.164 format, up to 30 characters. For example, enter 5085552600 (a standard 10-digit U.S. telephone number).
AESA-Address	Does not apply to addresses in native E.164 format. See “Assigning an AESA format address” next.
SVC-Address-Info	Assigned address in read-only ASCII string format. This parameter is for informational purposes only.

Assigning an AESA format address

The 20 bytes of an AESA address contain subfields, the size and contents of which can differ depending on the AESA format in use. The subfields are organized into an IDP portion and a DSP portion.

- The IDP portion specifies the authority and format identifier (AFI) and initial domain identifier (IDI) subfields.
- The DSP portion specifies the high-order domain-specific part (HO-DSP), end system identifier (ESI), and selector (SEL) subfields.

Note: The combination of IDP + HO-DSP + ESI must be unique. To ensure interoperability and equipment portability, use an ESI that is globally unique. For instance, if the ESI is not globally unique, and you move the ATM end system from one network to a different network, address conflicts can result.

For background information, see “AESA formats” on page 3-7. Following are the relevant parameters for assigning an AESA format address, shown with default settings:

```
[in ATM-INTERFACE/{{ any-shelf any-slot 0 }0}:svc-options:atm-address]
numbering-plan = undefined
aesa-address = { undefined { "" "" } { "" "" "" } }
svc-address-info = ""

[in ATM-INTERFACE/{ { any-shelf any-slot 0 } 0 }:svc-options:atm-
address:aesa-address]
format = undefined

[in ATM-INTERFACE/{ { any-shelf any-slot 0 } 0 }:svc-options:atm-
address:aesa-address:idp-portion]
afi = ""
idi = ""

[in ATM-INTERFACE/{ { any-shelf any-slot 0 } 0 }:svc-options:atm-
address:aesa-address:dsp-portion]
ho-dsp = ""
esi = ""
sel = ""
```

Parameter	Specifies
Numbering-Plan	Type of SVC address. The default value is `undefined`, which indicates that an ATM address on the interface has not been configured. To specify an E.164 address, set this parameter to `isdn`. To specify an AESA address, set it to `aesa`. The `unknown` and `x121` values are currently unsupported and have the same effect as the default `undefined`.
Format	AESA format for the interface. The default value is `undefined`, which indicates that the address has not been configured. Valid settings are `dcc-aesa`, `icd-aesa`, `e164-aesa`, and `custom-aesa`. For background information, see “AESA formats” on page 3-7.
SVC-Address-Info	Assigned address in read-only ASCII string format. This parameter is for informational purposes only.
AFI	Hexadecimal code that identifies the kind of AESA address, such as the DCC, ICD, or E.164 part of the AESA address, as well as the syntax of the rest of the address. The AFI is 1 byte, which contains 2 hexadecimal digits. For example, you can set `0x39` (for `dcc-aesa`), `0x47` (for `icd-aesa`), or `0x45` (for `e164-aesa`).
IDI	Hexadecimal code identifying the subauthority that has allocated the address. For `dcc-aesa` and `icd-aesa`, the IDI is 2 bytes long (4-hexidecimal digits). For `e164-aesa`, the IDI is 8 bytes long, containing 16 digits that specify the E.164 address. The E.164 address can be up to 15 digits, so the system pads the number with leading zeros as required.
HO-DSP	Hexadecimal number that specifies a segment of address space assigned to a particular device or network. For `dcc-aesa` and `icd-aesa`, the HO-DSP field is 10 bytes long, containing 20 hex digits. For `e164-aesa`, it is 4 bytes long (8 hex digits), and for `custom-aesa` it is 12 bytes long (24 hex digits).

Parameter	Specifies
ESI	Hexadecimal number that uniquely identifies the end system within the specified subnetwork, typically an IEEE media access control (MAC) address. This field is always 6 bytes long (12 hex digits).
SEL	Hexadecimal number that is not used for ATM routing, but can be used by the end system. This subfield is always 1 byte long (2 hex digits).

Configuring the Q.93B layer

Q.93B parameters specify the timers and retry values associated with the functionality of the Q.93B signaling layer. Q.93B is an International Telecommunication Union Telecommunication Standardization Sector (ITU-T) recommendation detailing the signaling protocol for establishing and maintaining ATM SVCs. Following are the relevant parameters, shown with default settings:

```
[in ATM-INTERFACE/{ { shelf-1 slot-4 1 } 0 }:svc-options:q93b-options]
max-restart = 2
max-statenq = 1
t303-ms = 4000
t308-ms = 30000
t309-ms = 0
t310-ms = 4000
t313-ms = 4000
t316-ms = 120000
t322-ms = 4000
```

Parameter	Specifies
Max-Restart	Maximum number of unacknowledged transmit RESTART messages (from `1` to `32`). The default value is `2`.
Max-Statenq	Maximum number of unacknowledged transmit STATUS ENQ messages (from `1` to `32`). The default value is `1`.
T303-ms	Timer (in milliseconds) for a response after a SETUP message is sent. The timer is stopped when a CONNECT, CALL PROCEEDING, or RELEASE COMPLETE message is received. Valid values are from `500` to `5000`. The default value is `4000`.
T308-ms	Timer (in milliseconds) for a response after a RELEASE message is sent. This timer is also called the *release indication timer.* The timer is started when the RELEASE message is sent and normally is stopped when the RELEASE or RELEASE COMPLETE message is received. Valid values are from `5000` to `50000`. The default value is `30000`.
T309-ms	Timer (in milliseconds) for Q.SAAL to reconnect. After this time has elapsed, calls are dropped. When set to `0` (the default), a default value based an ATM signaling protocol is used. Valid values are from `0` to `200000`.
T310-ms	Timer (in milliseconds) for a response after a SETUP message is received. This timer is also called the *call proceeding timer.* Valid values are from `5000` to `50000`. The default value is `4000`.

