ATM Analysis Application

User's Guide

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WAVETEK
WANDEL
GOLTERMANN

Communications Test Solutions

Notice
Specifications and functions described in this document are subject to change without notice.

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Contents

Preface

The ATM Analysis Application provides the ability to simulate and analyze traffic on ATM networks using switched virtual circuits and permanent virtual circuits and to easily measure quality of service parameters. The application operates with Microsoft® Windows® 95, Windows 98, and Windows NT 4.0.

About This Book

This book provides an overview of the ATM Analysis Application. We assume that you are familiar with the basic terminology and procedures for using personal computers, networks, and operating software.

Related Documentation

The following documentation includes important product information.

Online Help	Provides detailed information about the ATM Analysis Application, WG Examine, and the Domino Internetwork Analyzer within each application.
Release Notes	The release notes provide information about application features, requirements, installation, and customer support. Release notes are also available for the Domino Core software and the WG Examine software.
WG Examine User's Guide	Detailed information regarding using that application to analyze frames.
DominoPLUS Installation Guide	Provides a product orientation, including safety information for the DominoPLUS chassis hardware.
Domino Getting Started	Provides a brief introduction to the Domino Network Internetwork Analyzer. Describes both software installation and hardware setup (including pin assignments for interface cables) and provides a brief tour of the user interface.
Domino Operating Guide	Contains background information, procedures, and examples for using the basic and advanced features of the Domino Core software.

Customer Support

If you have a question about the ATM Analysis Application, refer to this manual or the online Help. If you cannot find the answer, contact Customer Support. To report problems, contact your local Sales Office or WG Customer Support.

When reporting a problem:

Be at your computer with the ATM Analysis Application running, and be prepared to provide the following information:

1. The name and version number of the WG software that you are using.
2. The type and serial number of the WG hardware that you are using.
3. The type of network hardware you are using.
4. The specifications of the computer that you are using, including:
    - Make and model number
    - Processor speed
    - Amount of installed RAM
    - Available hard drive space
    - Operating system (Windows 95, Windows NT or Windows 98)
5. The exact wording of any messages that appeared on your screen.
6. What happened and what you were doing when the problem occurred.

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www.wg.com

Explanation of Special Information

Convention	Description
Note:	A note conveys information, which if overlooked may seriously inconvenience you, but will not cause any permanent or unrecoverable errors.
⚠	A caution message alerts you to the possibility of damage to the instrument. In some cases it describes the nature of the potential damage and provides steps to avoid the problem.

1. An Introduction to ATM Technology

This chapter provides a brief orientation to Asynchronous Transfer Mode (ATM) technology. Read this chapter if you are new to ATM or do not have a strong understanding of ATM. This chapter does not provide specific information about the ATM Analysis Application. If you have a solid knowledge base in ATM technology, skip this chapter and start with Chapter 2.

1.1. Defining ATM

ATM uses cell-switching technology. Switching networks are connection-oriented, instead of being based on hosts and routers. Switching networks move data through paths, without routing tables, in a relatively fast process.

The Consultative Committee for International Telegraph and Telephone (CCITT), which is now the International Telecommunications Union - Telecommunications Standardization Sector (ITU-TSS) and the American National Standards Institute (ANSI) have worked for many years to define and design the ATM standards. In addition to the work of those two groups, the ATM Forum, (a large non-profit organization) seeks to accelerate industry acceptance and use of ATM.

The ATM Forum has worked since 1992 to make a global standard for ATM as a transport technology within Broadband Integrated Services Digital Network (B-ISDN) protocol stacks. For the purposes of the ATM Forum User-Network Interface Specification Version 3.1 Team, the definition of this “transport” use is equivalent to the OSI Layer 2 (Data Link Layer) for moving data through any user-to-network interface (UNI). There are two forms of UNI: Public and Private. Public UNI describes a public service provider’s network, while the Private UNI describes a network residing within the same local area or campus.

