Vanguard Managed Solutions

Vanguard Applications Ware
IP and LAN Feature Protocols

7300 Series T3/E3 ATM

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Chapter 1
Introduction to T3/E3 Asynchronous Transfer Mode (ATM)

Overview

Introduction

This chapter describes the T3/E3 Asynchronous Transfer Mode (ATM) feature for the Vanguard 7300 Series platform.

About T3/E3 ATM

T3/E3 ATM is a cell-switching and multiplexing protocol. It combines the capacity and constant transmission delay aspects of circuit switching with the flexibility and efficiency of packet switching. It allows for scalability in bandwidth up to megabits per second.

T3/E3 ATM provides fast and effective transmission of mixed media traffic. This is due, in part, to these ATM characteristics:

- Fixed cell size
- Faster switching of cells
- Built-in QoS support
- Traffic integration capabilities
- Dynamic Bandwidth Allocation

Networks transporting converged voice, data, and video traffic require all of these characteristics. These characteristics make T3/E3 ATM a perfect choice for transporting existing LAN traffic, such as Ethernet and Token Ring, and multiple Layer-3 protocol traffic, such as IP and IPX. Consequently, the inter-working of these protocols over ATM is critical to the efficiency of these networks.

Supplemental Documentation

For related and supplemental documentation, please refer to the Vanguard Applications Ware documentation web page at:

`http://www.vanguardms.com/documentation`

To fully understand Vanguard Managed Solutions' ATM implementation, refer to these specific documents:

- *Command Line Interface Feature Protocol Manual* (Part Number T0106-09).
- *Bandwidth Management Basics Guide* (Part Number T0108).
- *SNMP/MIB Management Feature Protocol Manual* (Part Number T0106-04).
- *Asynchronous Transfer Mode (ATM) Manual* (Part Number T0100-11).

Asynchronous Transfer Mode (ATM)

Introduction

This section provides background information on the various components that make up ATM. It is intended for use as a primer before understanding the ways in which Vanguard Managed Solutions has implemented this transport protocol.

■ **Note**

Specific areas of the Vanguard Managed Solutions implementation are referenced later in this manual.

ATM Cell Structure

ATM is a technology based on switching of fixed length cells. These cells are created by segmenting larger data frames so that the data fits into the data area, or payload, of multiple ATM cells. In ATM, each cell is fixed at 53 bytes with the payload occupying 48 bytes and the cell header occupying the remaining 5 bytes. This is illustrated in Figure 1-1.

It is important to realize that even if there is a payload of only one data byte needing transport, the ATM cell is always going to be 53 bytes long.

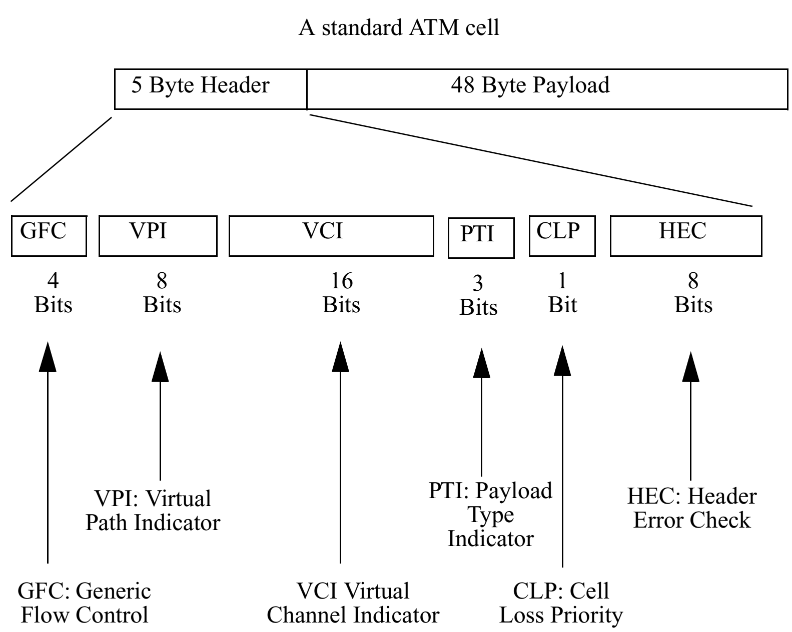


Figure 1-1. ATM Cell Construction at the User-Network Interface (UNI)

The use of short fixed cells simplifies the demand on switching hardware. This results in higher speeds and reduced transit delay in multi-node networks. Smaller cells are handled much more efficiently in hardware queues. The smaller, equally sized cells reduce the transit delay variations typically encountered when using variable length frames found, for example, in Frame Relay frames.

Because only the 5 byte header is checked for errors, ATM does not provide link level error recovery. Higher layer protocols (based on the OSI model) are responsible for payload error checking.

This table describes the components of the standard ATM cell header as shown in Figure 1-1:

Field	**Description**
Generic Flow Control	The four bits making up the GFC field is used to control the flow of cells between a user and an access switch.
Virtual Path Identifier	The eight bit Virtual Path Identifier (VPI) field is used in conjunction with the Virtual Channel Identifier (VCI) field to identify a cell’s next destination as it transits through other ATM switches towards its final destination.
Virtual Channel Identifier	The 16 bit Virtual Channel Identifier (VCI) field is used in conjunction with the VPI field to identify a cell’s next destination as it transits through other ATM switches towards its final destination.
Payload Type Indicator	This three bit field indicates whether a cell contains user data or maintenance traffic (such as management or congestion information.)
Cell Loss Priority	This one bit flag identifies whether the cell meets the requirements of the traffic contract. For example, it does not exceed the sustained cell rate of a variable bit rate connection for longer than the maximum burst size. The condition of this bit can determine what action an ATM switch takes on the cell when network congestion occurs. • CLP = 0: The cell is less likely to be discarded during network congestion. • CLP = 1: The cell is more likely to be discarded if the network becomes congested.
Header Error Control	This control field is used for detection and, if possible, correction of single bit errors found in the cell header.

ATM Adaptation Layers

The ATM Adaptation Layer (AAL) converts data frames into the ATM payload-header cell structure shown in Figure 1-1. The AAL is divided into two separate levels. The upper level is used to converge or adapt data into a form that is suitable for the lower level to convert into cells. For example, in the case of AAL5, the upper level is used to add enough padding to the data frame, so as to format the data into as an integral number of 48 bytes including AAL control fields. A second level is used to segment and reassemble the data between its format as converged data and its format as the payload of one or more ATM 53 byte cells. This is known as Segmentation and Reassembly (SAR). Different AALs support the various requirements of different data types. There are four distinct AALs:

- AAL1: Used by applications that need a Circuit Emulation Service (CES) in conjunction with constant bit rate (CBR). These applications are generally time-sensitive and require extensive end-to-end timing control. An example of this is PCM encoded voice traffic.
- AAL2: Used by multimedia applications that use some form of compression that allows variable bit rates (VBR). Even though the AAL2 data is compressed, there is still a need for end-to-end timing.
- AAL3/4: Used for transport of both connection less and connection-oriented data. This AAL has IEEE 802.6 compatibility, used by SMDS, which significantly increases cell overhead beyond what is supported in AAL5.

■ **Note**

For more information on SMDS, refer to the *Switched Multimegabit Data Service Manual* (Part Number T0103-08).

- AAL5: This is the preferred AAL for packet-oriented data transport. It is connection-oriented, virtually avoids corrupted data delivery, and adds a minimum of cell overhead. For details on how Vanguard Managed Solutions has implemented AAL5, refer to the “ATM Adaptation Layer 5 (AAL5)” section in Chapter 2.

ATM Traffic Management

Introduction

ATM networks implement several different traffic and congestion control mechanisms, collectively referred to as traffic management, to guarantee the network performance required in new and existing network connections.

Traffic management lets ATM networks deliver:

- Quality of Service (QoS) for individual connections.
- Protection against congestion conditions that result in performance degradation.
- Network resource optimization for new ATM connections.

Traffic Management in an ATM Network

The primary goal of ATM traffic management is to avoid congestion: a state where network conditions prohibit network components from meeting negotiated levels of service. ATM traffic can be unpredictable and multiple network nodes always vie for the same network resources. ATM allows data recipients to be notified whenever cells transiting a network experience congestion. Using mechanisms at higher OSI levels, these recipients can notify the senders of data to reduce the rate at which data is transmitted whenever a configured congestion threshold point is reached. In cases of severe network congestion, the network may discard cells. Usually a discard policy is implanted in the network to fairly and intelligently discard cells.

Traffic management in an ATM network is divided into two specific areas:

- Traffic Control: A set of actions configured into the network to avoid congestion conditions.
- Congestion Control: A set of actions configured into the network to minimize the amount of congestion and the duration that the network experiences congestion.

In an ATM network, traffic management:

- Maximizes use of available bandwidth to achieve desired network performance.
- Supports multiple traffic types at varying speeds.
- Satisfies the connection-based QoS requirements of multiple types of traffic.
- Minimizes the reliance on AAL and higher-layer traffic management schemes to reduce congestion.

Example

ATM can support different types of applications (video, voice, data, or any combination of the three) over the same physical network. This is beneficial because there can be significant variance in network loading.

E-mail applications for example, place no limitations on the time it takes for a message to reach its recipients. This application works properly despite the fact that an insignificant amount of network resources (bandwidth) have to be allocated.

Real-time video conferencing is quite different. This application can require vast amounts of bandwidth though the actual bandwidth in use varies from moment to moment. The transit time for cells containing digitized video conferencing data must be extremely short. Additionally, video conferencing applications do not work well when there is a significant delay variation in cells arriving at their destination. The network must have strict demands on it to ensure that a real-time video conferencing application operates correctly.

Quality of Service

Quality of Service (QoS) is a measurement of the delay and the dependability of a specific connection. QoS allocates network resources when a connection is used by traffic management to ensure that the network performance objectives are met. Six parameters must be specified, the first three of which can be negotiated at connection setup time (or when a PVC is provisioned at subscription):

- Peak-to-Peak CDV (Cell Delay Variation): Specifies any acceptable variation in cell transfer delay such as jitter.
- Maximum cell transfer delay (maxCTD): Specifies an acceptable end-to-end cell transfer delay.
- Cell Loss Ratio (CLR): Specifies an acceptable number of lost cells relative to the total number of transmitted cells.

The remaining three are:

- Cell Error Ratio (CER): Identifies the number of errored cells/(successfully transmitted cells+errored cells).
- Severely Errored Cell Block Ratio (SECBR): Identifies the number of severely errored cell blocks/total transmitted cell blocks.
- Cell Misinsertion Rate (CMR). Identifies the number of mis-inserted cells/ time interval.

Service Categories

There are five ATM service categories relating to Traffic Management and QoS:

- Constant Bit Rate (CBR).
- Unspecified Bit Rate (UBR).
- Variable Bit Rate-real time (VBR-rt).
- Variable Bit Rate-non-real time (VBR-nrt).
- Available Bit Rate (ABR).

■Note

Currently, the Vanguard Managed Solutions implementation of ATM does not support ABR.

For each traffic category there are corresponding traffic parameters that characterize the traffic flow. The following table summarizes the traffic parameters that are specified for a given traffic category:

Traffic Parameter	Traffic Category				
	CBR	VBR-rt	VBR-nrt	UBR	ABR
Peak Cell Rate (PCR)	√	√	√	N/A	√
Sustained Cell Rate (SCR)	N/A	√	√	N/A	N/A
Maximum Burst Size (MBS)	N/A	√	√	N/A	N/A
Minimum Cell Rate (MCR)	N/A	N/A	N/A	N/A	√

Constant Bit Rate (CBR)

Applications and connections requiring a constant amount of bandwidth use the Constant Bit Rate (CBR) category. The bandwidth and resources available on a CBR connection are fixed at the Peak Cell Rate (PCR) for as long as the connection is established. While required when cell transmission is sustained at the PCR, the Constant Bit Rate may become inefficient when the cell transmission rate falls below the PCR.

CBR is used in Circuit Emulation Service (CES) and it is useful for supporting real-time applications requiring very short network delay and low cell delay variation.

Variable Bit Rate real-time (VBR-rt)

Applications and connections requiring very short and tightly controlled network delay and CDV and having variable bandwidth requirements, use the Variable Bit Rate real-time (VBR-rt) service.

In the VBR-rt service, cells can be bursty (up to a maximum of the Peak Cell Rate) over short periods of time. On average though, the Sustained Cell Rate (SCR) is met for the duration of the connection. Cells exceeding the maximum Cell Transfer Delay (max CTD) do have impact on applications using VBR-rt. Cell input rate variation allows multiple VBR-rt sources to be statistically multiplexed, over one physical connection, to maximize available network resources.

Variable Bit Rate non-real-time (VBR-nrt)

Applications and connections that are insensitive to network delay and have bandwidth requirements that vary, such as SNA, use the Variable Bit Rate non-real-time (VBR-nrt) service. These applications are typically much more sensitive to CLR.

Cell input rate variation allows multiple VBR-nrt sources to be statistically multiplexed over one physical connection to maximize available network resources.

Unspecified Bit Rate (UBR)

Unspecified Bit Rate services are used strictly for applications and connections that have no requirements for service guarantees (are more tolerant of delays and losses). Traffic management or QoS parameters are not applied on a UBR connection and traffic contracts do not typically exist.

UBR services can be used at link access speeds when the necessary network resources are available. However, cells transmitted have the highest risk of being lost in the event of network congestion or failure since this is a best effort service. When this occurs, a higher layer protocol such as TCP attempts to recover the lost cells.

UBR is commonly used with LAN application that transfer data over an ATM network because it does not require initial information on either QoS or traffic rates.

Available Bit Rate (ABR)

Available Bit Rate (ABR) service is used in for applications that are, like UBR, more tolerant of delays and losses than other services. These applications have cell input rates that vary depending on network feedback. This information is available from Resource Management (RM) cells that indicate the current network status, including congestion status. The ABR uses this information to regulate the cell input rate to the network.

ATM Traffic Management Mechanisms

To provide optimized network resources, and avoid or limit congestion, various traffic management mechanisms are used. These include:

- Connection Admission Control (CAC).
- Usage Parameter Control (UPC).
- Selective Cell Discard.
- Traffic Shaping.
- Explicit Forward Congestion Indication (EFCI).
- Resource Management using Virtual Paths.
- Frame Discard.
- Generic Flow Control.

Connection Admission Control (CAC)

Connection Admission Control (CAC) identifies the traffic and QoS parameters for a specific connection, and then decides if that connection can be established or if it should be rejected. If sufficient bandwidth is available, the QoS requirements can be met, and there is no impact to other existing connections, the connection request is approved. However, if any one of these conditions is not met, the connection request fails.

CAC determines which traffic parameters are required by the UPC function and allocates network resources accordingly.

Usage Parameter Control (UPC)

Usage Parameter Control (UPC) monitors and controls traffic. This is sometimes known as Traffic Policing because it polices traffic as it enters the ATM network. UPC enforces all traffic contracts, and tags (if the CLP bit is set to 0) or discards (if the CLP bit is set to 1) cells as necessary.

Selective Cell Discard

The Selective Cell Discard function operates in a congested network environment. It discards cells that have the CLP bit set to 1, that is, the cells do not meet the requirements of a traffic contract as enforced by the UPC. This protects those cells that met the requirements of an existing traffic contract and have their CLP bit set to zero (0).

■ **Note**

Refer to the “ATM Cell Structure” section on page 1-2 for additional information.

Traffic Shaping

Traffic shaping is used to modify ATM cell traffic to optimize network efficiency while maintaining all required QoS functionality. Traffic shaping is typically an optional function that can be performed anywhere within an ATM network. For more details on traffic shaping for IP Voice and data, refer to the “Considerations for Traffic Shaping” section on page 1-11.

Explicit Forward Congestion Indication (EFCI)

The Explicit Forward Congestion Indication (EFCI) is found in one of the two bits that make up the Payload Type Indicator field in the ATM cell header.

This bit may be turned on (set to 1) when a cell transits a network containing congested links. This indicates that congestion exists somewhere in the network but does not identify where. This indicator should be used by the receiving node to notify the transmitting node to reduce the data transmission rate. This is analogous to the FECN bit in frame relay

Resource Management Using Virtual Paths

Virtual paths allow effective network resource management by maximizing the allocation of resources on that network. Since one Virtual Path contains multiple Virtual Channels, managing the Virtual paths simplifies traffic management.