Parameter	Specifies
T313-ms	Timer (in milliseconds) for a response after a CONNECT message is sent. This timer is also called the *connect request timer*. The timer is started when the CONNECT message is sent and is stopped when the CONNECT ACKNOWLEDGE message is received. Valid values are from `1000` to `10000`. The default value is `4000`.
T316-ms	Timer (in milliseconds) for a response after a RESTART message is sent. This timer is also called the *restart request timer*. The timer is started when the RESTART message is sent and is stopped when the RESTART ACKNOWLEDGE message is received. Valid values are from `10000` to `300000`. The default value is `120000`.
T322-ms	Timer (in milliseconds) for a response after a STATUS ENQ message is sent. Valid values are from `1000` to `10000`. The default value is `4000`.

Configuring the Q.SAAL layer

Q.SAAL parameters specify the timers and retry values associated with the functionality of the Q.SAAL layer. Q.SAAL is an adaptation layer protocol that defines the reliable transmission and reception of signaling data between ATM end points. Following are the relevant parameters, shown with default settings:

```
[in ATM-INTERFACE/{ { shelf-1 slot-4 1 } 0 }:svc-options:qsaal-
options]
window-size = 64
max-cc = 4
max-pd = 25
max-stat = 67
tcc-ms = 1000
tpoll-ms = 0
tkeepalive-ms = 0
tnoresponse-ms = 0
tidle-ms = 15000
```

Parameter	Specifies
Window-Size	Q.SAAL window size. Valid values are from `16` to `128`. The default value is `64`.
Max-Cc	Maximum number of control protocol data unit (PDU) retransmissions (BGN, END, RESYNC) allowed. Valid values are from `0` to `64`. The default value is `4`.
Max-PD	Maximum number of sequenced data PDUs allowed between poll intervals. Valid values are from `1` to `64`. The default value is `25`.
Max-Stat	Maximum length of STAT PDU. Valid values are from `32` to `128`. The default value is `67`.
Tcc-ms	Retry time (in milliseconds) for control PDUs (BGN, END, RESYNC). Valid values are from `0` to `3000`. The default value is `1000`.

Parameter	Specifies
Tpoll-ms	Poll interval (in milliseconds) when the Q.SAAL layer is active. When set to `0` (the default), a default value based on an ATM signaling protocol is used. Valid values are from `0` to `3000`.
Tkeepalive-ms	Poll interval (in milliseconds) when the Q.SAAL layer is active in a transient state. When set to `0` (the default), a default value based on an ATM signaling protocol is used. Valid values are from `0` to `3000`.
Tnoresponse-ms	Maximum interval (in milliseconds) between receipt of STAT PDUs. When set to `0` (the default), a default value based an ATM signaling protocol is used. Valid values are from `0` to `20000`.
Tidle-ms	Poll interval (in milliseconds) when the Q.SAAL layer is idle, for UNI 3.1 only. The default value is `15000`. Valid values are from `1000` to `20000`

Overview of Answer-Defaults setting

To enable the system to accept inbound SVC calls, you must enable SVCs in the Answer-Defaults profile. Following is the relevant parameter, shown with its default setting:

```
[in ANSWER-DEFAULTS:atm-answer]
svc-enabled = no
```

Parameter	Specifies
SVC-Enabled	Enable/disable incoming SVC calls. This parameter is disabled by default.

Overview of SVC options in a Connection profile

The ATM options in a Connection profile are not specifically related to SVC configuration. VPI-VCI pairs are assigned by the switch for ATM SVCs. Most of the other settings in the ATM-Options subprofile operate in a similar manner for SVCs as they do for PVCs, once the SVC connection has been established.

Following are the parameters (shown with default settings) that are specific to configuring an ATM SVC connection:

```
[in CONNECTION/""]
encapsulation-protocol = atm
dial-number = ""

[in CONNECTION/"":ip-options]
ip-routing-enabled = yes
remote-address = 0.0.0.0/0

[in CONNECTION/"":atm-options:svc-options]
enabled = no

[in CONNECTION/"":atm-options:svc-options:incoming-caller-addr]
numbering-plan = undefined
e164-native-address = ""
aesa-address = { undefined { "" "" } { "" "" "" } }
svc-address-info = ""
```

```
[in CONNECTION/"":atm-options:svc-options:outgoing-called-addr]
numbering-plan = undefined
e164-native-address = ""
aesa-address = { undefined { "" "" } { "" "" "" } }
svc-address-info = ""
```

Parameter	Specifies
Encapsulation-Protocol	Encapsulation method for the connection. This parameter must be set to `atm` for ATM SVC connections.
Dial-Number	Dial number for outbound calls. For dial-out ATM SVCs, you do not need to set this parameter. The system sets it to the same value as the `outgoing-called-addr` parameter when you write the Connection profile.
IP-Routing-Enabled	Enable/disable IP routing for the interface. IP routing must be enabled (as it is by default) for outbound SVCs that are dialed on the basis of IP routing.
Remote-Address	IP address of the far-end device, which can include a subnet specification. If it does not include a subnet mask, the router software in the TAOS unit uses a default subnet mask that is based on address class.
Enabled	Enable/disable SVC for the connection. SVC is disabled by default.
Incoming-Caller-Addr	ATM address of the far end of the dial-in SVC connection, used to authenticate the inbound call. The address subfields operate in exactly the same way as the subfields of the same name in the ATM-Interface profile. For details, see "Assigning a native E.164 address" on page 3-9 or "Assigning an AESA format address" on page 3-9.
Outgoing-Called-Addr	ATM address of the far end of the dial-out SVC connection used to dial outbound SVC calls. The address subfields operate in exactly the same way as the subfields of the same name in the ATM-Interface profile. For details, see "Assigning a native E.164 address" on page 3-9 or "Assigning an AESA format address" on page 3-9.

Note: An SVC that can be initiated by either a dial-in or dial-out call specifies the same ATM address in both the `incoming caller-addr` and `outgoing-called-addr` fields.

Configuring a static ATM SVC route

With the current software version, no more than one ATM-Interface profile can be created for each physical ATM port, and the system creates an internal call route to the logical interface. As a result, you need not create explicit ATM static routes in this release. However, some sites specify the route explicitly, to simplify route management. Following are the relevant parameters, shown with default settings, for creating an ATM static route:

```
[in ATMSVC-ROUTE/""]
name* = ""
active = no
```

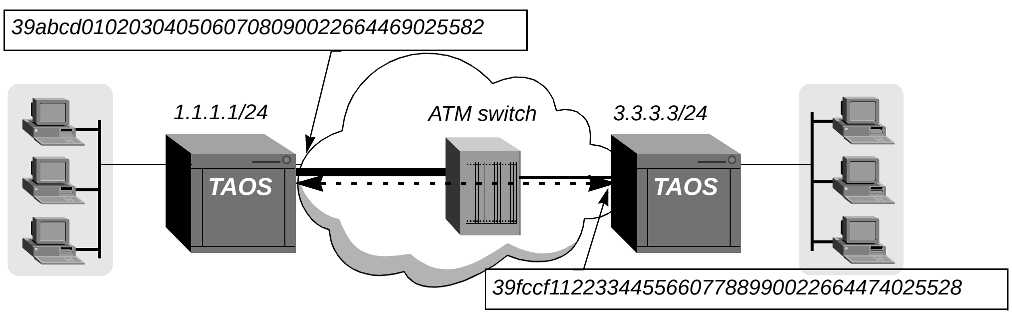
```
address-prefix = ""
interface-address = { { any-shelf any-slot 0 } 0 }
```

Parameter	Specifies
Name	Name of the route profile, up to 31 characters.
Active	Enable/disable the route for use.
Address-Prefix	The address prefix of the ATM address assigned to the interface in an ATM-Interface profile. For AESA-format addresses, the address prefix is the first 26 digits of the 40-digit hexadecimal number. For E.164 addresses, it is the entire address.
Interface-Address	Interface address of the ATM-Interface profile.

Typical ATM SVC configuration

In the example shown in Figure 3-5, the system at the left side of the ATM cloud (the unit with the IP address 1.1.1.1/24) is a TAOS unit to be configured for an ATM SVC. The SVC can be established by dial-in or dial-out on an OC3-ATM port. For the purposes of this example, the remote system (at the right side of the ATM cloud, with the IP address 3.3.3.3/24) is a TAOS unit, which has also been configured for an ATM SVC. The SVC can be established by a call to or from the remote system.

Figure 3-5. Typical ATM SVC with DCC-AESA addresses



This example shows how to configure the TAOS unit at the left side of the ATM cloud (the unit with the IP address 1.1.1.1/24) in Figure 3-5.

Configuring the OC3-ATM physical interface

The following commands configure the OC3-ATM physical interface and enable it for use:

```
admin> read oc3-atm { 1 2 1 }
OC3-ATM/{ shelf-1 slot-2 1 } read

admin> set name = atmswitch

admin> set enabled = yes

admin> set line-config clock-source = eligible

admin> write
OC3-ATM/{ shelf-1 slot-2 1 } written
```

Configuring the SVC logical interface

The following commands configure the SVC interface for the OC3-ATM port:

```
admin> read atm-interface { { 1 2 1 } 0 }
ATM-INTERFACE/{ { shelf-1 slot-2 1 } 0 } read

admin> set name = atmswitch

admin> set svc-options enabled = yes

admin> set svc-options atm-address numbering-plan = aesa

admin> list svc-options atm-address aesa-address
[in ATM-INTERFACE/{ { shelf-1 slot-2 1 } 0 }:svc-options:atm-address:+
format = undefined
idp-portion = { "" "" }
dsp-portion = { "" "" "" }

admin> set format = dcc-aesa

admin> set idp-portion afi = 39

admin> set idp-portion idi = abcd

admin> set dsp-portion ho-dsp = 01020304050607080900

admin> set dsp-portion esi = 226644690255

admin> set dsp-portion sel = 82

admin> write
ATM-INTERFACE/{ { shelf-1 slot-2 1 } 0 } written
```

Enabling incoming SVC calls

The following commands enable the system to authenticate incoming SVCs:

```
admin> read answer-defaults
ANSWER-DEFAULTS read

admin> set atm-answer svc-enabled = yes

admin> write
ANSWER-DEFAULTS written
```

Configuring a Connection profile to the far-end device

The following commands create a Connection profile to the far-end TAOS unit:

```
admin> new connection hanif-tnt
CONNECTION/hanif-tnt read

admin> set active = yes

admin> set encapsulation-protocol = atm

admin> set ip-options remote-address = 3.3.3.3/24

admin> set atm-options svc-options enabled = yes

admin> set atm-options svc incoming-caller-addr numbering-plan = aesa

admin> set atm-options svc outgoing-called-addr numbering-plan = aesa
```