Frame Discard

Frame discard (dropping cells) is how ATM deals with network congestion. If cells are derived from a data frame using AAL5 procedures, then when one cell of the frame is dropped, all subsequent cells are dropped until the ATM switch receives the end-of-frame indicator in the last associated cell.

Generic Flow Control

The first four bits in an ATM cell indicate either controlled or uncontrolled traffic.

- Controlled traffic has a congestion control function applied.
- Uncontrolled traffic, which is the most popular implementation, relies on external congestion control.

■ Note

Generic Flow Control is rarely used.

Traffic Contract

When an ATM connection request is created by either signaling (SVC) or subscription (PVC) an implicit traffic contract is created. This contract indicates that the ATM network supports the connection, and the associated QoS requirements, for as long as the subscriber stays within the agreed upon parameter values.

For a given connection, the following table shows the relationship between the various service categories, traffic parameters and QoS parameters:

<table>
<tr><th rowspan="5">Traffic Characteristics</th><th rowspan="2">Attributes</th><th colspan="5">ATM Service Category</th></tr>
<tr><th>CBR</th><th>VBR-rt</th><th>VBR-nrt</th><th>UBR</th><th>ABR</th></tr>
<tr><td>PCR</td><td colspan="5">Specified</td></tr>
<tr><td>SCR, MBS</td><td>N/A</td><td colspan="2">Specified</td><td colspan="2">N/A</td></tr>
<tr><td>MCR</td><td colspan="4">N/A</td><td>Specified</td></tr>
<tr><th rowspan="3">QoS Characteristics</th><td>CDV</td><td colspan="2">Specified</td><td colspan="3">N/A</td></tr>
<tr><td>Max CTD</td><td colspan="2">Specified</td><td colspan="3">N/A</td></tr>
<tr><td>CLR</td><td colspan="3">Specified</td><td>N/A</td><td>Low</td></tr>
</table>

Considerations for Traffic Shaping

Introduction

This section describes several issues to take into consideration when traffic shaping is used on a 7300 T3/E3 ATM port.

Constant Bit Rate (CBR) Configuration

When configuring CBR traffic shaping stations on an T3/E3 ATM port, there are certain effects to consider. This is especially important if the peak cell rate (PCR) of a CBR station(s) is configured to be less than the data rate required by the data flow for sustained periods of time. When a CBR station is configured as such, the relatively low transmission rate of the CBR station might have these results:

- Transmission of buffered data can consume all available buffers causing new data to be discarded.
- Since the buffer pool is consumed, data transmitted to the port on all channels is discarded.
- Any remaining bandwidth for Unspecified Bit Rate (UBR) traffic might also be less than expected. This is due to the finite number of buffers in the ATM hardware shared by all channels.

■ **Note**

Constant Bit Rate ATM stations can become deactivated if the total aggregate PCR does not exceed the link speed. This occurs because the CBR scheduling is very rigid and has to fit into the transmit scheduling table in a certain way. Even though it appears that bandwidth is available, if it does not fit in the scheduling table, the station is not created. To increase the chances of fitting into the scheduling table, the larger CBR entries (PCR rate) should be created first. To workaround this issue, use VBR stations.

Avoiding Bandwidth Issues

To avoid bandwidth issues, match the traffic shaping with the flow requirements. In some circumstances, the AAM port is an ATM uplink that supports a mix of voice and data.

Avoiding Congestion Issues

To avoid congestion issues and maintain Quality of Service (QoS) in the overall design, place the voice traffic on one Private Virtual Circuit (PVC) and the data on a different PVC. To ensure the best quality voice, configure the voice PVC for CBR. For the data PVC, either CBR or UBR can be used. The CBR subscription provides Cell Loss Ratio (CLR) and delay characteristics.

CBR Shaping of the Data Stream

If the network is enforcing Usage Parameter Control (UPC) policing the amount of data sent to the network, then typically there is a requirement for the use of CBR shaping of the data stream. When the data PVC is configured for CBR shaping with a certain Peak Cell Rate (PCR) and there is a possibility of the data flow exceeding the PCR for sustained periods of time, then it is required to restrict the flow within the 7300 node. This can be done by introducing bandwidth management using QoS facilities of the node. For more information on QoS, refer to the *Quality of Service Manual* (Part Number T0100-10).

Chapter 2
T3/E3 ATM Implementation

Overview

Introduction

This chapter describes the current implementation of the T3/E3 Asynchronous Transfer Mode (ATM) feature protocol for the Vanguard 7300 Series platform.

T3/E3 ATM Features

The Vanguard Managed Solutions implementation of T3/E3 ATM offers these features:

- Supports both T3 (up to 44.736 Mbps) and E3 interfaces (up to 34.368 Mbps).
- ATM Adaptation Layer 5 (AAL5).
- RFC 1483 support. Encapsulation is controlled by the WAN Adapter:
  - RFC 1483 LLC SNAP
  - RFC 1483 VC Multiplexing
- Permanent Virtual Circuits (PVCs). Up to 4000 PVCs are supported by the VanguardMS implementation of ATM. A WAN Adapter LCON connects directly to an ATM Station to create an ATM Virtual Circuit.
- Legacy protocol traffic encapsulated using SoTCP and transmitted over ATM using RFC 1483 encapsulation.
- RFC 1577. Inverse Address Resolution Protocol, known as InARP, for PVCs is supported and controlled at the LCON.
- Quality of Service. Prioritization of traffic across Virtual Channel Connections (VCCs), using CBR, UBR, and VBR is based on available traffic management and standard ATM QoS functions.
- FRF.8 Transparent Mode. Frame Relay DLCI channel is mapped one for one to an ATM VCC.
- SNMP Agent Access Function. The SNMP Agent Access Function of the T3/E3 ports provide managed object RFC 2496, which is mapped to CMEM records and statistical data in the T3/E3 port module.
- Fast Relay Services Termination (FRST). This feature provides Frame Relay services across a network using ATM with a Frame Relay FRI port.

Product Support

Vanguard Managed Solutions’ implementation of T3/E3 ATM is supported on the Vanguard 7300 Series products only.

■Note
Refer to the *Vanguard 7300 Series Installation Manual* (Part Number T0185) for related information on installing the T3/E3 ATM Module.

T3/E3 ATM Software Implementation

Introduction

This section describes the 7300 Series T3/E3 ATM software implementation including:

- ATM Adaptation Layer 5 (AAL5)
- Frame Relay to ATM Service Interworking Environment
- Frame Relay Services Termination (FRST) Module
- Operations, Administration, and Maintenance (OAM) Flows
- Service Categorization
- Quality of Service (QoS)
- IP Encapsulation (RFC 1483 and RFC 1577)

ATM Adaptation Layer 5 (AAL5)

Introduction

ATM Adaptation Layer 5 (AAL5) is the most common AAL used for packet data. It supports connection oriented transfer of IP data over ATM. Data frames that are processed by AAL5 are called Protocol Data Units (PDUs)

Convergence Sublayer

AAL5 uses a convergence sublayer to augment PDUs with transmission error detection and end-to-end SAR information. The convergence sublayer also adds sufficient padding to make that augmented PDU an integral number of 48 bytes.

Segmentation

Additionally, AAL5 uses segmentation to manipulate the original data frames prior to transport across the ATM network (see Figure 2-1). First it renames data frames (carrying any type of data including voice or video) as PDUs. Then enough padding is inserted to ensure that, after the ATM trailer is added, the total number of bytes is evenly divisible by 48. The resultant PDU (with trailer) is divided into multiple 48 byte ATM cell payloads and a five byte ATM cell header is added to each payload. This results in the standard 53 byte ATM cell.

The first bit of the Payload Type Indicator field in the cell header, and the Length field in the PDU trailer, are used to ensure that the receiving node knows how to reassemble the cells back into the original frame.

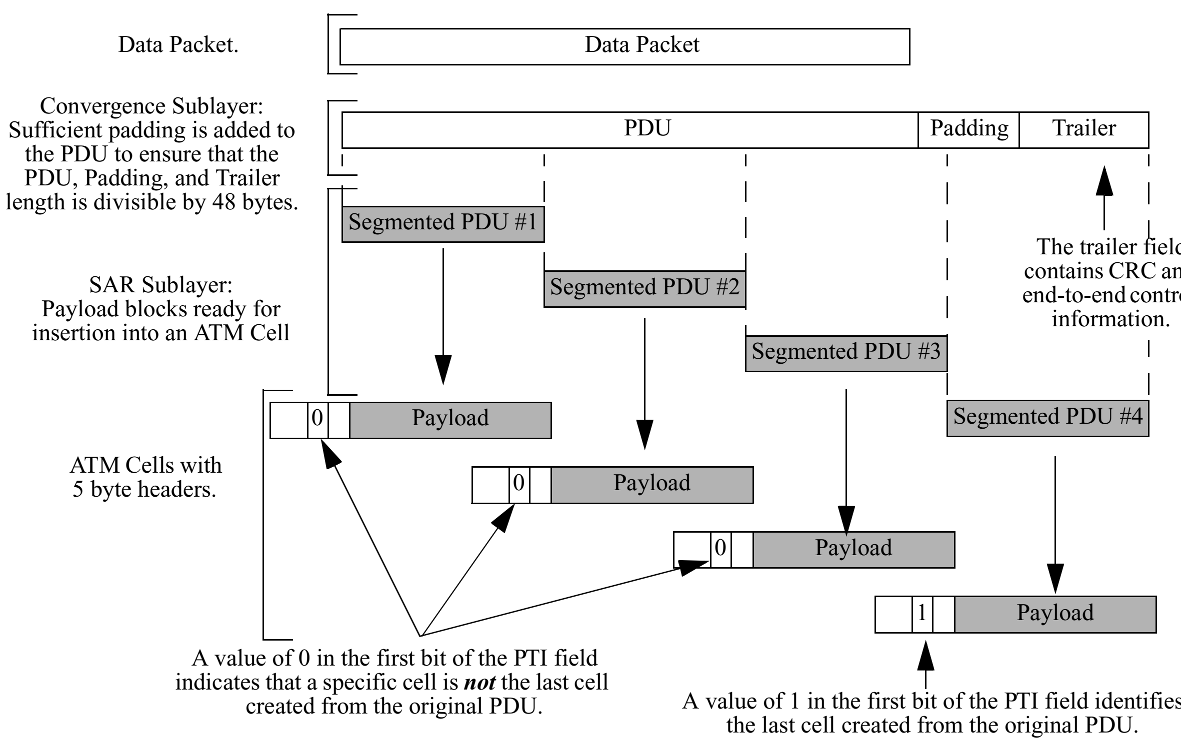


Figure 2-1. AAL5 Segmentation and Reassembly (SAR)

Reassembling the PDU

When the cells reach their final destination, the payload of each cell is extracted and assembled into a frame that is transmitted to the user device. When the cells are initially created, the first bit in the Payload Type Indicator field (see Figure 2-2) is set to 0. However, this does not apply to the last cell carrying the payload of the original frame. When the last cell is received, it contains the Length and CRC fields of the PDU trailer.

The last cell contains the remaining frame payload, padding (if needed), and the UU and CPI fields of the PDU trailer. The Length Field in the PDU trailer is used, by the receiving node, to discard the padding and preserve all of the data. The Length field in the PDU trailer (see Figure 2-2) identifies the amount of actual data in the PDU. This lets the receiving node calculate the amount of padding that was added, and what must subsequently be discarded.

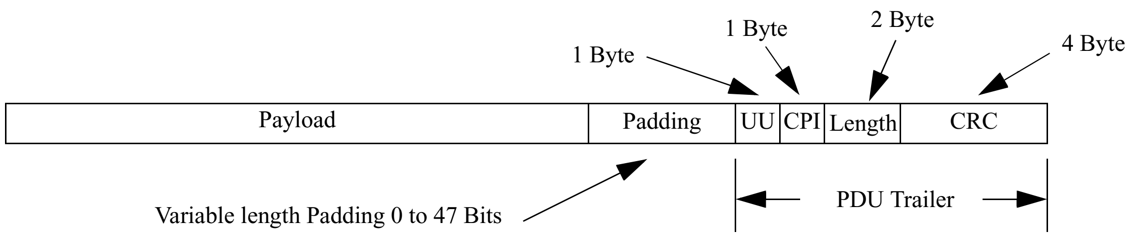


Figure 2-2. AAL5 PDU Reassembly

Frame Relay to ATM Service Interworking Environment

Introduction

Frame Relay to ATM service interworking takes place when the Frame Relay DLCI channel is mapped one to one to an ATM VCC, both are PVC. These different connection types are transparent to both the ATM and Frame Relay end-user. The interworking network provides conversion between ATM and Frame Relay.

Service Interworking

FRF.8 is the Frame Relay Forum Implementation Agreement for Frame Relay to ATM service interworking. Service interworking has two modes, translation and transparent. In these modes of operation, the interworking function also transfers the congestion status of a packet and the discard status of packet.

Translational Mode

This can be achieved by enabling ATM on the central router (A in Figure 2-3) and configuring each of the virtual connections (LCONs) connecting to branch nodes B, C, D, and E (in Figure 2-3) with RFC1483 encapsulation. The branch nodes use normal RFC1294 encapsulation on all virtual connections to the central site.

An IWF function exits between the ATM and Frame Relay networks. This provides translation of encapsulation headers (RFC1483 to/from RFC1294) and the ARP packets (ARP to/from ATMARP) exchanged on the virtual connections between the central router and branch nodes.

Transparent Mode

This can be achieved by using an IWF function between the ATM and Frame Relay networks. Translation of Encapsulation headers (RFC1483 to/from RFC1294) and ARP packets (ARP to/from ATMARP) is not provided in this example configuration. Both ends of the virtual connection between the central router and branch nodes must be configured with RFC1294 encapsulation to eliminate the need to translate the encapsulation header and ARP packets.

Service Interworking Example

Figure 2-3 shows an example of service interworking and how a central site connects to an ATM network, and multiple branch sites connect to a Frame Relay network. The necessary interworking, between the ATM and Frame Relay networks, is provided by an Inter-Working Function (IWF) that is generally offered by the network. Each end of the connection is unaware of the different link level protocols being used. In this example, the link level protocols are Frame Relay and ATM.

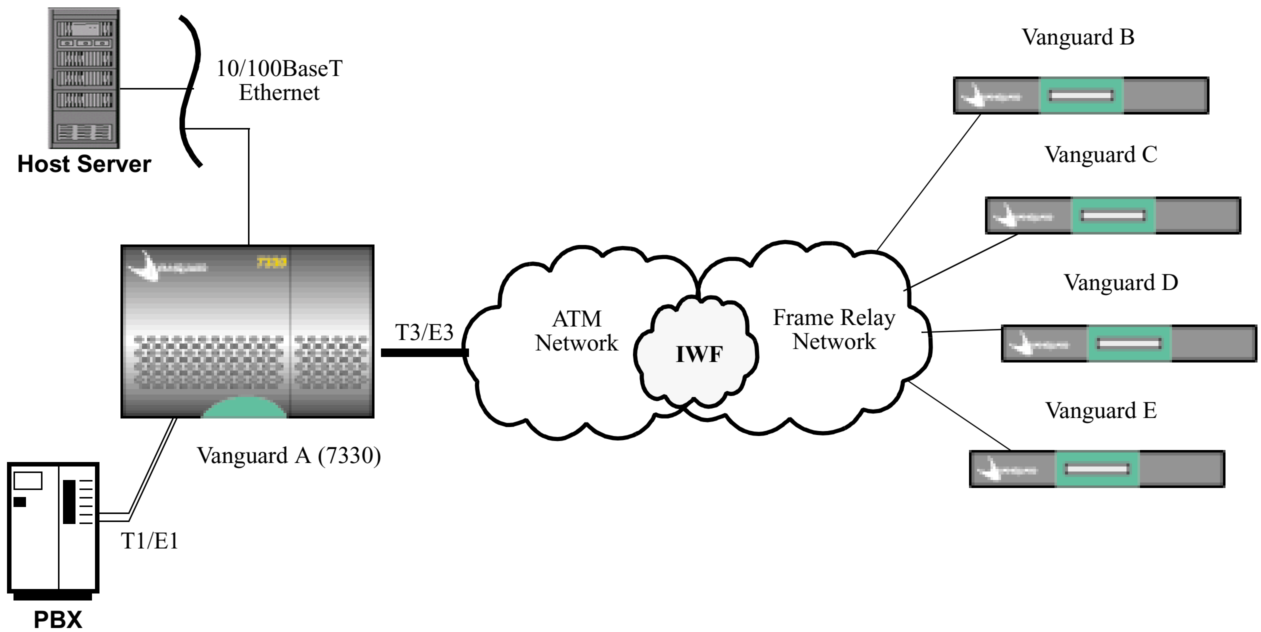


Figure 2-3. Service Interworking Example

■Note

The IWF can offer RFC 1483 or RFC 1490 Encapsulation Conversion.