In the following set of commands, notice that the `incoming-caller-addr` and `outgoing-called-addr` addresses are the same. This configuration allows the SVC to be established by a call to or from the far-end TAOS unit.

```
admin> list atm-options svc-options incoming-caller-addr aesa-address
[in CONNECTION/hanif-tnt:atm-options:svc-options:incoming-caller-
addr:aesa-address
format = undefined
idp-portion = { "" "" }
dsp-portion = { "" "" "" }

admin> set format = dcc-aesa

admin> set idp-portion afi = 39

admin> set idp-portion idi = fccf

admin> set dsp-portion ho-dsp = 11223344556607788990

admin> set dsp-portion esi = 226644740255

admin> set dsp-portion sel = 28

admin> list .. .. outgoing-called-addr aesa-address
[in CONNECTION/hanif-tnt:atm-options:svc-options:outgoing-called-
addr:aesa-address
format = undefined
idp-portion = { "" "" }
dsp-portion = { "" "" "" }

admin> set format = dcc-aesa

admin> set idp-portion afi = 39

admin> set idp-portion idi = fccf

admin> set dsp-portion ho-dsp = 11223344556607788990

admin> set dsp-portion esi = 226644740255

admin> set dsp-portion sel = 28

admin> write
CONNECTION/hanif-tnt written
```

When you write the profile with `outgoing-called-addr` configured, the system uses the configured value to set the `dial-number` parameter.

Configuring ATM Direct

4

Overview of ATM direct settings. 4-1

Typical ATM direct connection 4-3

Overview of ATM direct settings

TAOS units support ATM direct for concentrating incoming PPP calls onto an ATM interface. The ATM direct configuration forwards multiple PPP connections onto the ATM interface as a combined data stream on the basis of the ATM direct configuration. The unit does not examine the packets. An upstream device then examines the packets and routes them appropriately.

Note: An ATM direct connection is not a full-duplex tunnel between a PPP dial-in user and a far-end device. Although the TAOS unit does not route the packets onto the ATM interface, it must use the router to send packets it receives on the ATM interface back to the appropriate PPP caller. For this reason, ATM direct connections must enable IP routing.

Connection profile settings for ATM direct

Following are the ATM direct parameters in a Connection profile, shown with default settings:

```
[in CONNECTION/""]
encapsulation-protocol = mpp

[in CONNECTION/"":atm-options]
atm-direct-enabled = no
atm-direct-profile = ""

[in CONNECTION/"":ip-options]
ip-routing-enabled = yes
remote-address = 0.0.0.0/0
address-pool = 0
```

Parameter	Specifies
Encapsulation-Protocol	Encapsulation protocol. This parameter must be set to `ppp`, `mp`, or `mpp` for ATM direct connections.
ATM-Direct-Enabled	Enable/disable ATM direct mode for this connection.
ATM-Direct-Profile	Name of a Connection or RADIUS profile that specifies an ATM link with a VPI-VCI pair.
IP-Routing-Enabled	Enable/disable IP routing for this connection. Must be enabled for the TAOS unit to send data back to the appropriate PPP caller.

Parameter	Specifies
Remote-Address	PPP caller's IP address. As the TAOS unit receives return packets for many ATM direct connections across the same ATM link, it uses this address to determine the PPP caller that receives the return packets.
Address-Pool	Number of the address pool from which to acquire an address. If the Remote-Address is null and pools have been configured, the system assigns an IP address dynamically. For details about configuring and using dynamic IP addresses, see the *APX 8000/MAX TNT WAN, Routing, and Tunneling Configuration Guide*.

RADIUS attribute-value pairs for ATM direct

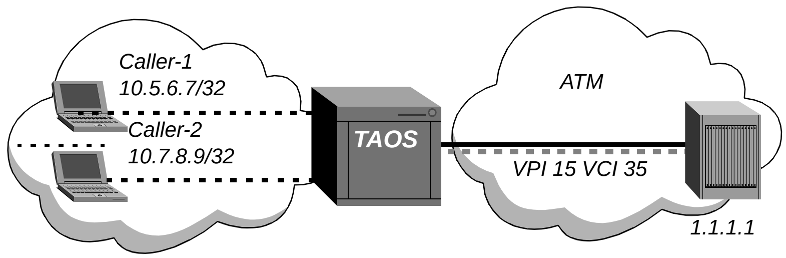
RADIUS uses the following attribute-value pairs for ATM direct connections:

RADIUS attribute	Value
Framed-Protocol (7)	Encapsulation protocol. This attribute must be set to PPP (1), MP (262), or MPP (256) for ATM direct connections.
Ascend-ATM-Direct (76)	Enable/disable ATM direct mode for this connection. ATM-Direct-No (0) is the default. Set this attribute to ATM-Direct-Yes (1) for ATM direct connections.
Ascend-ATM-Direct-Profile (77)	Name of a profile that specifies an ATM link with a VPI-VCI pair.
Ascend-Route-IP (228)	Enable/disable IP routing for this connection. (IP is enabled by default.) If this attribute is present, it must be set to Route-IP-Yes to enable the TAOS unit to send data back to the appropriate PPP caller.
Framed-IP-Address (8)	PPP caller's IP address. As the TAOS unit receives return packets for many ATM direct connections across the same ATM link, it uses this address to determine the PPP caller that receives the return packets. If the Framed-IP-Address attribute-value pair is missing from the RADIUS profile and pools have been configured, the system assigns an IP address dynamically. For details about configuring and using dynamic IP addresses, see the *APX 8000/MAX TNT WAN, Routing, and Tunneling Configuration Guide*.
Framed-IP-Netmask (9)	Subnet mask for Framed-IP-Address.

Typical ATM direct connection

In the example shown in Figure 4-1, a TAOS unit forwards the data stream from two PPP dial-in hosts across the same ATM link.

Figure 4-1. ATM direct concentrating PPP calls to an ATM interface



For information about configuring the physical interface, see Chapter 2, "Physical Interface Considerations," and the *APX 8000/MAX TNT Physical Interface Configuration Guide*.

The following set of commands configures the ATM link with a VPI-VCI pair.

```
admin> new connection atm-switch-1
CONNECTION/atm-switch-1 read

admin> set active = yes

admin> set encapsulation-protocol = atm

admin> set ip-options remote-address = 1.1.1.1

admin> set telco-options call-type = ft1

admin> set telco-options nailed-groups = 99

admin> set atm-options vpi = 15

admin> set atm-options vci = 35

admin> write
CONNECTION/atm-switch-1 written
```

The following set of commands configures ATM direct Connection profiles for the incoming calls. The name of the profile for the connection to the ATM switch in this example is `atm-switch-1`.

```
admin> new conn caller-1
CONNECTION/caller-1 read

admin> set active = yes

admin> set encapsulation-protocol = ppp

admin> set ppp-options recv-password = caller1*3

admin> set ip-options remote-address = 10.5.6.7/32

admin> set atm-options atm-direct-enabled = yes

admin> set atm-options atm-direct-profile = atm-switch-1

admin> write
CONNECTION/caller-1 written

admin> new conn caller-2
CONNECTION/caller-2 read
```

```
admin> set active = yes

admin> set encapsulation-protocol = ppp

admin> set ppp-options recv-password = caller2!!8

admin> set ip-options remote-address = 10.7.8.9/32

admin> set atm-options atm-direct-enabled = yes

admin> set atm-options atm-direct-profile = atm-switch-1

admin> write
CONNECTION/caller-2 written
```

Following are comparable RADIUS profiles:

```
caller-1 Password = "caller1*3", Service-Type = Framed-User
    Framed-Protocol = PPP,
    Framed-IP-Address = 10.5.6.7,
    Framed-IP-Netmask = 255.255.255.255,
    Ascend-ATM-Direct = ATM-Direct-Yes,
    Ascend-ATM-Direct-Profile = "atm-switch-1"

caller-2 Password = "caller2!!8", Service-Type = Framed-User
    Framed-Protocol = PPP,
    Framed-IP-Address = 10.7.8.9,
    Framed-IP-Netmask = 255.255.255.255,
    Ascend-ATM-Direct = ATM-Direct-Yes,
    Ascend-ATM-Direct-Profile = "atm-switch-1"
```

Configuring ATM-Frame Relay Circuits

5

ATM-Frame Relay translation-mode circuits 5-1

ATM-Frame Relay transparent-mode circuits 5-5

ATM-Frame Relay virtual channel trunking 5-8

TAOS units support ATM-Frame Relay circuits for exchanging traffic between an ATM PVC and a Frame Relay PVC, as defined in *FRF.8 Frame Relay ATM/PVC Service Interworking Implementation Agreement*. An ATM-Frame Relay circuit can be configured in translation mode or transparent mode.

A translation-mode circuit removes Frame Relay multiprotocol encapsulation (RFC 1490) from the data stream received on a Frame Relay interface and adds ATM multiprotocol encapsulation (RFC 1483) to the data stream sent on an ATM interface, and vice versa, from one side of the circuit to the other.

A transparent-mode circuit performs no encapsulation processing. Transparent mode requires that the circuit end points support compatible upper-layer protocols for applications such as packetized voice.

TAOS units also support virtual channel trunking, which allows circuits with more than two end points (*N*-to-1 circuits). The system aggregates traffic from multiple host links onto one trunk link, creating an *N*-to-1 circuit.

For details about Frame Relay configuration, see the *APX 8000/MAX TNT Frame Relay Configuration Guide*.

ATM-Frame Relay translation-mode circuits

A translation-mode ATM-Frame Relay circuit defines two circuit end points, each of which requires its own Connection profile. One profile defines the Frame Relay data link connection identifier (DLCI) interface, and the other defines an ATM interface. The data is switched from one interface to another on the basis of the circuit configuration.

The TAOS unit performs the necessary processing to translate the frames received on one interface to cells on the other, and vice versa. An ATM-Frame Relay circuit that performs this operation from one interface to another is a translation-mode circuit.

Connection profile settings for translation-mode circuits

Following are the Connection profile parameters (shown with sample settings) for configuring an ATM-Frame Relay circuit in translation mode:

```
[in CONNECTION/fr-endpoint]
encapsulation-protocol = frame-relay-circuit

[in CONNECTION/fr-endpoint:fr-options]
frame-relay-profile = fr7
dlci = 100
circuit-name = atmfr-1

[in CONNECTION/fr-endpoint:telco-options]
call-type = ft1

[in CONNECTION/atm-endpoint]
encapsulation-protocol = atm-frame-relay-circuit

[in CONNECTION/atm-endpoint:fr-options]
circuit-name = atmfr-1

[in CONNECTION/atm-endpoint:atm-options]
vpi = 0
vci = 32
atm-enabled = yes

[in CONNECTION/atm-endpoint:telco-options]
call-type = ft1
nailed-groups = 111
```

Parameter	Specifies
Encapsulation-Protocol	Encapsulation protocol. For an ATM-Frame Relay circuit, one end point specifies ATM-Frame-Relay-Circuit and the other specifies Frame-Relay-Circuit.
Frame-Relay-Profile	Name of the Frame-Relay profile that defines the data link.
DLCI	DLCI for the Frame Relay PVC end point. The unit does not allow you to enter duplicate DLCIs, except when they are carried by separate physical links specified in different Frame-Relay profiles.
Circuit-Name	Circuit name (up to 16 characters). The other end point must specify the same circuit name. If only one profile specifies a circuit name, data received on the specified DLCI is dropped. If more than two profiles specify the same circuit name, only two of the profiles are used to form a circuit.
Call-Type	Type of nailed call. Set this parameter to FT1 for PVCs.
Nailed-Groups	Group number assigned in the physical interface configuration.
VPI	Virtual path identifier (VPI) for the ATM PVC. A VPI identifies the unidirectional transport of ATM cells belonging to a bundle of virtual channels. The VPI-VCI pair must be assigned by an ATM administrator.
VCI	Virtual channel identifier (VCI) for the ATM PVC.