Frame Relay Services Termination (FRST) Module

Introduction

When using Frame Relay to ATM service interworking, there are two proprietary functions that can mutually exist on a given virtual circuit. They are:

- FRI port operating in segmentation mode according to Vanguard Managed Solutions Segmentation Protocol (MSP) or, in some cases FRF.12.
- FRI station operating with X.25 encapsulation (Annex G). This includes Vanguard Managed Solutions proprietary Voice Relay.

Because these functions are proprietary, the network cannot translate or terminate them. The FRST module provides termination of both protocols when necessary. The FRST module is located in the node terminating ATM circuits, as shown in Figure 2-5 (Vanguard A).

FRST Module

For each AAM virtual circuit, a FRST circuit is attached to the AAM station in order to offer the required services on a data path basis. The service can be either FRI segmentation or Annex G, depending on the needs of the circuit. If the segmentation is not needed, it can be considered a null layer. The second layer Annex G/X.25, can be null.

If the second layer is null, the circuit continues to the WAN Adapter. If it is X.25, the X.25 protocol is terminated and the top side of the FRST circuit looks like an X.25 layer three interface to the rest of the node. If RFC1490 muliplexing is performed, then the muliplexing is offered for serial SNA and for WAN Adapter traffic.

Even though individual data paths through the FRST module are totally independent of each other, there can be cases where multiple data paths, with SAR procedures (either MSP or FRF.12) enabled, are routed to the same Frame Relay port on a remote node. In this case, the individual SAR layer instances need to be grouped together so that they can enter and exit SAR procedures collectively. The SAR instances that collect together in this manner are called an SAR Group.

For a given SAR group, any data path can force entry of the group into SAR procedures. The presence of voice traffic forces this dynamic change. All data paths must be free of voice traffic for the group to exit SAR procedures. Administrative procedures such as boot executed on an SAR group affects all data paths in that group.

Configuring the FRST Module

The FRST module is configured at the FRST data path level. A data path configuration specifies an SAR type and a multiplexor type in combination. It is illegal to configure a data path without at least a SAR or a muliplexor. These are the configurable items for Frame Relay to ATM:

- Individual FRST data path record: Specifies the SAR profile name and selects the multiplexing method by naming a X.25 or a RFC1490 profile. This is configured in the FRST Path Configuration Table.
- If applicable, the SAR Group for this record is also identified. This is configured in the SAR Profile Configuration Table.
- If the profile name of the multiplexor is not blank and not equal to the RFC1490 reserved name, then the name must agree with an X.25 profile corresponding to an Annex G station. This is configured in the X.25 Profile Configuration Table.

FRST Path Configuration Table

FRST Path Parameters

You can configure the Frame Relay Service Termination (FRST) Path Configuration Table parameters from:
Main Menu->Configure->FRST Path

SAR Profile Name

Range:	0 to 8 alphanumeric characters
Default:	SAR
Description:	Specifies the name of the SAR profile to use. If this parameter is blank, SAR is not used. ■ **Note** Use the space bar to blank the field. ■ **Note** Changes to this parameter require an FRST Path Boot to take effect.

X.25 Profile Name

Range:	0 to 8 alphanumeric characters
Default:	Annex G
Description:	Specifies the name of the X.25 profile to use. If this parameter is blank, X.25 is not used. ■ **Note** Use the space bar to blank the field. ■ **Note** Changes to this parameter require an FRST Path Boot to take effect.

SAR Profile Configuration Table

SAR Profile Parameters

You can configure the SAR Profile Configuration Table parameters from the **Main Menu->Configure->SAR Profile**.

Profile Name

Range:	0 to 8 alphanumeric characters
Default:	SAR
Description:	References the name of the SAR profile in use. MSPSAR is a predefined profile name. ■ **Note** Use the space bar to blank the field. ■ **Note** Changes to this parameter require an SAR Group Boot to take effect.

SAR Method

Range:	FRF.12, MSP, NONE
Default:	MSP
Description:	Specifies the SAR method. • FRF.12 - standard fragmentation • MSP - Vanguard Managed Solutions proprietary segmentation • NONE - fragmentation/segmentation is disabled ■ **Note** Changes to this parameter require an SAR Group Boot to take effect.

Segment Size When Voice is Present

Range:	32, 64, 128, 256, 512, 1024
Default:	64
Description:	Specifies data packets to be segmented into this maximum frame size when voice is active on this port. ■ **Note** Changes to this parameter require an SAR Group Boot to take effect.

Segment Size When Voice is Not Present

Range:	32, 64, 128, 256, 512, 1024, 2048, 4096, Disable
Default:	Disable
Description:	Specifies data packets to be segmented into this maximum frame size when voice is not active on this port. ■ **Note** The segmentation header is always present in the packet flow, even when disabled. ■ **Note** Changes to this parameter require an SAR Group Boot to take effect.

Group Name

Range:	0 to 8 alphanumeric characters
Default:	(blank)
Description:	Specifies to the name of the group belonging to the SAR instance. As a unit, SAR group members collectively enter and exit segmentation procedures according to the traffic flows across all group members. ■ **Note** Use the space bar to blank the field. ■ **Note** Changes to this parameter require an SAR Group Boot to take effect.

X.25 Profile Configuration Table

X.25 Profile Parameters

You can configure the X.25 Profile Configuration Table parameters from the **Main Menu->Configure->X.25 Profile**.

Any parameter title containing an asterisk (*) indicates that a Node boot must be performed if any changes to that parameter are to take effect.

Profile Name

Range:	0 to 8 alphanumeric characters
Default:	Annex G
Description:	References the name of the X.25 profile in use. DTE and DCE are predefined profile names. If this parameter is blank, X.25 is not used. ■ **Note** Use the space bar to blank the field.

Link Address

Range:	DTE, DCE, Negotiate
Default:	DCE
Description:	Sets the port's logical address to operate with the X.25 protocol, which dictates that a port's logical address must complement the logical address of the port on the other end of the link. • DTE - link to have logical DTE address (A) • DCE - link to have logical DCE address (B) • NEGOTIATE - link ends negotiate which end is DCE address (B)

*Number of PVC Channels

Range:	0 to 128
Default:	0
Description:	Specifies the maximum number of logical channels used for Permanent Virtual Circuits. The total number of PVC and SVC channels on a link should be as small as possible. PVC connections must be configured in the PVC Table.

*Starting PVC Channel Number

Range:	1 to 4095
Default:	1
Description:	The starting logical channel number for the Permanent Virtual Circuits on this link. ■ **Note** If the Number of PVC Channels = 0, this parameter is ignored.

*Number of SVC Channels

Range:	0 to 512
Default:	16
Description:	Specify the number of logical channels used in Two Way Switched Virtual Circuit (SVC) channels for this port. You can configure up to 4096 SVC channels per port. However, keep the number of configured PVC and SVC channels per port as small as possible. The total number of configured SVCs and PVCs combined can not exceed 4096. If you configure the maximum number of SVC channels on a port, set the Maximum Simultaneous Calls parameter on the corresponding Node record to zero (0) to support an unlimited number of calls, or enter the desired number of calls you expect to pass. ■ **Note** The number of SVCs configured per port on a node is limited by the mount of available RAM. Eight megabytes (MB) of RAM is required to support the maximum number of 4096 SVC channels on one port per node (four MB on-board memory and four MB SIMM).

*Starting SVC Channel Number

Range:	0 to 4095
Default:	1
Description:	Specifies the starting logical channel number for the Two Way SVCs on this link. ■ **Note** If the parameter Number of Two Way SVC Channels = 0, this parameter is ignored.

*Number of Voice SVC Channels

Range:	0 to 15
Default:	0
Description:	Specifies the number of logical channels used for Voice Switched Virtual Circuits. ■ **Note** The total number of PVC, One Way Incoming, One Way Outgoing, Two Way SVC, and Voice SVC channels should be kept as small as possible and consistent with the requirements of this port.

*Starting Voice SVC Channel Number

Range:	0 to 4095
Default:	1
Description:	Specifies the starting logical channel number for the Voice Switched Virtual Circuits on this link. ■ **Note** If the parameter *Number of Voice SVC Channels = 0, this parameter is ignored.

Initial Frame

Range:	NONE, SABM, DISC
Default:	SABM
Description:	Specifies the first frame the other end requires for link startup: • NONE: Do nothing (the other end starts) • SABM: Send SABM • DISC: Send DISC then SABM

T1 Transmission Retry Timer (1/10 sec)

Range:	1 to 254
Default:	30
Description:	Sets the T1 Retry Timer. • Set to a value less than the parameter T4 Poll Timer. • Avoid setting the value to less than 10. • If you use the DCP option, value on all INL or network links in the network should be the same. ■ **Note** Values are in tenths of a second: 30 = 3.0 seconds.

T4 Poll Timer

Range:	0, 10 to 255
Default:	40 (values are in tenths of a second: 40 = 4.0 seconds)
Description:	Sets the T4 Poll Timer. This parameter specifies how often an idle link is probed for assurance of a connection to the remote device. To disable this parameter, enter a value of 0. ■ **Note** Values are in tenths of a second: 40 = 4.0 seconds. ■ **Note** Set this parameter to a value greater than the parameter T1 Transmission Retry Timer.

N2 Transmission Tries

Range:	1 to 20
Default:	10
Description:	Specifies the maximum number of times a node attempts to complete a transmission.

Frame Sequence Counting

Range:	NORM, EXT
Default:	NORM
Description:	Specifies the type of frame-level sequence numbers the port uses: • NORM: Normal sequencing (Modulo 8) • EXT: Extended sequencing (Modulo 128) ■ **Note** Values must be the same for both ends of the link.

K Frame Window

Range:	1 to 15
Default:	7
Description:	Specifies the number of unacknowledged frames that can be outstanding at X.25 layer 2. • This parameter should be set relatively high when there is a high link delay to improve throughput. • Set this parameter to the same value for the devices on both ends of the link. • Set the parameter Frame Sequence Counting = EXT to select the values 8 to 15. ■ **Note** To use the extended X.25 Window Size (modulo 128): • Set the INL option to Disabled. • Set the T1 Retry Timer to a value larger than your network's round trip delay time. Configure the adjacent port on the node to the X25/Annex G port as a X25/Annex G port. This is not mandatory, but it should improve performance with extended Window sizes.

Packet Sequence Counting

Range:	NORM, EXT
Default:	NORM
Description:	Specifies the type of packet level sequence numbers that the port uses: • NORM: Normal sequencing (Modulo 8) • EXT: Extended sequencing (Modulo 128) ■ **Note** Values must be the same for both ends of the link.

W Packet Window

Range:	1 to 15
Default:	7
Description:	Specifies the default packet level window size (X.25 layer 3) when it is not negotiated for the individual call. **■Note** Values must be the same for both ends of the link. **■Note** Set the parameter Packet Sequence Counting = EXT to select the values 8 to 15. **■Note** To use the extended X.25 Window Size (modulo 128): • Set the INL option to Disabled. • Set the T1 Retry Timer to a value larger than your network's round trip delay time. **■Note** Configure the adjacent port on the node to the X25/Annex G port as a X25/Annex G port. This is not mandatory, but it should improve performance with extended Window sizes.

P Packet Size

Range:	128, 256, 512, 1024
Default:	128
Description:	Specifies the maximum default packet size (in bytes) for inbound and outbound calls on this X.25 link when packet size is not negotiated. **■Note** Values must be the same for both ends of the link.

Maximum Negotiated Packet Size

Range:	128, 256, 512, 1024
Default:	1024
Description:	Specifies the maximum negotiated packet size (in bytes) for inbound and outbound calls on this X.25 link.

Data Queue Upper Threshold

Range:	5 to 15
Default:	5
Description:	Specifies the maximum number of data packets a channel on this port queues for transmission before it invokes flow control to the attached channel. ■ **Note** When applications that use large data packets are considered, set this value to **15**. ■ **Note** To use the extended X.25 Window Size (modulo 128): • Set the INL option to Disabled. • Set the T1 Retry Timer to a value larger than your network's round trip delay time. ■ **Note** Configure the adjacent port on the node to the X25/Annex G port as a X25/Annex G port. This is not mandatory, but it should improve performance with extended Window sizes.

Data Queue Lower Threshold

Range:	0 to 4
Default:	0
Description:	Specifies the minimum number of data packets a channel on this port queues for transmission when it releases flow control to the attached channel. ■ **Note** When applications that use large data packets are considered, set this value to **4**. ■ **Note** To use the extended X.25 Window Size (modulo 128): • Set the INL option to Disabled. • Set the T1 Retry Timer to a value larger than your network's round trip delay time. • Configure the adjacent port on the node to the X25/Annex G port as a X25/Annex G port. This is not mandatory, but it should improve performance with extended Window sizes.

Restart Timer

Range:	5 to 255 (seconds)
Default:	180
Description:	Specifies the length of time, in seconds, the node waits before an unacknowledged restart request is sent again.

Reset Timer

Range:	5 to 255 (seconds)
Default:	180
Description:	Specifies the length of time, in seconds, the node S waits before an unacknowledged reset request is sent again.

Call Timer

Range:	5 to 255 (seconds)
Default:	200
Description:	Specifies the length of time, in seconds, the node waits for the response to a call request. A call will clear whenever this timer expires. After two clear requests, the channel is marked as being idle.

Clear Timer

Range:	5 to 255 (seconds)
Default:	180
Description:	Specifies the length of time, in seconds, the node waits before an unacknowledged clear request is sent again. After two clear requests, the channel is marked as being idle.

Facilities to Delete from Outbound Calls

Range:	NONE, THRO, NUI, CUG, PROP
Default:	NONE
Description:	Specifies the facilities (which can be summed) that are deleted from outbound calls: • NONE: No facilities deleted • THRO: Delete throughput class negotiation • NUI: Delete NUI • CUG: Delete CUG • PROP: Delete all Vanguard Managed Solutions defined proprietary facilities. **■Note** The facility is negotiated to the configured value, not the maximum value. **■Note** Use summing to combine several parameter values. For example, THRO+NUI.

Facilities to Add to Outbound Calls

Range:	NONE, REV, PACK, WIND
Default:	NONE
Description:	Specifies the facilities (which can be summed) that are added to outbound calls: • NONE: No facilities added • REV: Reverse Charging added • PACK: Packet Size negotiation added • WIND: Window Size negotiation added **■Note** Use summing to combine several parameter values. For example, WIND+PACK.

Facilities to Bar in Outbound Calls

Range:	NONE, REV, FAST, BCUG, DGRAM
Default:	NONE
Description:	Specifies the facilities that, if present in an outbound call, will cause the call to be cleared: • NONE: No facility barred • REV: Reverse Charging barred • FAST: Fast select barred • BCUG: Bilateral Closed User Group barred • DGRAM: Datagram barred **■ Note** Use summing to combine several parameter values.

Facilities to Bar in Inbound Calls

Range:	NONE, BCUG, DGRAM, REV
Default:	NONE
Description:	Specifies the facilities, if present in an inbound call, that clear the call: • NONE: No facility Blocked • BCUG: Bar Bilateral Closed User Group • DGRAM: Bar Datagram • REV: Bar Reverse Charging **■ Note** Use summing to combine several parameter values.

X.25 Options

Range:	NONE, 1980, NUI, PDN, CUD, IBAR, OBAR, CBCK, CUG, CAUSE, HOLD, NRST, BKUP, INL, INLA, DELAY, AP, GP, CNUI, CNGL, CINFO
Default:	NONE
Description:	Defines the X.25 port operating characteristics.
	NONE: No options are specified
	1980: The port is to operate with X.25/1980 implementation instead of 1984 or later versions. Post 1980 versions include changes that the 1980 version considers illegal or is incompatible with a particular implementation.