RADIUS attribute-value pairs for translation-mode circuits

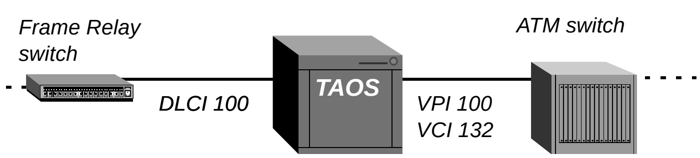
Following are the RADIUS attribute-value pairs for configuring an ATM-Frame Relay circuit:

RADIUS attribute	Value
Framed-Protocol (7)	Encapsulation protocol. Both end points of a circuit must specify FR-CIR (263) or ATM-FR-CIR (265) encapsulation.
Ascend-FR-Profile-Name (180)	Name of the Frame-Relay profile that defines the data link.
Ascend-FR-DLCI (179)	DLCI for the Frame Relay PVC end point. The unit does not allow you to enter duplicate DLCIs, except when they are carried by separate physical links specified in different Frame-Relay profiles.
Ascend-FR-Circuit-Name (156)	Circuit name (up to 16 characters). The other end point must specify the same circuit name. If only one profile specifies a circuit name, data received on the specified DLCI is dropped. If more than two profiles specify the same circuit name, only two of the profiles are used to form a circuit.
Ascend-Group (178)	Group number assigned in the physical interface configuration.
Ascend-ATM-Vpi (94)	Virtual path identifier (VPI) for the ATM PVC. A VPI identifies the unidirectional transport of ATM cells belonging to a bundle of virtual channels. The VPI-VCI pair must be assigned by an ATM administrator.
Ascend-ATM-Vci (95)	Virtual channel identifier (VCI) for the ATM PVC.

Typical translation-mode circuit configuration

Figure 5-1 shows a TAOS unit that switches data between ATM and Frame Relay interfaces by using an ATM-to-Frame Relay circuit configuration.

Figure 5-1. ATM-Frame Relay circuit



Using local profiles

The following commands define the data link to the Frame Relay switch:

```
admin> new frame fr-switch
FRAME-RELAY/fr-switch read

admin> set active = yes

admin> set nailed-up-group = 999
```

```
admin> set link-type = nni

admin> write
FRAME-RELAY/fr-switch written
```

The next set of commands configures a physical interface, in this example, a DS3-ATM interface:

```
admin> read ds3-atm {1 3 1}
DS3-ATM/{ shelf-1 slot-3 1 } read

admin> set name = atm-switch

admin> set enabled = yes

admin> set line nailed-group = 111

admin> set line high-tx-output = yes

admin> write
DS3-ATM/{ shelf-1 slot-3 1 } written
```

The next set of commands specifies the circuit between the Frame-Relay and ATM interfaces:

```
admin> new conn fr-endpoint
CONNECTION/fr-endpoint read

admin> set active = yes

admin> set encaps = frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set telco call-type = ft1

admin> set fr-options frame-relay-profile = fr-switch

admin> set fr-options dlci = 100

admin> set fr-options circuit-name = atmfr-1

admin> write
CONNECTION/fr-endpoint written

admin> new conn atm-endpoint
CONNECTION/atm-endpoint read

admin> set active = yes

admin> set encaps = atm-frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set fr-options circuit-name = atmfr-1

admin> set telco call-type = ft1

admin> set telco nailed-groups = 111

admin> set atm vpi = 100

admin> set atm vci = 132

admin> write
CONNECTION/atm-endpoint written
```

Using RADIUS profiles

The following `frdlink` pseudo-user profile defines the data link to the Frame Relay switch:

```
frdlink-sys-1 Password = "ascend", Service-Type = Dialout-Framed-User
   Ascend-FR-Profile-Name = "fr-switch",
   Ascend-Call-Type = Nailed,
   Ascend-FR-Type = Ascend-FR-NNI,
   Ascend-FR-Nailed-Grp = 999
```

The physical interface is configured in a local profile, as shown in the "Using local profiles" section. The next set of profiles specifies the circuit between the Frame Relay and ATM interfaces:

```
permconn-sys-1 Password = "ascend", Service-Type = Dialout-Framed-User
   User-Name = "fr-endpoint",
   Framed-Protocol = FR-CIR,
   Ascend-Route-IP = Route-IP-No,
   Ascend-FR-DLCI = 100,
   Ascend-FR-Profile-Name = "fr-switch",
   Ascend-FR-Circuit-Name = "atmfr-1"
```

```
permconn-sys-2 Password = "ascend", Service-Type = Dialout-Framed-User
   User-Name = "atm-endpoint",
   Framed-Protocol = ATM-FR-CIR,
   Ascend-Route-IP = Route-IP-No,
   Ascend-Group = "111",
   Ascend-ATM-Vpi = 100,
   Ascend-ATM-Vci = 132,
   Ascend-FR-Circuit-Name = "atmfr-1"
```

ATM-Frame Relay transparent-mode circuits

A transparent-mode ATM-Frame Relay circuit defines two circuit end points, each of which requires its own Connection profile. Unlike translation-mode circuits, however, the system performs no translation in transparent-mode, but simply passes the data stream from one side of the circuit to the other. Transparent mode requires that the circuit end points support compatible upper-layer protocols for applications such as packetized voice.

Connection profile setting for transparent-mode circuits

Following is the relevant parameter, shown with its default value for configuring an ATM-Frame Relay circuit in transparent mode:

```
[in CONNECTION/"":atm-options]
fr-08-mode = translation
```

Parameter	Specifies
FR-08-Mode	Translation or transparent mode of operation for the ATM-Frame Relay circuit. The default is `translation` mode, which causes the system to convert RFC 1490 encapsulation to RFC 1483, and vice versa. In `transparent` mode, the data is passes from one side of the circuit to the other without 1490-to-1483 translation. The encapsulation mode for the profile must be `atm-frame-relay-circuit` for this parameter to have an effect.

RADIUS attribute-value pair for transparent-mode circuits

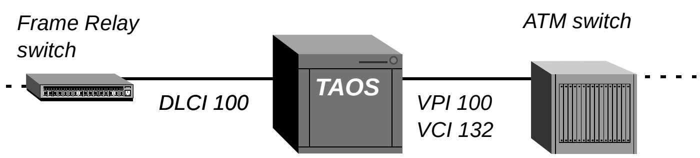
RADIUS uses the following attribute-value pair to specify a transparent mode circuit:

RADIUS attribute	Value
Ascend-FR-08-Mode (30)	Translation (0) or transparent (1) mode of operation for the ATM-Frame Relay circuit. The default is translation mode, which causes the system to convert RFC 1490 encapsulation to RFC 1483, and vice versa. In transparent mode, the data is passes from one side of the circuit to the other without 1490-to-1483 translation. The encapsulation mode for the profile must be `atm-frame-relay-circuit` for this setting to have an effect.

Typical transparent-mode circuit configuration

In the example shown in Figure 5-2, a TAOS unit receives frames on a Frame Relay DLCI interface and transmits them on an ATM PVC (and vice versa) without removing the frames' encapsulation and adding the encapsulation required by the other end point.

Figure 5-2. Typical ATM-Frame Relay circuit



Using local profiles

The following commands define the data link to the Frame Relay switch:

```
admin> new frame fr-switch
FRAME-RELAY/fr-switch read

admin> set active = yes

admin> set nailed-up-group = 999

admin> write
FRAME-RELAY/fr-switch written
```

The following commands configure the physical interface, in this example, an OC3-ATM interface:

```
admin> read oc3-atm {1 3 1}
OC3-ATM/{ shelf-1 slot-3 1 } read

admin> set name = atm-switch

admin> set enabled = yes

admin> set line nailed-group = 111

admin> write
OC3-ATM/{ shelf-1 slot-3 1 } written
```

The following commands specify a transparent-mode circuit between the Frame Relay and ATM interfaces:

```
admin> new conn fr-endpoint
CONNECTION/fr-endpoint read

admin> set active = yes

admin> set encapsulation-protocol = frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set telco-options call-type = ft1

admin> set fr-options frame-relay-profile = fr-switch

admin> set fr-options dlci = 100

admin> set fr-options circuit-name = atmfr-1

admin> write
CONNECTION/fr-endpoint written

admin> new conn atm-endpoint
CONNECTION/atm-endpoint read

admin> set active = yes

admin> set encapsulation-protocol = atm-frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set fr-options circuit-name = atmfr-1

admin> set telco-options call-type = ft1

admin> set telco-options nailed-groups = 111

admin> set atm-options vpi = 100

admin> set atm-options vci = 132

admin> set atm-options fr-08-mode = transparent

admin> write
CONNECTION/atm-endpoint written
```

Using RADIUS profiles

The following `frdlink` pseudo-user profile defines the data link to the Frame Relay switch:

```
frdlink-sys-1 Password = "ascend"
   Service-Type = Dialout-Framed-User,
   Ascend-FR-Profile-Name = "fr-switch",
   Ascend-Call-Type = Nailed,
   Ascend-FR-Type = Ascend-FR-NNI,
   Ascend-FR-Nailed-Grp = 999
```

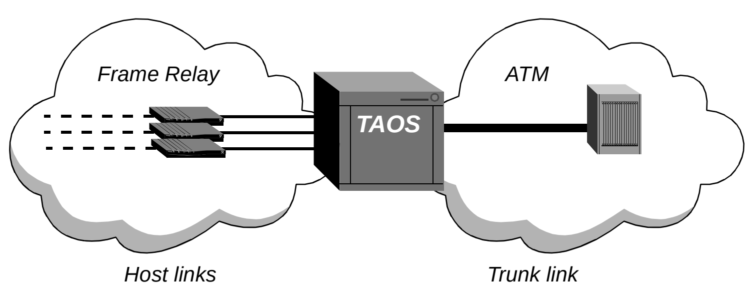
The physical interface is configured in a local profile, as shown in the "Using local profiles" section. The next set of profiles specifies the circuit between the Frame Relay and ATM interfaces:

```
permconn-sys-1 Password = "ascend"
   Service-Type = Dialout-Framed-User,
   User-Name = "fr-endpoint",
   Framed-Protocol = FR-CIR,
   Ascend-Route-IP = Route-IP-No,
   Ascend-FR-DLCI = 100,
   Ascend-FR-Profile-Name = "fr-switch",
   Ascend-FR-Circuit-Name = "atmfr-1"

permconn-sys-2 Password = "ascend"
   Service-Type = Dialout-Framed-User,
   User-Name = "atm-endpoint",
   Framed-Protocol = ATM-FR-CIR,
   Ascend-Route-IP = Route-IP-No,
   Ascend-Group = "111",
   Ascend-ATM-Vpi = 100,
   Ascend-ATM-Vci = 132,
   Ascend-FR-Circuit-Name = "atmfr-1",
   Ascend-FR-08-Mode = 1
```

ATM-Frame Relay virtual channel trunking

Unlike standard ATM-Frame Relay circuits, which always have two end points (1-to-1 circuits), virtual channel trunking allows *N*-to-1 circuits. With virtual channel trunking, a circuit can have more than two end points, as long as multiple end points are designated as host links and only one end point is designated as a trunk link. The system aggregates traffic from multiple host links onto one trunk link, creating an *N*-to-1 circuit, as shown in Figure 5-3.