X.25 Options *(continued)*

Description: (Continued)	• NUI: An X.25 port validates an NUI facility for inbound calls. All inbound calls must have this facility present or the port clears them. If a call request successfully passes the NUI check, the NUI facility is stripped from the call request, which is then forwarded in the usual manner. If NUI is not selected, call requests with the NUI facility are forwarded with the facility intact.
	• Public Data Network (PDN): A port is connected to a PDN or non-Vanguard Managed Solutions router network using different addressing schemes. The port: • Selects PDN when these parameters are set to a value other than 0 (zero): – Number of Routing Digits in Call User Data. – Number of Prefix Address Digits Stripped from Outgoing Calls. – Number of Prefix Address Digits Stripped from incoming Calls. When PDN and CUD are selected, the network address and the Subaddress in the CUD: • For inbound calls: – Implement inbound called address translation using the Inbound Call Translation Table. • For outbound calls: – Implement outbound called address translation using the Outbound Call Translation Table. Or: – Strip the number of prefix digits specified in the port parameter Address Prefix Digits from the called address if no suitable entries exist in the Outbound Call Translation Table. PDN cannot be summed with INL.
	Call User Data (CUD): To specify that the subaddress for the call is carried in the call request's Call User Data (CUD) field.
	IBAR • Calls coming into the port are to be blocked. • Do not select IBAR and OBAR for a single port because they essentially disable the port; no status messages report this action.
	• Blocks calls leaving the port. • Do not select IBAR and OBAR for a single port because they essentially disable the port; no status messages report this action.

X.25 Options *(continued)*

Description: (Continued)	• CBCK Calls are to be routed back on the same link that received the call. The port number and address must be in the Routing Table.
	• CUG: Check CUG (Closed User Group) otherwise, call passes transparently.
	• CAUSE Passes cause codes in outbound packets. When not selected, cause codes are set to 00 in the Clear Request Packet. (Many X.25 implementations do not tolerate cause codes other than zeros in Clear Request Packets.)
	• HOLD: Calls are placed on hold when link level restarts occur. Individual logical channels can exchange resets, but the calls stay in place. Calls are lost, however, when the retransmission attempt expires, and the link is declared down. If data loss occurs, an indication is provided; a reset packet is not sent when the link comes up (after a short disruption); and the channel does not lock up. Both ends of the X.25 link must have X.25 Options = HOLD.
	• NRST: Suppresses the restart procedure at link-up time. Select when X.25 devices interpret the restart packet reception as a fault condition.
	• BKUP: Defines the port as a backup port that activates if other ports are down, enabling control signal operation when the link is idle. This value cannot be selected if Port Type is set to SIMP.
	• Internodal Link (INL): – Clears calls when call routing loops are detected because a link is down or an error exists in the route selection table. – Looks at clear calls and reroutes, improving unidirectional X.25 traffic. Window size is set to 7 or higher because internodal receiver readies (RRs) at levels 2 and 3 are reduced. – When selected, CAUSE is automatically selected. – If CAUSE is not selected, a warning message is printed. – INL cannot be summed with PDN.
	• INLA: When the link is connected to a node running revisions 2.10 and 2.12xx release (except revisions 2.12.05 and 2.13.34).

X.25 Options *(continued)*

	• Delay: Enable Delay and Path Trace on this link. Link must be connected to a Vanguard node.
	• AP: To recognize this port as an Access Protocol.
	• GP: To recognize this port as a Gateway Protocol.
	• CNUI: To select centralizd NUI verification.
	• CNGL: To reserve SVCs for NUIC operation.
	• CINFO: For charging Information.
■Note You can select several of these settings by summing the values. Example: CUG+HOLD.	

Number of Routing Digits in Call User Data

Range:	0 to 12
Default:	5
Description:	Specifies the number of routing digits in the Call User Data (CUD) field. This is used on X.25 links, attached to a PDN, where the private network address is carried in the CUD. **■Note** Set this parameter to 0 when the X.25 Options is *not* set to CUD. When the X.25 Options parameter is set to PDN, a non-zero value must be entered for this parameter.

Number of Prefix Address Digits Stripped from Outgoing Calls

Range:	0 to 14
Default:	0
Description:	Specifies the number of prefix digits that are removed from the called address when forwarding a call to a PDN. **■Note** When the X.25 Options parameter is set to PDN, a non-zero value must be entered for this parameter.

Number of Prefix Address Digits Stripped from Incoming Calls

Range:	0 to 15
Default:	0
Description:	Specifies the number of prefix digits that are removed from the called address when forwarding a call from a PDN. **■Note** When the X.25 Options parameter is set to PDN, a non-zero value must be entered for this parameter.

Restricted Connection Destination

Range:	0 to 32 alphanumeric characters
Default:	(blank);
Description:	Specifies the port destination of calls inbound from the port. This parameter overrides the Route Selection Table entries. For example, to route all calls to X.25 port 3, use X25-3. **■Note** Using the default disables this parameter.

Port Address

Range:	0 to 15 decimal digits
Default:	N/A
Description:	Specifies the address to be inserted into a call packet's calling address when the parameter X.25 Options = REGO or REGI.

CUG Membership

Range:	0 to 8 two-digit numbers
Default:	--,--,--,--,--,--,--,--
Description:	Specifies a port's membership in up to 8 Closed User Groups (CUGs). Each CUG membership must be a two-digit number (00 to 99), separated from other groups by a comma. ■ **Note** To delete a CUG, press the minus key twice for each group.

Billing Records

Range:	OFF, ON
Default:	OFF
Description:	Billing Records summarize the data collected on calls to this port. • ON generates billing records for all calls to and from this port and for failed calls from this port. • OFF generates no billing records.

Number of Subaddress Digits in X.25 Address

Range:	0 to 3 digits
Default:	2
Description:	Specifies the number of digits in an X.25 address's subaddress for ports connected to a public data network.

Facility Subscription Control

Range:	NONE, FCN_ON, FCN_OFF, TCN_ON, TCN_OFF, DBITMOD, CUGOA, CUGIA, REDIRECT, BCUG_ON, BCUGOA, BCUG_OFF
Default:	NONE
Description:	Flow Control Negotiation (FCN), Throughput Control Negotiation (TCN) and D-bit Modification (DBITMOD) are part of the facilities defined (in the X.2 standard) for data networks. They are facilities which can be turned on or off for a network subscriber. The FCN, TCN and DBITMOD parameters can be implemented alone or in combination. For instance, you can use FCN_ON, TCN_OFF, and DBITMOD concurrently.
	• NONE: Subscription to facilities not enforced.

Facility Subscription Control *(continued)*

Description: (Continued)	• FCN_ON: Flow Control Negotiation enabled. Packet and Window size negotiation facilities in an inbound call are allowed. Packet and Window size facilities are always included in outbound calls and call accepted/connected when this parameter is set.
	• FCN_OFF: Flow Control Negotiation disabled. Inbound calls containing Packet and Window size facilities are cleared. Packet and Window size facilities are not present in outbound calls and calls accepted/connected when this parameter is set.
	• TCN_ON: Throughput Class Negotiation enabled. The throughput class negotiation facility is always included in outbound calls and call accepted/connected when this parameter is set. The facility is passed onward to the destination in the call packet transparently and does not alter the handling of the SVC data within the node.
	• TCN_OFF: Throughput Class Negotiation disabled. Inbound calls containing the throughput class negotiation facility are cleared. The throughput class negotiation facility is not present in outbound calls and call accepted/connected when this parameter is set.
	• DBITMOD: D-bit Modification Facility enabled. This facility sets the D-bit to 1 in every data packet traversing this port. Setting the D-bit to 1 enables packet delivery acknowledgment from the remote end. (When the D-bit is set to its default, 0, acknowledgment comes from the intermediary node.)
	• CUGOA: Checks CUG but allows OA: otherwise, CUG passes transparently.
	• CUGIA: Closed User Group Incoming Access enabled. This facility checks the CUG of incoming calls but allows incoming access from addresses that do not belong to the CUG.
	• REDIRECT: Call Redirection enabled. This facility redirects inbound calls to a disabled or busy port to other ports. Alternate ports are defined by X.25 addresses in the Call Redirection table on the node which originated the call.
	• BCUG_ON: Subscription to Bilateral Closed User Group facility enabled.
	• BCUGOA: Subscription to Bilateral Closed User Group with Outgoing Access facility enabled.
	• BCUG_OFF: Subscription to Bilateral Closed User Group facility disabled.
	• BCUG_ON, BCUGOA, and BCUG_OFF are mutually exclusive and can be enabled only on Access ports. Some combinations of these options are allowed such as FCN_ON+TCN_ON.

Alarm Priority

Range:	NETWORK, ACCESS
Default:	NETWORK
Description:	Specifies the severity level of LINK UP and LINK DOWN alarms: • NETWORK: Severity HIGH alarms are generated. • ACCESS: Severity LOW alarms are generated.

Connecting the FRST Module

Below are the steps required to tie your FRST module to your AAM station and connect to your applications:

Connection of the FRST Module

Step	*Procedure*
1	Connect the PVC AAM Station to the SAR-***x*** Module PVC Station Example: Source: SAR-1 Destination: aam-2251s1
2	Connect the Application (LCON, Route Table, PVC, etc.) to FRST-***x*** Example: address: 100* Destination: FRST-1

■ **Note**

The (-***x***) above on SAR and FRST refer to the FRST table entry number.

Also note that in older releases of software (in PVC or the Route Selection Table):

- SAR was called FTDN
- FRST was called FTUP

SAR-1, 2, 3, 4 (etc...) is the entry point for the bottom side of the FRST stack (even if SAR is not enabled) and FRST is the top side of the stack. A PVC connects to the bottom side of the station, and the SVC or PVC connects to the top side.

ATM FRST Module

Figure 2-4 shows an example of FRST operation detailing the Vanguard 7300 Series ATM's FRST function and programming.This diagram shows a visual of the links used.

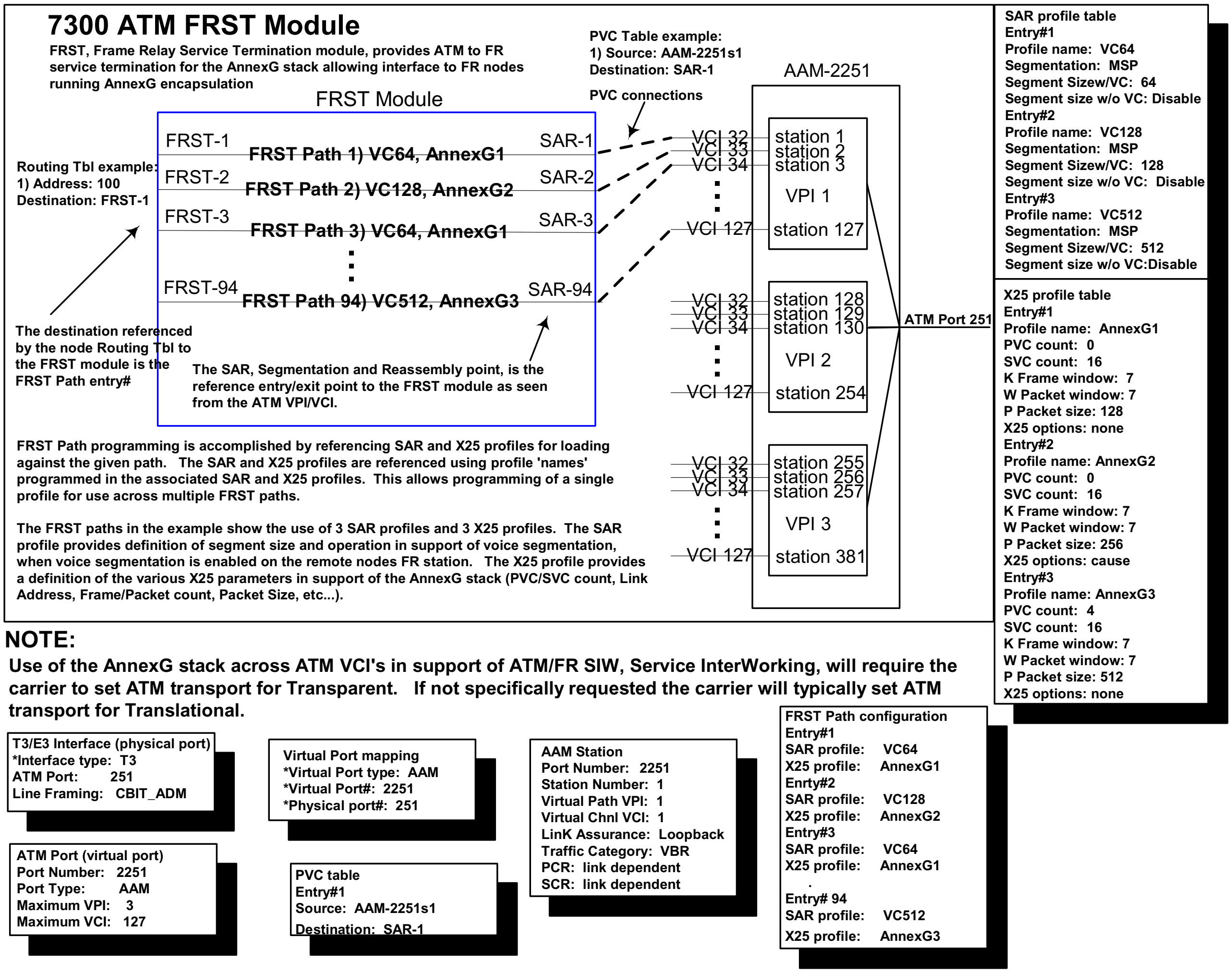


Figure 2-4. 7300 ATM FRST Module Example

Operations, Administration, and Maintenance (OAM) Flows

Introduction

Networks containing equipment from multiple vendors require network monitoring strategies to create a reliable network. Operations, Administration, and Maintenance (OAM) identifies standard data elements that are inserted into data streams to provide and detect particular information about the network and the elements it comprises. OAM provides these functions for each Virtual Path and Virtual Channel connection:

- Fault Management. Fault management OAM cells are used to send two types of warning messages: Alarm Indication Signal (AIS) and Remote Defect Indication (RDI). RDI is sometimes referred to as Far End Reporting Failure or FERF.
- Activation/Deactivation of Continuity Checking. Continuity Check cells monitor the connection and Loopback cells allow for the testing of any given connection.

OAM Flows

There are five standard OAM flows, numbered F1 through F5. The Vanguard Managed Solutions' implementation of T3/E3 ATM supports F4 and F5 flows and these operate at the Virtual Channel level.

OAM flows can be either segment or end-to-end. An end-to-end flow covers from one VCC endpoint to the other. A segment flow only covers a portion of the entire VCC. Segment flows also allow the management of a specific piece of the connection.

OAM cells for an F5 flow use the same VPI and VCI as the user cells of the VCC. The PTI field in an ATM header is used to distinguish between segment and end-to-end F5 flows. Refer to the "ATM Cell Structure" section in Chapter 1.

Fault Management

Fault management encompasses three different types of events. It determines when a failure has occurred, notifies other network elements within the connection of the failure, and provides methods of isolating and diagnosing the failure.

AIS and RDI

In Figure 2-5 a VP or VC connection exists between end nodes 100 and 400. If a failure occurs (shown between nodes 200 and 300) an AIS signal is sent to node 400. This is considered the downstream direction and notifies node 400 of the failure.

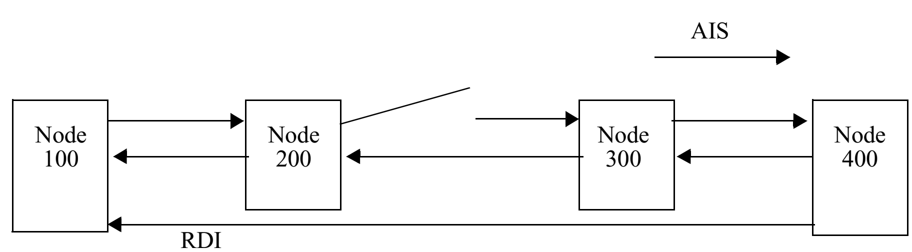


Figure 2-5. AIS and RDI for Signal Direction Failure

Node 400, after receiving the AIS signal, sends an RDI signal all the way back to node 100. When this occurs the connection failure message is received. If the RDI failure message was not received by node 100 it would never know that a failure had occurred between nodes 200 and 300. AIS reports defects or failures in the forward direction while RDI does the same but in the backward direction.

A single failure can result in many OAM cells being generated. Once a fault is detected an OAM cell is periodically sent through the connection. The period of time between OAM cells is in the order of seconds and this is used to regulate the number of cells that are sent. This ensures that AIS and RDI are delivered efficiently.