Figure 5-3. N-to-1 circuit between multiple Frame Relay hosts and an ATM trunk



With virtual channel trunking, the circuit end points can include multiple Frame Relay DLCI interfaces and an ATM VPI-VCI interface, as long as only one trunk link is specified.

When the system receives upstream traffic from a host link, it learns the host's media access control (MAC) address and then forwards the data to the trunk-link interface. When the system receives downstream traffic from the trunk link, it uses the destination MAC address to transmit the packets on the appropriate host link.

Current limitations of virtual channel trunking

In the current software version, the virtual channel trunking implementation is subject to the following limitations:

- Only one ATM end point can be defined per circuit.
- Broadcast and multicast packets from the trunk link are not forwarded to the host links of the circuit.
- Packets from the individual host links are not forwarded to the other host links.

Overview of Connection profile settings for virtual channel trunking

Following are the relevant parameters, shown with default values, for configuring ATM-Frame Relay virtual channel trunking:

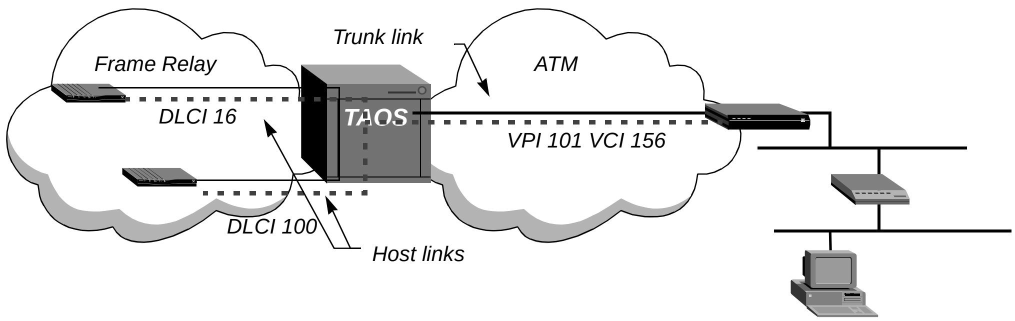
```
[in CONNECTION/"":fr-options]
circuit-name = ""
fr-link-type = transparent-link
```

Parameter	Specifies
Circuit-Name	Circuit name (up to 16 characters). The other end point(s) of a circuit must specify the same circuit name.
FR-Link-Type	Type of link for the circuit end point. Valid values are `transparent-link` (the default), `host-link`, and `trunk-link`. A transparent-link circuit is a 1-to-1 circuit. It requires two end points that specify the same circuit name and the `transparent-link` type. If only one end point is specified, data received on the specified DLCI is dropped. If more than two transparent-link end points are specified with the same circuit name, only two of the profiles are used to form a circuit. Virtual channel trunking allows an *N*-to-1 circuit. It can have more than two end points that specify the same circuit name, as long as multiple end points specify the `host-link` type and only one end point specifies the `trunk-link` type.

Typical virtual channel trunking configuration

In the following example, two Frame Relay hosts are switched to an ATM trunk link, as shown in Figure 5-4.

Figure 5-4. Circuit using virtual channel trunking



The example commands do not include data link or physical link configurations. For details on Frame Relay data links, see the *APX 8000/MAX TNT Frame Relay Configuration Guide*. For information about physical links, see Chapter 2, "Physical Interface Considerations," or the *APX 8000/MAX TNT Physical Interface Configuration Guide*.

The following commands configure the Connection profile for the ATM trunk link, where the nailed group is configured on an ATM interface:

```
admin> new conn atm-trunk1
CONNECTION/atm-trunk1 read

admin> set active = yes

admin> set encapsulation-protocol = atm-frame-relay-circuit

admin> set telco-options call-type = ft1

admin> set telco-options nailed-groups = 111

admin> set ip-options ip-routing-enabled = no

admin> set fr-options circuit-name = vtrunk-cir1

admin> set fr-options fr-link-type = trunk-link

admin> set atm-options vpi = 101

admin> set atm-options vci = 156

admin> write
CONNECTION/atm-trunk1 written
```

The following commands configure the Connection profile for the first Frame Relay host link:

```
admin> read conn frhost-1
CONNECTION/frhost-1 read

admin> set active = yes

admin> set encapsulation-protocol = frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set telco-options call-type = ft1

admin> set fr-options frame-relay-profile = ct1.8-fr
```

```
admin> set fr-options dlci = 16

admin> set fr-options circuit-name = vtrunk-cir1

admin> set fr-options fr-link-type = host-link

admin> write
CONNECTION/frhost-1 written
```

The following commands configure the Connection profile for the second Frame Relay host link:

```
admin> read conn frhost-2
CONNECTION/frhost-2 read

admin> set active = yes

admin> set encapsulation-protocol = frame-relay-circuit

admin> set ip-options ip-routing-enabled = no

admin> set telco-options call-type = ft1

admin> set fr-options frame-relay-profile = ut1.3-fr

admin> set fr-options dlci = 100

admin> set fr-options circuit-name = vtrunk-cir1

admin> set fr-options fr-link-type = host-link

admin> write
CONNECTION/frhost-2 written
```

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