Continuity Check

Continuity Checking is referred to as CC and monitors the availability of a connection. Refer to Figure 2-6. Continuity Checking monitors connection availability by tracking the elapsed time between received cells (CC or user data). In the absence of user data the End Point sends CC cells at the rate of 1 CC cell per second (ITU-T I.610 02/1999). If a circuit is idle, that is, no cells have been received for more than a fixed time period (ITU-T I.610 02/1999 specifies the interval to be 3.5 +-0.5 seconds), the End Point declares a Loss of Continuity (LOC) state and begins sending RDI cells. The next cell received cancels the LOC state.

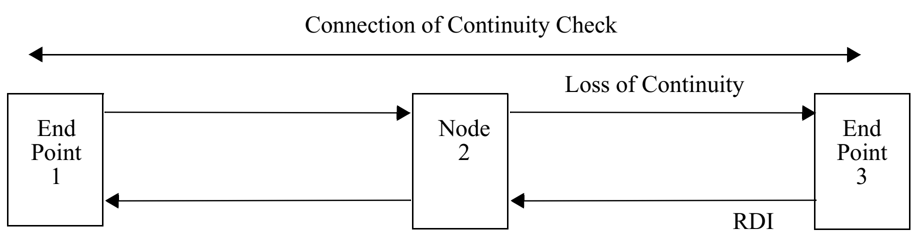


Figure 2-6. Continuity Checking

During normal operation, End Point #3 periodically receives a CC or user data cell. A discontinuity between node 2 and End Point 3 causes End Point 3 not to receive the cell for a period of time. When sufficient time has passed a Loss of Continuity state is declared and the RDI signal is generated. The RDI is transmitted all the way back to the other end point (there could be many other nodes between the two end points) where End Point #1 becomes aware of the discontinuity.

Continuity checks can be activated or deactivated and all results of the checks can be monitored.

End-to-End Loopback

Loopback cells determine connectivity at specific points in a network. They also allow you to isolate defective elements in a network.

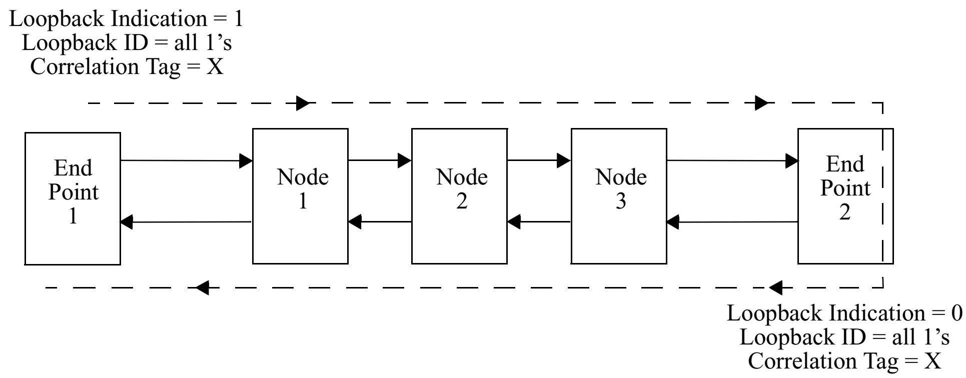


Figure 2-7. End-to-End Loopback

Figure 2-7 shows an end-to-end loopback that can be used by an end point to verify connectivity with a remote end point. In Figure 2-7, End Point #1 is the originator of an end-to-end loopback cell that has a loopback indication of 1, a Loopback ID indicating the end point, and a correlation tag that it looks for in received OAM cells. The loopback destination, End Point #2, removes the loopback cell, decrements the Loopback indication field to 0, and then retransmits the loopback cell in the other direction. Nodes 1, 2, and 3, convey the end-to-end loopback cell between the End Points and, eventually, End Point #1 extracts the loopback cell to match up the correlation tags. This technique is used to verify the continuity of VP or VC links between End Point #1 and End Point #2.

Service Categorization

Introduction

The Vanguard Managed Solutions implementation of ATM uses four types of services:

- Constant Bit Rate (CBR)
- Unspecified Bit Rate (UBR)
- Variable Bit Rate real-time (VBR-rt)
- Variable Bit Rate non-real-time (VBR-nrt)

Constant Bit Rate (CBR)

Constant Bit Rate (CBR) data provides a constant data flow. CBR uses guaranteed bandwidth whenever this connection type is used and is structured in its use of that bandwidth.

CBR connections require fixed amounts of bandwidth (specified by the Peak Cell Rate) that are continuously available throughout the time a connection is made. A sending ATM station may transmit cells at a rate equal to or less than the specified PCR. It may also be silent for some period but the bandwidth remains available.

CBR connections are used for real time applications, such as video and voice, that have tightly controlled Cell Transfer Delay (CTD) and Cell Delay Variation (CDV) characteristics. CBR is not, however, restricted to such applications.

Once a CBR connection is established, the negotiated QoS is assured to all cells that conform to the connection requirements. Any cells that are delayed beyond that specified for the Cell Transfer Delay (CTD) are less significant to the application.

Some applications generate traffic smoothly, that is, the volume of traffic remains relatively constant over a specific period of time. Other applications have response time requirements that are so tightly constrained that the use of CBR connections can be justified. Some examples of these applications are:

- Video Conferencing.
- Interactive audio such as telephony.
- Audio/video distribution. For example, this may include television, distance learning and pay-per-view entertainment.
- Audio/video retrieval. For example, video-on-demand and audio libraries.

Unspecified Bit Rate (UBR)

Unspecified Bit Rate (UBR) provides a less structured form of data flow and uses any available bandwidth. When CBR and UBR data exists simultaneously, CBR uses all of the bandwidth it is allowed and UBR uses the remainder.

A UBR connection offers an efficient option for applications less demanding of bandwidth requirements. These applications, such as FTP, have limited service requirements and are tolerant of Cell Transfer Delay or loss. For example, text/data/image transfer (FAX), e-mail, and remote terminal operation (telecommuting), applications operate relatively efficiently through the use of spare available bandwidth though not quite as efficiently as when CBR connections are used. However, these applications can use the less expensive UBR connection.

UBR is a Best Effort service that should not be used in mission critical applications or environments. As a best effort service, UBR offers little in the way of specified QoS as it provides very loose, if any, Cell Transfer Delay (CTD), Cell Delay Variation (CDV), and Cell Loss Ratio (CLR) characteristics and has no negotiated bandwidth or service guarantee.

Variable Bit Rate real-time (VBR-rt)

Applications and connections requiring very short and tightly controlled network delay and CDV and having variable bandwidth requirements, use the Variable Bit Rate real-time (VBR-rt) service.

In the VBR-rt service, cells can be bursty (up to a maximum of the Peak Cell Rate) over short periods of time. On average though, the Sustained Cell Rate (SCR) is met for the duration of the connection. Cells exceeding the maximum Cell Transfer Delay (max CTD) do have impact on applications using VBR-rt. Cell input rate variation allows multiple VBR-rt sources to be statistically multiplexed, over one physical connection, to maximize available network resources.

Variable Bit Rate non-real-time (VBR-nrt)

Applications and connections that are insensitive to network delay and have bandwidth requirements that vary, such as SNA, use the Variable Bit Rate non-real-time (VBR-nrt) service. These applications are typically much more sensitive to CLR.

Cell input rate variation allows multiple VBR-nrt sources to be statistically multiplexed over one physical connection to maximize available network resources.

Quality of Service (QoS)

Description

Quality of Service is provided to the Vanguard Managed Solutions implementation of ATM through the prioritization of traffic across VCCs and is based on Traffic Management.

The fixed, relatively small size of ATM cells, and well defined traffic management rules, allow multimedia traffic to be transmitted over a single line. This is accomplished through the assignment of this multimedia traffic to different VCCs, each of which has specific QoS characteristics.

For example, packetized voice traffic can be placed on a channel set up for CBR characteristics although file transfer traffic might be placed on an Unspecified Bit Rate (UBR) channel.

In the Vanguard 7300 Series, traffic travelling from the ATM port is tagged according to the QoS requirements defined for the LCON at the ATM station. Policy Based Routing (PBR) then routes traffic to the correct LCON. This in turn connects the QoS configured LCON with the correct ATM station.

■ **Note**

Refer to the *IP Routing Feature Protocol Manual* (Part Number T0100-03) for related information on Policy Based Routing.

IP Encapsulation (RFC 1483 and RFC 1577)

Introduction

In this implementation:

- ATM is used to forward IP traffic.
- Logical subnetting is imposed on ATM networks.
- Routing for the inter-subnet communication is required.

Consequently, an ATM network is divided into Logical IP Subnets that represent a single IP subnetwork. An address resolution mechanism maps IP addresses to ATM addresses to establish link level connectivity to the ATM endpoint in the LIS.

ATM is divided into logical subnets and follows the Classical IP over ATM approach.

RFC 1483 Encapsulation

Introduction

Network Interconnection and bridged traffic are transmitted in the payload field of an AAL5 Protocol Data Unit (PDU). This requires a standardized method of encapsulating the routed and bridged traffic in an AAL5 PDU so that transmitted data traffic is uniquely identified at the receiving end.

RFC 1483 supports two different types of encapsulation:

- LLC/SNAP Encapsulation.
- VC Based Multiplexing.

Each encapsulation type offers a different method of multiplexing routed and bridged traffic over an ATM virtual connection. Each also has its own advantages and disadvantages. The selection of a particular type of encapsulation is performed by static configuration and the encapsulation type selected is dependent on the ATM environment.

LLC/SNAP Encapsulation

LLC/SNAP encapsulation allows the transportation of multi-protocol traffic (routed and bridged packets) over a single ATM virtual connection. This is made possible by encoding the transported Protocol ID (PID) into the LLC/SNAP header. The PDU protocol is therefore identified by the LLC/SNAP header that is placed immediately in front of the AAL5 PDU.

When using LLC encapsulation, both routed and bridged PDUs are identified by prefixing the LLC header. This header may be followed by the Subnetwork Attachment Point (SNAP) header. Protocol traffic that does not have a universally identified PID must have the SNAP header added.

Figure 2-8 shows the format of LLC and SNAP headers.

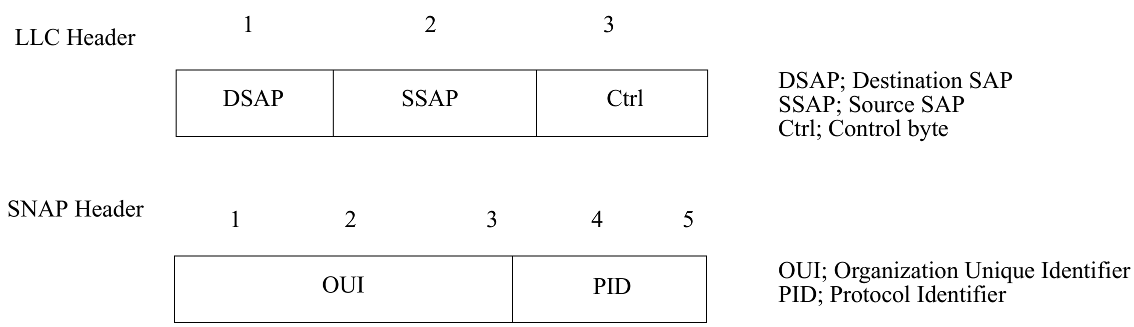


Figure 2-8. LLC and SNAP Header Structure

Address Resolution for IP Traffic Using RFC 1577

Introduction

Address resolution of multiple protocols over ATM feature follows the Classical IP Over ATM model for the transportation of connectionless IP traffic over connection oriented ATM networks.

Classical IP Over ATM

The Classical IP Over ATM is classical in that it assumes that logical subnetting and inter-subnet routing are imposed on the ATM network. The ATM network is therefore divided into 'Logical IP Subnets' that represent a single IP subnetwork. An address resolution mechanism maps IP addresses to ATM addresses (the combination of the VPI and VCI) to establish link level connectivity to the ATM endpoint.

Address Resolution in PVC only ATM Environments

In a PVC environment, virtual circuits are established as part of initialization. The IP address of the communication station at the other end is unknown to each VC end point. However, in Point to Multipoint networks, containing ATM PVCs, the IP address of the remote end determines the destination of the VC (LCON) to which the IP traffic is forwarded.

Static Address Resolution

The IP address of a remote node is statically configured on each of the virtual connections (LCONs). Consequently, there is no need for a specific address resolution mechanism to dynamically learn the remote end's IP address. In the case of unnumbered interfaces, the remote end router ID uniquely identifies that remote end. On unnumbered links, therefore, the remote end's router ID should be configured as the next hop IP address.

Dynamic Address Resolution

With Dynamic Address Resolution, a station dynamically learns the IP address of the other nodes. This is accomplished through a mechanism called Inverse ATM ARP (InATMARP). InATMARP builds a database to store IP Address to ATM VC mappings. Dynamic Address resolution on a particular VC (LCON) using dynamic address resolution is identified by the NULL Nexthop Hop IP Address value in the LCON (VC) configuration.

Inverse ATM ARP (InATMARP)

InATMARP resolves IP address to the ATM VC used to reach the ATM peer representing that IP Address. This mechanism is used on virtual connections using RFC 1483 LLC/SNAP encapsulation.

InATMARP Protocol Operation

1) When a PVC is active, the clients at both ends of the PVC send an InATMARP request to each other to identify the IP address of remote end of the PVC. Each client sends it's own IP address in the InATMARP request packet. If the Source and Target ATM Address is known, this is included in the packet. If this information is not known, the corresponding length fields are set to 0. When unnumbered interfaces exist, each client sends it's router ID in the InATMARP request, as it's IP address.

2) After receiving the InATMARP request, each client maps the Source IP address, in the InATMARP packet, to the VC (LCON) on which the request is received. The local ATMARP database is updated with the entry representing this map.

3) After processing the InATMARP request, each client sends their IP address in the InATMARP reply packet. This fills in the Source and Target ATM Address fields, if they are present in InATMARP request packet. When unnumbered interfaces exist, each client sends its router ID in the InATMARP reply, as it's IP address.

4) Once an InATMARP reply is received, each client updates their local ATMARP database. The database then contains a current map that corresponds to the IP address that exists in the InATMARP reply. Once this occurs, both clients know each other's IP address and the PVC between them becomes operational. IP traffic can then be exchanged.

InATMARP Retries

If an ATM client does not receive the InATMARP reply within 10 seconds after submitting a request it retransmits the InATMARP request to the remote end. The client stops sending these requests after three attempts and the corresponding ATM PVC between the Clients is not used for sending internetworking traffic.

Encapsulation using RFC 1483

Many access protocols, including VoIP, can be IP encapsulated for use on an ATM port. Network protocols, in particular Frame Relay Interface (FRI), use this technique so that the ATM port has characteristics similar to a Frame Relay FRI port, with Bypass stations.

■Note

The ATM port primarily supports IP encapsulation traffic, though in some cases the Serial Over TCP (SoTCP) feature is used. SoTCP is necessary to send serial traffic such as SNA/SDLC and Bisync over ATM. For additional information on SoTCP, refer to the *SoTCP Feature Protocol Manual* (Part Number T0100-06).

The ATM transport of IP encapsulation is referred to as Classical IP over ATM. Vanguard Managed Solution’s current implementation conforms to RFC1577 with RFC1483 encapsulation. Vanguard Managed Solutions’ current implementation also supports IPX and Bridging over ATM. These additional protocols are supported using the appropriate RFC 1483 encapsulation.

ATM and Frame Relay ports can be inter-connected over a carrier network. This is possible when the network provides Frame Relay Forum implementation Agreement 8 (Frame Relay Service Internetworking). Service internetworking allows an ATM virtual circuit channel to be mapped to a Frame Relay virtual circuit. In this case, you can have two modes: transparent and translation. The translation mode causes an ATM 1483 header to be translated to a Frame relay 1490 header. Wherever a Frame Relay channel interworks with an ATM channel, and no encapsulation conversion is used, RFC1490 encapsulation must be used at the ATM end of the circuit.

Traffic Supported

These traffic types are supported by RFC 1483 LLC/SNAP or VC_MUX Encapsulation:

- IP (unicast, multicast or broadcast) traffic is received either from an external source or generated internally from within the node.
- Bridged LAN (802.3 & 802.5) traffic is received either from an external source or generated internally from within the node.
- IPX traffic is received either from an external source or generated internally from within the node.
- RTP/UDP/IP header compressed packets sent or received by the node.

■Note

AppleTalk traffic, either received from an external source or generated internally from within the node, is not supported by RFC 1483 LLC/SNAP or VC_MUX Encapsulation.

Chapter 3
T3/E3 ATM Configuration

Overview

Introduction

This section describes how to configure your 7300 device for T3/E3 ATM. These topics are discussed:

- Configuration Process
- Configuration Example
- T3/E3 ATM Configuration

Configuration Process

Introduction

This section describes the configuration process for T3/E3 ATM.

Process Steps

When configuring T3/E3 ATM in a 7300, you must follow this process:

Step	Action	Reference
1	Configure the ATM Access Module Port Record.	page 3-6
2	Configure the T3/E3 Interface.	page 3-16
3	Configure the ATM Access Module Station Record.	page 3-11
4	Configure the LAN Connection Table Record.	page 3-16
5	Configure the PVC Setup Table.	page 3-22
6	Configure the Virtual Port Mapping Table Record.	page 3-22
7	Warm Boot the Node.	page 3-6

■ **Note**

You must configure the LAN and WAN interfaces. Please refer to the *Vanguard Configuration Basics* manual (Part Number T0113) for information concerning this configuration.

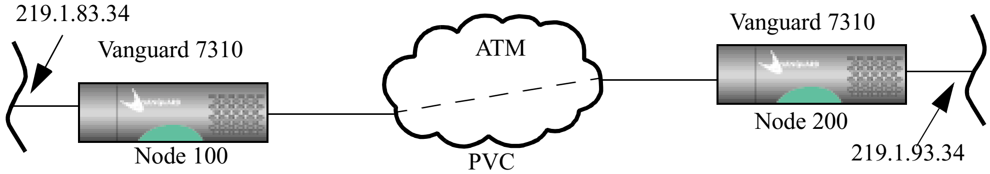
Configuration Example

Introduction

This section describes a typical T3/E3 ATM configuration example.

Configuration Example

Figure 3-1 shows an example T3/E3 ATM configuration illustrating a point to point ATM network connection between two Vanguard 7310 devices. Figure 3-1 shows the point to point nature of this example and identifies the parameters that must be changed (and the values they must be changed to), to work properly.



Node 100

ATM Port	
Port Number:	2000
Port Type:	AAM
Maximum VPI Range:	3
Maximum VCI Range:	127
F5 Link Assurance Count:	3
CC Activate/Deactivate Count:	3

AAM Station	
Port Number:	2000
Station Number:	1
Virtual Path Indicator (VPI):	0
Virtual Channel Identifier (VCI):	40
Link Assurance Method:	DISABLED
Traffic Service Category:	UBR
Peak Cell Rate (PCR):	1333

LAN Connection	
*Lan Forwarder Type:	ROUT
Lan Connection Type:	PT_TO_PT
*Router Interface Number:	51
Encapsulation Type:	RFC1483_LLC_SNAP

Router Interface	
Interface #1 State:	Enabled
Interface #51 State:	Enabled
Interface #52 State:	Unconfigured

IP-Interface	
Interface Number:	51
IP Address:	**10.10.10.1**
IP Address Mask:	255.255.255.0
Accept RIP:	VER1

PVC Setup	
Source:	LCON-1
Destination:	AAM-2000s1

IP-Interface	
Interface Number:	1
IP Address:	**219.1.83.34**
IP Address Mask:	255.255.255.0
Accept RIP:	VER1
RIP metric:	1
Send RIP Version:	VER1
MTU Size:	1500

T3/E3 Interface	
*Interface Type:	T3
ATM Port:	351
Transmit Clock:	**Int**

Virtual Port Mapping	
*Virtual Port Type:	AAM
*Virtual Port Number:	2000
*Physical Port Type:	T3E3
*Physical Port Number:	351

Node 200

ATM Port	
Port Number:	2000
Port Type:	AAM
Maximum VPI Range:	3
Maximum VCI Range:	127
F5 Link Assurance Count:	3
CC Activate/Deactivate Count:	3

AAM Station	
Port Number:	2000
Station Number:	1
Virtual Path Indicator (VPI):	0
Virtual Channel Identifier (VCI):	40
Link Assurance Method:	DISABLED
Traffic Service Category:	UBR
Peak Cell Rate (PCR):	1333

LAN Connection	
*Lan Forwarder Type:	ROUT
Lan Connection Type:	PT_TO_PT
*Router Interface Number:	51
Encapsulation Type:	RFC1483_LLC_SNAP

Router Interface	
Interface #1 State:	Enabled
Interface #51 State:	Enabled
Interface #52 State:	Unconfigured

IP-Interface	
Interface Number:	51
IP Address:	**10.10.10.2**
IP Address Mask:	255.255.255.0
Accept RIP:	VER1

PVC Setup	
Source:	LCON-1
Destination:	AAM-2000s1

IP-Interface	
Interface Number:	1
IP Address:	**219.1.93.34**
IP Address Mask:	255.255.255.0
Accept RIP:	VER1

T3/E3 Interface	
*Interface Type:	T3
ATM Port:	351
Transmit Clock:	**REC**

Virtual Port Mapping	
*Virtual Port Type:	AAM
*Virtual Port Number:	2000
*Physical Port Type:	T3E3
*Physical Port Number:	351

Figure 3-1. ATM Configuration Example

T3/E3 ATM Configuration

Introduction

This section explains how to configure your 7300 for T3/E3 ATM. These topics are discussed:

- Warm Booting an ATM Node
- ATM Access Module (AAM) Port Record Configuration
- T3/E3 Port Type and Interface Type Configuration
- AAM Station Record Configuration
- T3/E3 Port Type and Interface Type Configuration
- LAN Connection Table Configuration
- PVC Setup Table Configuration
- Virtual Port Mapping Table Record Configuration

Warm Booting an ATM Node

Introduction

This section explains how to warm boot an ATM Node.

Warm Booting an ATM Node

Booting updates the operational parameters of a node using the ATM parameters stored in configuration memory (CMEM). Use these steps to boot the ATM Node:

Step	*Action*
1	Select **Boot** from the Main menu. then select **Port**.
2	Select the **Node (Warm)** option. This message appears: **Boot the Node** **WARNING: Booting the node will cause all current calls to be abnormally disconnected. This operation may result in lost data and disruption of network user sessions.** **`Proceed (y/n):`**
3	Press **y** and **Enter**.

ATM Access Module (AAM) Port Record Configuration

Introduction

This section explains how to configure an ATM Access Module (AAM) Port Record.

Accessing and the AAM Port Record

Use these steps to access and configure the AAM Port Record:

Step	Action
1	From the CTP Main menu, select **`Configure`**.
2	From the Configure Menu, select **`Port`** and type the number of your virtual port. Virtual ports are numbered starting from 2000.
3	Select the AAM port type and then configure the parameters as shown in Figure 3-2. ■ **Note** The AAM port type indicates an ATM Access Module port. This identifier is used for an ATM port in the 7300 T3/E3 ATM implementation. The AAM port is a virtual port operating over a T3/E3 physical port. Virtual port numbers range from 2000 to 3999.

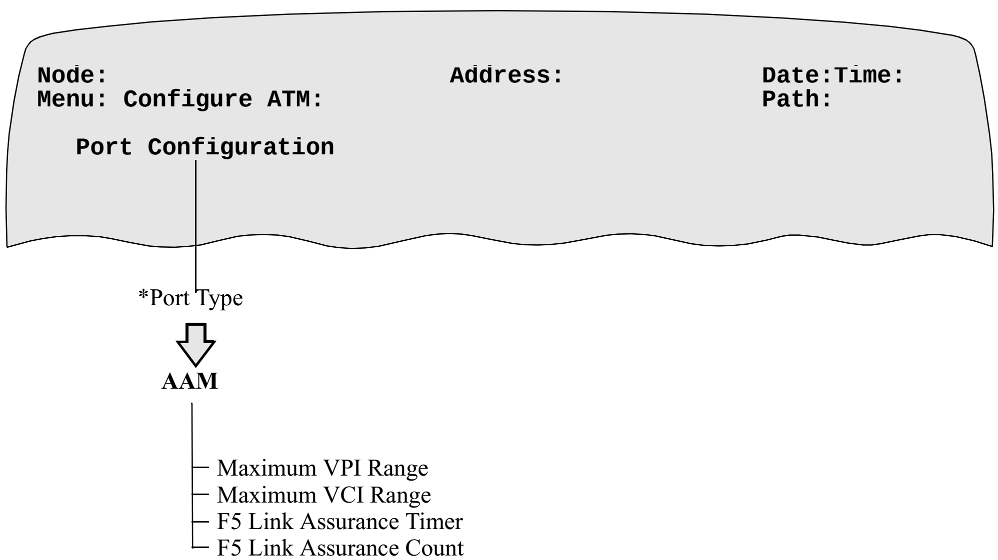


Figure 3-2. ATM Port Parameters

AAM Port Parameters

These are the parameters that must be configured:

Maximum VPI Range

Range	1, 3, 7, 15, 31, 63, 127
Default	3
Description	Specifies the maximum Virtual Path Indicator (VPI) value that any station on this port can operate with. Increasing this value has the effect of decreasing the maximum Virtual Channel Identifier (VCI) that you can specify. ■ **Note** The value 1 may be preceded by a negative (-) symbol. This symbol should be ignored. ■ **Note** Changes to this parameter require a Node boot to take effect.

Maximum VCI Range

Range	63, 127, 255, 511, 1023, 2047, 4095
Default	127
Description	Specifies the maximum Virtual Channel Indicator (VCI) value that any station on this port can operate with. Increasing this value has the effect of decreasing the maximum Virtual Path Identifier (VPI) that you can specify. ■ **Note** Changes to this parameter require a Node boot to take effect.

F5 Link Assurance Timer

Range	1 to 120
Default	3
Description	Specifies the time to wait before sending the next loopback cell. ■ **Note** This only applies to stations which have the **Link Assurance Method** parameter set to **Loopback**. ■ **Note** Changes to this parameter require a Port boot to take effect.

F5 Link Assurance Count

Range	1 to 120
Default	3
Description	Specifies the maximum number of consecutive loopback cells to be sent without receiving a response before declaring Loss of Continuity state. ■ **Note** This only applies to stations which have the **Link Assurance Method** parameter set to **Loopback**. ■ **Note** Changes to this parameter require a Port boot to take effect.

CC Activate/Deactivate Timer

Range	5 to 120
Default	5
Description	Specifies the amount of time, in seconds, that a node waits for a reply to a transmitted proposal to activate or deactivate the Continuity Checking option. ■ **Note** This only applies to stations which have the **Link Assurance Method** parameter set to **Negotiate**. ■ **Note** Changes to this parameter require a Port boot to take effect.

CC Activate/Deactivate Count

Range	3 to 120
Default	3
Description	Specifies the number of times the Activate/Deactivate Continuity Checking proposal is sent before declaring that the negotiation has failed. ■ **Note** This only applies to stations which have the **Link Assurance Method** parameter set to **Negotiate**. ■ **Note** Changes to this parameter require a Port boot to take effect.

VCC Traffic Prioritization

Range	DISABLE, SEQUENCE, PRIORITY
Default	DISABLE
Description	This parameter controls the manner in which voice packets are prioritized ahead of data packets within the same VCC. The port parameter prioritization are: • DISABLE: There is no prioritization of traffic within a VCC. • SEQUENCE: High priority and normal priority traffic are place in separate queues that are serviced in sequential order. • PRIORITY: High priority and normal priority traffic are placed in separate queues. The high priority queue is serviced completely before the low priority queue. ■ **Note** Changes to this parameter require a Port boot to take effect.

AAM Station Record Configuration

Introduction

This section explains how to configure the AAM Station Record.

Accessing the Station Record

Use these steps to access and configure the ATM Access Module (AAM) Station Record:

Step	Action
1	From the CTP Main menu, select **Configure**.
2	From the Configure Menu, select **AAM Station**.
3	Type the port number of your physical port and press enter.
4	Configure the parameters as shown in Figure 3-3.

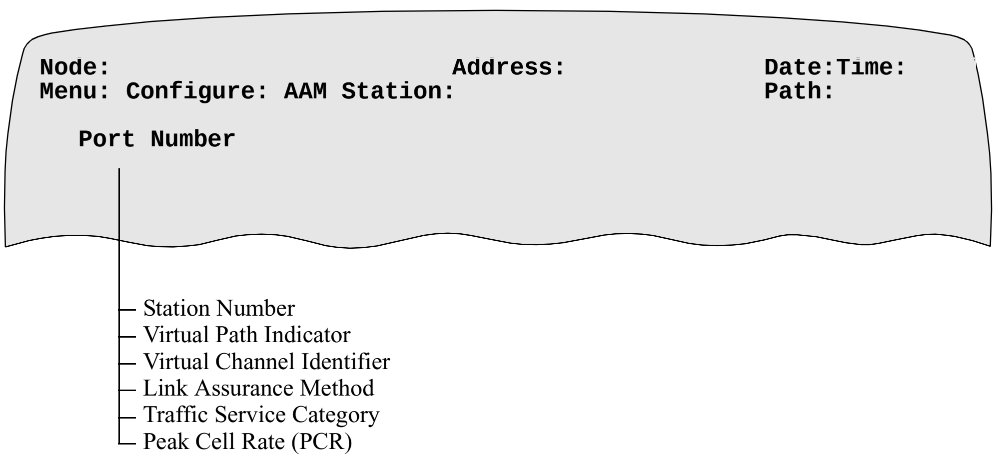


Figure 3-3. ATM Access Module (AAM) Station Record Parameters

AAM Station Parameters

These are the ATM Access Module (AAM) station parameters that must be configured:

Station Number

Range	1 to 4000
Default	1
Description	Identifies the station number on the AAM port. ■ **Note** Changes to this parameter require an AAM Station boot to take effect.

Virtual Path Identifier (VPI)

Range	0 to 127
Default	0
Description	Specifies the VPI value used in cells for the virtual channel associated with this connection. This is the provisioned virtual path number for the station of circuit type PVC on the ATM port. ■ **Note** Changes to this parameter require an AAM Station boot to take effect.

Virtual Channel Identifier (VCI)

Range	32 to 4095
Default	Station Number + 31
Description	Specifies the VCI value used in cells for the virtual channel associated with this connection. This is the provisioned virtual channel number for the station of circuit type PVC on the ATM port. ■ **Note** Changes to this parameter require an AAM Station boot to take effect.

Link Assurance Method

Range	DISABLED, LOOPBACK, NEGOTIATE, ENABLED
Default	DISABLE
Description	Specifies which Link Assurance method is used to determine end-to-end data channel integrity: • DISABLED: No Link Assurance messages are sent. • LOOPBACK: Link Assurance using F5 Loopback Cells. • NEGOTIATE: Link Assurance using CC Cells activated by the negotiating stage. • ENABLED: Link Assurance using CC Cells without negotiating. ■ **Note** Changes to this parameter require an AAM Station boot to take effect.

Traffic Service Category

Range	CBR, UBR, VBR
Default	UBR
Description	Specifies the service type to be used on the station. The service types are: • UBR: Unspecified Bit Rate. • CBR: Constant Bit Rate. • VBR: Variable Bit Rate. **■Note** Changes to this parameter require an AAM Virtual Port boot to take effect.

VCC Priority Level

Range	NORMAL, HIGH
Default	NORMAL
Description	Controls the priority of the VCC station in comparison to other stations within the same service category (either UBR or VBR). • NORMAL: Normal priority. Setting this parameter to NORMAL classifies a VCC as VBRnt (non-real time). • HIGH: High priority. Setting this parameter to HIGH classifies a VCC as VBRrt (VBR real time). **■Note** Changes to this parameter require an AAM Station boot to take effect.

Peak Cell Rate (PCR)

Range	20 to 105500
Default	1400
Description	Specifies the agreed to peak rate (cells per second) that the network receives cells from the station. This parameter characterizes the amount of bandwidth for CBR traffic class. For other traffic classes, it is the upper bound for submitting cells to the network. The PCR cannot be greater than these specified link speeds: • 3620 for T1 • 4800 for E1 • 105500 for T3 (96000 for PLCP) • 81040 for E3. ■ **Note** Changes to this parameter require an AAM Virtual Port boot to take effect.

VBR Traffic Shapping

Range	SINGLE, DUAL
Default	DUAL
Description	Specifies whether a station configured for VBR traffic category conforms to single or dual leaky bucket traffic shapping. Single leaky bucket means the traffic is shapped to only a PCR. Dual bucket shapping means traffic is shapped to PCR, SCR, and MBS. • SINGLE: Single bucket VBR. Traffic is shaped to only a PCR • DUAL: Dual bucket VBR. Traffic is shaped to PCR, SCR, and MBS. ■ **Note** Changes to this parameter require an AAM Station boot to take effect.

Sustainable Cell Rate (SCR)

Range	20 to 105500
Default	1400
Description	Specifies the agreed to rate (cells per second) that the network receives cells from the station. This parameter characterizes the amount of bandwidth for VBR traffic class. The SCR cannot be greater than these specified link speeds: • 3620 for T1 • 4800 for E1 • 105500 for T3 (96000 for PLCP) • 81040 for E3. ■ **Note** Changes to this parameter require an AAM Virtual Port boot to take effect.

Maximum Burst Size (MBS)

Range	1 to 400
Default	40
Description	Specifies the maximum burst size for VBR traffic in cells. ■ **Note** Changes to this parameter require an AAM Station boot to take effect.

Stacking Support

Range:	Enabled, Disabled
Default:	Disabled
Description:	This parameter specifies whether protocol stacking support is enabled to receive stack connection requests. In the case of PPPoA, this allows AAM station to receive stack connection request initiated by PPP. ■ **Note** This parameter needs to be enabled to support PPP over ATM application (PPPoA).

T3/E3 Port Type and Interface Type Configuration

Introduction

This section explains how to configure the T3/E3 Port and Interface Type.

Accessing the Port and Interface Type for T3/E3

The T3/E3 interface operates as an unchannelized port. Therefore, many of the parameters used for a channelized port are not used for ATM. It is not necessary for you to change any of your standard T3/E3 configuration parameters when configuring ATM on a port. Figure 3-4 shows T3/E3 Interface parameter that must be configured.

Use these steps to access and configure the T3/E3 port and interface type for use with ATM:

Step	Action
1	From the CTP Main menu, select **`Configure`**.
2	From the Configure Menu, select **`Port`** and type the number of your physical port.
3	Configure the parameters as shown in Figure 3-4.

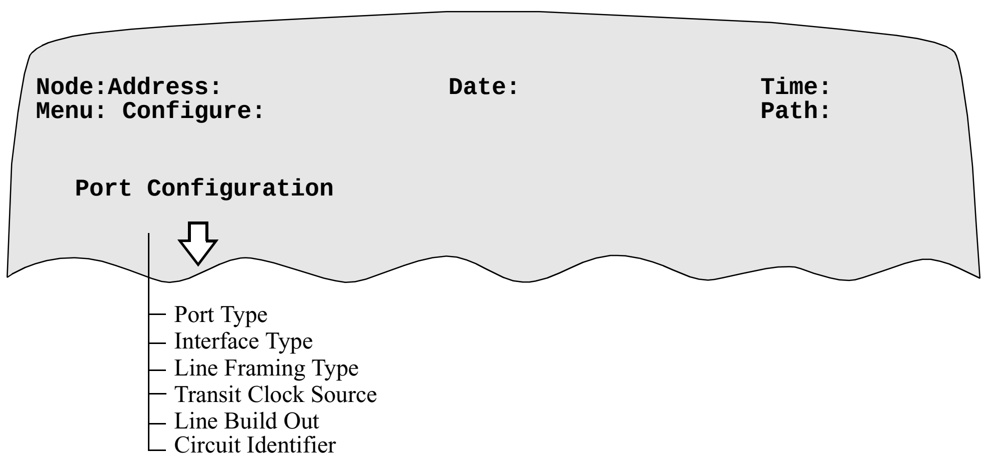


Figure 3-4. Configuring T3/E3 Interfaces

T3/E3 Port and Interface Parameters

These are the T3/E3 Port and Interface parameters that must be configured:

*Port Type

Range	NULL, T3E3
Default	T3E3
Description	Specifies the T3E3 port type for ATM. ■ **Note** Changes to this parameter require a Node boot to take effect.

Interface Type

Range	T3/DS3, E3
Default	T3/DS3
Description	Specifies the configure type according to the provided service: • T3/DS3: T3 (DS3) service is provided • E3: E3 service is provided ■ **Note** Changes to this parameter require a Port boot to take effect.

Line Framing Type

Range	M23_ADM, CBIT_ADM, M23_PLCP, CBIT_PLCP, G832_ADM, G751_ADM, G751_PLCP
Default	CBIT_ADM
Description	Specifies these line framing types according to the service provided (T3 Lines): • M23_ADM: M23 with direct mapping • CBIT_ADM: C Bit encoding with direct mapping • M23_PLCP: M23 with PLCP • CBIT_PLCP: C Bit encoding with PLCP Specifies these line framing types according to the service provided (E3 Lines): • G832_ADM: G832 with direct mapping • G751_ADM: C751 with direct mapping • G751_PLCP: G751 with PLCP ■ **Note** Changes to this parameter require a Port boot to take effect.

Transmit Clock Source

Range	RCV, INT
Default	RCV
Description	Specifies these transmit clock sources: • RCV - The transmit clock is recovered from the received data • INT - The transmit clock is generated by an internal oscillator ■**Note** Changes to this parameter require a Port boot to take effect.

Line Build Out

Range	SHORT, LONG
Default	SHORT
Description	Specifies these cable lengths to the service access point: • SHORT - Cable length is less than 225 feet • LONG - Cable length is greater than 225 feet ■**Note** Changes to this parameter require a Port boot to take effect.

Circuit Identifier

Range	0 to 16 alphanumeric characters
Default	blank
Description	Specifies the name assigned by service provider for this link. Use the space bar to blank the field. ■**Note** Changes to this parameter require a Port boot to take effect.

Cell Payload Scrambling

Range:	ENABLE, DISABLE
Default:	ENABLE
Description:	Configure cell payload scrambling. Cell payload scrambling may be disabled to ensure backwards compatiblility with older equipment.

LAN Connection Table Configuration

Introduction

This section explains how to configure the LAN Connection Table Record.

Accessing the LAN Connection Table Record

Use these steps to access and configure the LAN Connection Table Record:

Step	Action
1	From the CTP Main menu, select **Configure**.
2	From the Configure Menu, select **Configure LAN Connections**.
3	From the Configure LAN Connections menu, select **LAN Connection Table**.
4	Select the Entry Number and configure the parameters as shown in Figure 3-5.

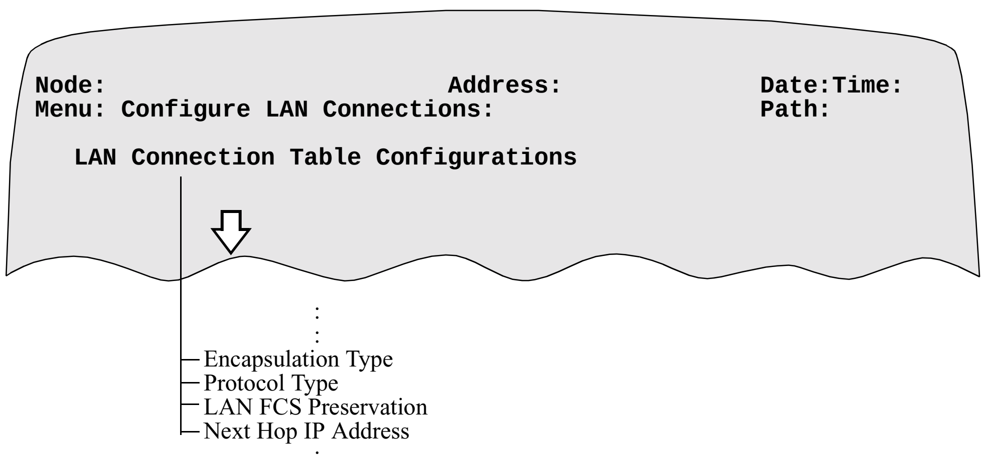


Figure 3-5. LAN Connection Table

LAN Connection Table Record Parameters

To support multiple protocols over ATM, these ATM LAN Connection Table parameters must be configured in the LAN Connection Table Record:

Encapsulation Type

Range:	CODEX, RFC1294, RFC877, RFC1483_LLC_SNAP, RFC1483_VC_MUX
Default:	RFC1294
Description:	Specifies the data encapsulation format to be used on this LAN connection: • CODEX: Codex Proprietary Encapsulation. • RFC 877: RFC 877 Encapsulation. • RFC 1294: RFC 1294 Multiprotocol Encapsulation. • RFC 1483_LLC_SNAP: RFC 1483 LLC/SNAP Encapsulation. • RFC1483_VC_MUX: RFC 1483 VC Based Multiplexing Encapsulation. ■ **Note** If you configure this parameter for RFC1483_VC_MUX encapsulation the next parameter 'VC_MUX_Protocol' appears. Otherwise that parameter is not displayed. ■ **Note** Changes to this parameter require a Table Record Boot to take effect.

VC MUX Protocol

Range:	IP, IPX, 802.3, 802.5
Default:	IP
Description:	Specifies the type of traffic that can be sent or received on this LAN Connection using rfc1483_VC_Mux type Encapsulation: • IP: Internet Protocol traffic • IPX: Internetworking Packet Exchange traffic • 802.3: Ethernet traffic • 802.5: Token Ring traffic Only the traffic type selected for this parameter are permitted on this LAN Connection. ■ **Note** This parameter appears only if the parameter Encapsulation Type is set to RFC1483_VC_MUX. ■ **Note** Changes to this parameter require a Table Record Boot to take effect.

LAN FCS Preservation

Range:	Enable, Disable
Default:	Disable
Description:	Specifies whether the LAN Frame Check Sequence (FCS) is preserved for bridged packets (802.3 & 802.5) sent or received on this LAN Connection: • Disable: LAN FCS is not preserved within bridged packets sent or received on this LAN Connection and the receiving LAN port has to regenerate the FCS. • Enable: LAN FCS is preserved within sent and received bridged packets on this LAN Connection ■ **Note** This parameter appears only if the parameter Encapsulation Type for this LAN connection is set to either RFC1294, RFC1483_LLC_SNAP, or RFC1483_VC_MUX and only if the LCON type is set to BRID or BROUT. ■ **Note** Changes to this parameter require a Table Record Boot to take effect.

Next Hop IP Address

Range:	A valid IP address in dotted decimal notation
Default:	0.0.0.0
Description:	Specifies the IP address of the Router Interface on the other end of this LAN Connection which is the next hop on the path to the final destination. This LAN Connection is used if it is the optimum route to reach the destination IP address. Note that the Network and Host portion of the IP address is needed. Using 0.0.0.0 for a LAN connection results in either of the following conditions: • LCON using RFC 1294 encapsulation and mapped to either a Frame Relay (BYPASS/Annex G) or an ATM station. • A LAN connection using RFC 1483 LLC/SNAP encapsulation and mapped to an ATM station. InvATMARP is not supported on LCONs using RFC1483 _VC_MUX encapsulation. For all other LAN connections a value of 0.0.0.0 causes this parameter to be ignored. ■ **Note** This parameter appears only if the parameter LAN Connection Type is set to GROUP. ■ **Note** Changes to this parameter require a Table Record Boot to take effect.

PVC Setup Table Configuration

Introduction

This section explains how to configure the PVC Setup Table.

Accessing the PVC Setup Table

Use these steps to access and configure the PVC Setup Table:

Step	Action
1	From the CTP Main menu, select **Configure**.
2	From the Configure Menu, select **Configure Network Services**.
3	From the Configure Network Services menu, select **PVC Setup Table**.
4	Select the Entry Number and configure the parameters as shown in Figure 3-6.

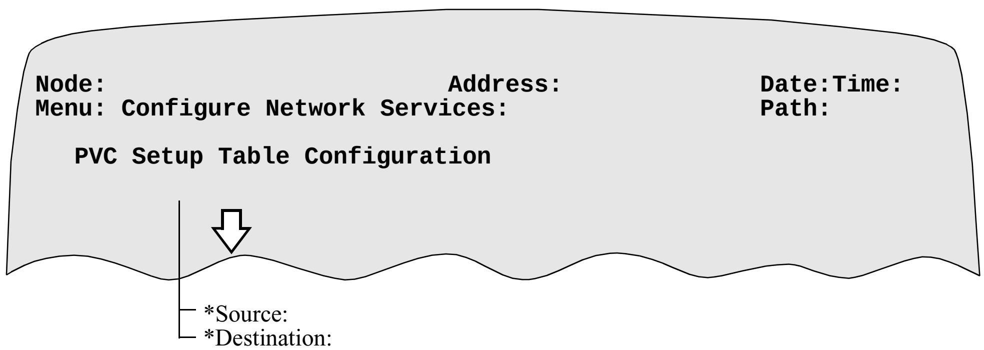


Figure 3-6. PVC Setup Table

PVC Setup Table Parameters

To support multiple protocols over ATM, these PVC Setup Table parameters must be configured:

*Source

Range:	0 to 32 alphanumeric characters
Default:	blank
Description:	Specifies the source channel identifier. Entries are not case sensitive. For example: • BCST route calls from the broadcast module. • MX25-2s3(2) route calls from MX25 port 2, station 3, channel 2. • PAD-5 route calls from PAD port 5. • P54S9(22) route calls from port 54, station 9, channel 22. • SDLC-4s5 route calls from SDLC port 4, station 5. • X25-1(5) route calls from X25 port 1, channel 5. **■ Note** Use the space bar to blank the field. **■ Note** Changes to this parameter require a Node Boot to take effect.

*Destination

Range:	0 to 32 alphanumeric characters
Default:	blank
Description:	Specifies the destination channel identifier. Entries are not case sensitive. For example: • BCST route calls from the broadcast module. • MX25-2s3(2) route calls from MX25 port 2, station 3, channel 2. • PAD-5 route calls from PAD port 5. • P54S9(22) route calls from port 54, station 9, channel 22. • SDLC-4s5 route calls from SDLC port 4, station 5. • X25-1(5) route calls from X25 port 1, channel 5. **■ Note** Use the space bar to blank the field. **■ Note** Changes to this parameter require a Node Boot to take effect.

Virtual Port Mapping Table Record Configuration

Introduction

This section explains how to configure the Virtual Port Mapping Table Record.

Configuring the Virtual Port Mapping Table Record

Use these steps to configure the Virtual Port Mapping Table record:

Step	*Action*
1	From the CTP Main menu, select **Configure**.
2	From the Configure Menu, select **Virtual Port Mapping Table**.
3	Select the Entry Number and then configure the parameters as shown in Figure 3-7.

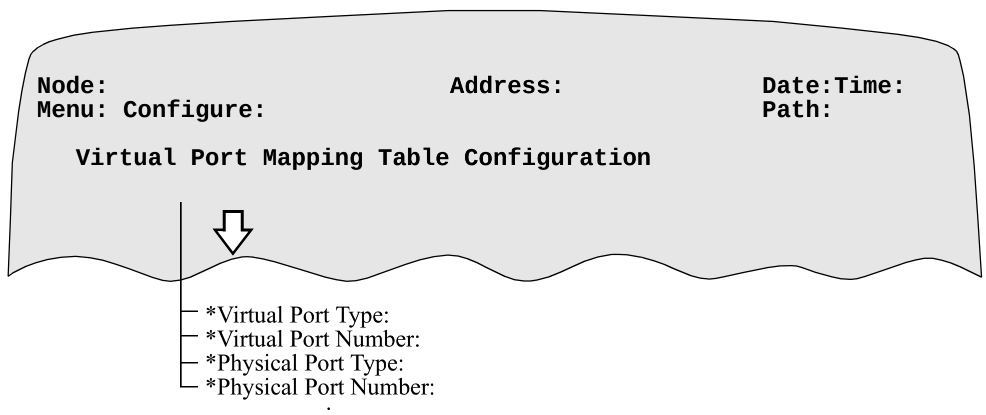


Figure 3-7. Virtual Port Mapping Table Record

Virtual Port Mapping Table Record Parameters

These are the Virtual Port Mapping Table Record parameters that must be configured:

*Virtual Port Type

Range	NULL, TDM-VOICE, PRI-VOICE, TDM-DATA, PRI-DATA, AAM
Default	NULL
Description	Specifies these types of virtual ports: • NULL: No Configuration • TDM-VOICE: Voice port operates on a configured DS0 • PRI-VOICE: Voice port operates on a DS0 determined by the ISDN/QISG D-Channel • TDM-DATA: Data port operates on a configured DS0 • PRI-DATA: Data port operates on a DS0 determined by the ISDN/QISG D-Channel • AAM: DS3/E3 ATM port ■ **Note** Changes to this parameter require a Node boot to take effect.

*Virtual Port Number

Range	2000 to 3999
Default	2000
Description	Specifies the Virtual Port Number. ■ **Note** Changes to this parameter require a Node boot to take effect.

*Physical T3/E3 Port Number

Range	251, 351, 451, 551
Default	251
Description	Specifies the Physical T3/E3 Port Number. ■ **Note** Changes to this parameter require a Node boot to take effect.

Chapter 4
T3/E3 ATM Statistics

Overview

Introduction

This section describes these detailed statistics for the T3/E3 ATM Access Module:

- LAN Connection Statistics
- T3/E3 Port Statistics
- AAM Port Statistics
- AAM Station Statistics

LAN Connection Statistics

Introduction

This section describes the LAN Connection statistics related to ATM.

Viewing LAN Connection Statistics

Use these steps to view the LAN Connection Statistics:

Step	***Action***
1	From the CTP Main menu, select **Status/statistics**.
2	From the Status/statistics Menu, select **LAN Connection Statistics**.
3	From the LAN Connection Statistics menu, select **LAN Connection Stats**.
4	Type the LAN Connection Number and press Enter to display the selected statistics.

LAN Connection Statistics Screen

When you select LAN Connection Statistics, the LAN Connection Statistics screen provides three pages of detailed information about all current LAN Connections and LAN Connection Groups. The first page identifies the Encapsulation Type and, as shown in Figure 4-1, the ATM related encapsulation type configured for this ATM LAN connection is identified.

■Note

In case of GROUP LCONs, the Next Hop IP Address is shown regardless of whether it is configured statically or learned through InvARP/InATMARP.

```
Node:                Address:             Date:          Time:
LAN Connection Statistics: LCON-1                        Page: 1 of 3

 Call Summary:

 Connection Type: GROUP SVC(1)    Encapsulation Type: RFC1483_LLC_SNAP
 Connection State: Connected
 Forwarders Connected: Router
 Remote Address: 80094
 Next Hop IP Address: 134.33.200.4
               :
               :
```

Figure 4-1. LAN Connection Statistics Screen

■Note

For additional statistics information and the definition of related LAN Connection Statistics terminology refer to the *Vanguard Router Basics Manual* (Part Number T0100-01).

T3/E3 Port Statistics

Introduction

This section describes the Detailed T3/E3 Port Statistics and explains screen terms.

Note
The T3/E3 Module is only available for the Vanguard 7300 Series.

Viewing Detailed T3/E3 Port Statistics

Use these steps to view the Detailed T3/E3 Port Statistics:

Step	*Action*
1	From the CTP Main menu, select **Status/statistics**.
2	From the Statistics Menu, select **Detailed Port Stat**.
3	At the prompt, type the physical T3/E3 port number, station number, and then press **Enter**.

Detailed T3/E3 Port Statistics Screen - Page 1

Figures 4-2 shows an example of page 1 of the Detailed T3/E3 Port Statistics screen.

```
Node:              Address: Date:  Time:
Detailed T3E3 Port Statistics: Port nn                  Page 1 of 9
Time Since Last Stat Reset: 12:22:09
Interface Type: T3/DS3
Port Status: Enabled       Circuit Identifier:
Port State: UP

Last Statistics Reset:

Received Alarms Present: NONE
Transmitted Alarms Present: NONE

Line Error Count:
24 Hour Totals
 PES   PSES SEFS UAS   LCV  PCV   LES   CCV   CES   CSES
 1      0    0    0   166    3     1     3     1     0

 Current 15 Minutes Interval   Time Elapsed in Current Interval: 9
 PES   PSES SEFS UAS   LCV  PCV   LES   CCV   CES   CSES
 0      0    0    0    0    0     0     0     0     0
```

Figure 4-2. Detailed T3/E3 Port Statistics - Page 1

Detailed T3/E3 Port Statistics Screen Terms

This table explains the terms shown in the Detailed T3/E3 Port Statistics screens:

Term	***Description***
Interface Type	Specifies the configure type according to the provided service: • T3/DS3: T3 (DS3) service is provided • E3: E3 service is provided
Port Status	Port CTP status: Enabled, Disabled
Circuit Identifier	Specifies the name assigned by service provider for this link.
Received Alarms Present	Indicates any alarms currently being received.
Transmitted Alarms Present	Indicates any alarms currently being transmitted.
Line Error Count: 24 Hour Totals	
PES	Number of seconds containing one or more P-bit errors.
PSES	Number of seconds containing many severely errored P-bit errors.
SEFS	Severely Errored Framing Seconds have: • one or more out of frame defects • a detected alarm indication signal defect
UAS	Unavailable Seconds: the DS3 interface is unavailable from the onset of 10 contiguous SESs or from the onset of the condition leading to a failure: • once unavailable and if no failure is present, the DS3 interface becomes available at the onset of 10 contiguous seconds with no SESs • once unavailable and if a failure is present, the DS3 interface becomes available at the onset of 10 contiguous seconds with no SESs if the failure clearing time is less than or equal to 10 seconds • once unavailable and if a failure is present, the DS3 interface becomes available: – at the onset of 10 contiguous seconds with no SESs if the failure clearing time is more than 10 seconds – or from the onset period leading to the successful clearing condition, whichever occurs later
LCV	Line Coding Violations are the occurrences of a bipolar violation.

Term	*Description (continued)*
PCV	Path Coding Violations, which are frame synchronization bit errors or CRC errors.
LES	Line Error Seconds, which are seconds in which one or more line code violation error events are detected.
CCV	The count of C-bit Coding Violations.
CES	Number of seconds containing one or more errored C-bit errors.
CSES	Number of seconds containing many severely errored C-bit errors.
Current 15 Minutes Interval Time Elapsed in Current Intervals: **Note** Terms and Descriptions for PES, PSES, SEFS, UAS, LCV, PCV, LES, CCV, CES, and CSES are identical to the terms and definitions in Line Error Count: 24 Hour Totals are listed in this table.	

Detailed T3/E3 Port Statistics Screens - Pages 2 to 9

Figure 4-3 shows an example of page 2 of the Detailed T3/E3 Port Statistics screens, part of a series of screens that display line error statistics at 15-minute intervals, beginning with 00:15 and ending with 24 hours. The number of screens that may appear for a T3/E3 port can vary. Each screen captures a four-hour interval up to a maximum of 24 hours. Screens 3 through 9 display similar information. Only the time interval increments differ.

```
Node:                Address:                Date:          Time:
Detailed T3E3 Port Statistics: Port nn                      Page 2 of 9
Interface Type: T3/DS3

Interval: PES   PSES SEFS UAS   LCV   PCV   LES   CCV    CES   CSES
00:15      1     0    0    0    166    3     1     3      1     0
00:30      0     0    0    0     0     0     0     0      0     0
00:45      0     0    0    0     0     0     0     0      0     0
01:00      0     0    0    0     0     0     0     0      0     0
01:15      0     0    0    0     0     0     0     0      0     0
01:30      0     0    0    0     0     0     0     0      0     0
01:45      0     0    0    0     0     0     0     0      0     0
02:00      0     0    0    0     0     0     0     0      0     0
02:15      0     0    0    0     0     0     0     0      0     0
02:30      0     0    0    0     0     0     0     0      0     0
02:45      0     0    0    0     0     0     0     0      0     0
03:00      0     0    0    0     0     0     0     0      0     0


Press any key to continue (ESC to exit)...
```

Figure 4-3. Detailed T3/E3 Port Statistics - Page 2

AAM Port Statistics

Introduction

This section describes the Vanguard statistics used in ATM. You can use the information in the statistics screens to monitor node operation.

Viewing Detailed AAM Port Statistics

Use these steps to view the Detailed AAM Port Statistics:

Step	Action
1	From the CTP Main menu, select **Status/statistics**.
2	From the Statistics Menu, select **Detailed Port Stat**.
3	At the prompt, type the desired port number and press Enter to display the selected statistics.

Detailed AAM Port Statistics Screens

Figures 4-4, 4-5, and 4-6 show examples of the AAM Port Statistics screens.

```
 Node:            Address:            Date:           Time:
 Detailed AAM Port Statistics: Port 2000              Page 1 of 3

Port Status: UP                  Last Statistics Reset:

Data Summary:      IN        OUT                  IN      OUT
 Octets:           208109854 219213352 Octets/sec:       1588761 1641040
 Frames:           4335619   4566492 Frames/sec:         33099   34188
 Discarded Frames:          0

Operation and Maintenance Summary:
 OAM Cells:        0        0

ATM layer Summary:
 Tot. Good Cells:8665895    9128134

Physical Layer Summary:
  Err Cells (Cor) 0
  Err Cells (Dis) 0
  Cell Delineation State: IN SYNC
  Cell Delineation Stat Change Time:
```

Figure 4-4. Detailed AAM Port Statistics Page 1 of 3

```
Node:             Address: Date:Time:
Detailed AAM Port Statistics: Port 2000Page 2 of 3


Number of Operating Stations: 4

Operating Stations: 1 - 4







Press any key to continue (esc to exit)...
```

Figure 4-5. AAM Port Statistics Page 2 of 3

```
Node:             Address: Date:Time:
Detailed AAM Port Statistics : Port 1Page 3 of 3


Stn#  VPI  VCI  Adm  Peer  Adj   Stn# VPI  VCI  Adm   Peer  Adj
====  ===  ===  ===  ====  ====  ==== ===  ==== ====  ====  ====
1     0    32     1    1    0    2    0    33     1     1     1
3     0    34     1    1    0    4    0    35     1     1     0







Press any key to continue (esc to exit)...
```

Figure 4-6. Detailed AAM Port Statistics Page 3 of 3

AAM Port Statistics Screen Terms

This table explains the terms found in the AAM Port Statistics screens:

Term	*Description*
Port Status	There are three status indicators that indicate: • DISABLED: The AAM port is disabled. • UP: The AAM Port is enabled and can pass data. • DOWN: The AAM port is disabled and can not pass data.
Data Summary	• Octets: Indicates the total number of octets that have been received and sent since the last reset of the port statistics. This value is displayed in units of thousands when the count exceeds the 32-bit maximum value. • Frames: Indicates the total number of frames that have been received and sent since the last reset of the port statistics. This value is displayed in units of thousands when the count exceeds the 32-bit maximum value. • Octets/sec: Indicates the calculated average number of data octets per second that are received or transmitted on a port over a 64 second interval. • Frames/sec: Indicates the calculated average number of data frames per second that are received or transmitted on a port over a 64 second interval. • Discarded Frames: Indicates the number of frames the station has discarded due to lack of resources (memory). These discards occur on the outbound direction. A non-zero count means the adjacent protocols in the node are sending more packets than can be transmitted by the ATM station on a long term basis. Implement Quality of Service (QoS) controls or other means to pace the adjacent.
Last Statistics Reset	The date and time of the last statistics reset. Resetting the statistics does not clear the last call information from the detailed port statistics screen. This information is cleared only on a node boot.
Operation and Maintenance Summary	OAM Cells IN/OUT: Identifies the total number of OAM cells, on all VCCs, that have been received or transmitted.
ATM Layer Summary	Total Good Cells: Number of un-errored cells transmitted and received.

Term	*Description (continued)*
Physical Layer Summary	• Err Cells (Cor): Identifies the number of received cells with cell header errors that have been corrected. • Err Cells (Dis): Identifies the number of discarded received cells with cell header error that are not corrected, using Header Error Check field, because there are too many bit errors. • Cell Delineation State: Identifies the current state of the physical layer with respect to cell delineation. – SYNC: The physical layer is in sync with ATM cell delineation. – OUT OF SYNC: Indicates that the physical layer is out of sync with ATM cell delineation. • Cell Delineation State Change Time: Indicates when the last state change (moving from OUT OF SYNC to IN SYNC) took place.
Stn#	Indicates the station for which these statistics appear.
VPI	Indicates the configured Virtual Path Indicator
VCI	Indicates the configured Virtual Channel Indicator
Adm	Indicates the administrative state of the station. Values include: • 0: Disabled • 1: Enabled
Peer	Indicates the state of this nodes peer (the node at the other end of the ATM link). Values include: • 0: Down • 1: Up
Adj	Indicates the state of the adjacent station. This is the entity inside the node to which the PVC is connected. Values include: • 0: Down • 1: Up

AAM Station Statistics

Introduction

This section describes the detailed AAM Station Statistics and explains screen terms.

Viewing Detailed AAM Station Statistics

Use these steps to view the AAM Station Statistics:

Step	*Action*
1	From the CTP Main menu, select **Status/Statistics**.
2	From the Status/Statistics Menu, select **AAM Station Statistics.**
3	From the AAM Station Statistics Menu, select **Detailed AAM Station Stats.**
4	At the prompt, type the desired port and station number.

AAM Station Statistics Screen

Figure 4-7 shows an example of the AAM Station Statistics screen.

```
 Node:             Address:       Date:               Time:
 Detailed AAM Station Statistics: Port 2000, Station 1Page 1 of 1

Station Status: UP                      Last Statistics Reset:

Data Summary:      IN         OUT                    IN      OUT
 Octets:           208109854 219213352   Octets/sec: 15887611641040
 Frames:           4335619   4566492     Frames/sec: 3309934188
 Discarded Frames:          0

Operation and Maintenance Summary:         IWF Summary:
 F5 Cells:        0       0                   CI Bit:     0       0
 AIS Cells:       0                           CLP Bit:    0       0
 RDI Cells:       0       0                   UU Bit:     0       0
 CC Cells:        0       0



VC Failures:      0




 Press any key to continue (esc to exit)...
```

Figure 4-7. Detailed AAM Station Statistics

AAM Station Statistics Screen Terms

This table explains the terms found in the AAM Station Statistics screens.

Term	***Description***
Station Status	Indicates the current station status. • DISABLED: The AAM station is disabled. • UP: The AAM station is enabled and can pass data. • DOWN: The AAM station is down and unable to pass data.
Last Statistics Reset	Indicates the date and time that the statistics were last reset. Resetting the statistics does not clear the last recorded statistics information from the detailed station statistics screen. This information is cleared only when the node is booted.
Data Summary	• Octets: Indicates the total number of octets that have been received and sent since the last reset of the port statistics. This value is displayed in units of thousands when the count exceeds the 32-bit maximum value. • Frames: Indicates the total number of frames that have been received and sent since the last reset of the port statistics. This value is displayed in units of thousands when the count exceeds the 32-bit maximum value. • Octets/sec: Indicates the calculated average number of data octets per second that are received or transmitted on a port over a 64 second interval. • Frames/sec: Indicates the calculated average number of data frames per second that are received or transmitted on a port over a 64 second interval. • Discarded Frames: Indicates the number of frames the station has discarded due to lack of resources (memory). These discards occur on the outbound direction. A non-zero count means the adjacent protocols in the node are sending more packets than can be transmitted by the ATM station on a long term basis. Implement Quality of Service (QoS) controls or other means to pace the adjacent.

Term	***Description** (continued)*
Operation and Maintenance Summary	• F5 Cells IN/OUT: Indicates the total number of F5 OAM cells that have been received and sent since the last reset of the station statistics. • AIS Cells IN: Indicates the total number of station AIS OAM cells that are received. • RDI Cells IN/OUT: Indicates the total number of station RDI OAM cells that are received/transmitted. • VC Failure: Number of times the VC failed.
IWF Summary	These bits correspond to the ATM Frame Relay interworking. • CI Bit: Indicates the number of Congestion Indication (CI) bits the station has received or transmitted. Corresponds to Frame Relay FECN bit. • CLP Bit: Indicates the number of Cell Loss • Priority (CLP) bits set to 1 the station has received or transmitted. Corresponds to Frame Relay DE bit. • UU Bit: Indicates the number of UU bit #0 (LSB) bits the station has received or transmitted. Corresponds to Frame Relay C/R bit.
Negotiated CC State	Displayed only when the Link Assurance Method parameter is configured to Negotiate. • Running: The CC Link Assurance has been negotiated successfully and is running. • Failed: The CC Link Assurance negotiation has failed. • Negotiating: The CC Link Assurance negotiation process is in progress.

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