Information sent using ATM technology moves in fixed-length cells using asynchronous time-division multiplexing. The ATM cells are always 53 bytes long with a 48-byte payload. The initial five bytes comprise the header. User information (data, voice, or video) is converted into these relatively small packets. The ATM cells provide a standard way to accommodate the differences in the transmission rates of data and video (bursty, variable-length packets) and voice (constant bit-rate). Switching the cells combines the benefits of packet switching and circuit switching. For example, packet switching is designed for the bursty nature of data transmissions, while circuit switching is optimal for the guaranteed bandwidth availability and minimal network delays required by voice and full-motion video transmissions. No software is required to analyze and process ATM cells, as is required with variable-length packets. Optical fiber is the ideal medium for data transfer when using ATM technology.

1.1.1. How ATM Works

Individual ATM cells move between two end stations on the network through virtual channels and virtual paths. A virtual channel (VC) is one connection between two ATM end stations. It also encompasses all of the links necessary to create the communication between those stations. A virtual path (VP) comprises a group of VCs that connect two end stations, including all of their associated links over the ATM network. VPs are a convenient way of bundling virtual channel traffic across one or more ATM links. The virtual path identifier (VPI) appears in the cell header along with the virtual channel identifier (VCI). ATM uses both the VPI and VCI to establish the virtual circuit for each transmission. This virtual circuit maintains the correct cell sequence and a defined quality of service level throughout the life of the transmission.

When using ATM technology and other connection-oriented protocols, individual cells cannot be sent to another location until a connection is set up. There are two basic types of connections: Permanent Virtual Circuits (PVCs) and Switched Virtual Circuits (SVCs). A PVC is a virtual circuit that is set up either manually or by some other external means. An SVC is a virtual circuit that is set up between end stations through a signaling protocol.

When setting up an SVC, an end station first makes a request for a connection to another end station by sending a signaling request across the UNI to the network. The network passes this request on to the destination station. If the destination station agrees to form a connection, a virtual circuit is setup across the network between the two end stations. Next, mapping is defined between the VPI and VCI at both UNIs and between the appropriate input link and corresponding output link of all intermediate switches. The same applies for network-to-network interface (NNI) route mapping. After the virtual circuit is established between two stations, the stations exchange data by sending ATM cells across their respective UNIs.

The use of layers is an important aspect of ATM technology. Data arrives from a higher layer at the sending station; the ATM adaptation layer (AAL) segments the data (into the 48-byte cells), the ATM layer creates the headers, and the cells are sent out onto the network. Each of the ATM cells contains the values of the VPI:VCI assigned to that virtual circuit on each UNI. Therefore, when cells arrive at a switch, the switch can look at the headers and quickly switch the cells to the correct output port on the switch.

If an end station has two or more virtual circuits assigned across the UNI, it can mix and interleave cells for each circuit as it chooses. The only restrictions imposed are those to ensure the quality of service requirements and to ensure that cells for a particular virtual circuit are transmitted in order. After the cells are transmitted across the UNI, they are relayed from link to link through ATM switches. Each switch changes the VPI:VCI values as appropriate and guides the cells from its input port to the appropriate output port until the cells are finally delivered to the destination end station across the destination UNI.

1.1.2. The Six Fields of the Five-Byte UNI Cell Header

Figure 1-1, below, shows the contents of the five bytes that make up the UNI cell header.

GFC	VPI	VCI	PTI & CLP	HEC
4 bits	8 bits	16 bits	3 bits & 1 bit	8 bits
Byte 1	Byte 2	Byte 3	Byte 4	Byte 5

Figure 1-1. The Contents of the UNI Cell Header.

The five fields are described in the following sections.

Generic Flow Control

The generic flow control (GFC) field exists only in cells at the UNI (that is, there is no GFC for the NNI). The basic purpose of the GFC is to provide metering and control of data before it enters the ATM network, because the ATM network does not provide store-and-forward buffering. The GFC provides flow control across the UNI and is used to alleviate short-term overload conditions.

This field is not defined across the NNI; these bits are used for an expanded VPI field across the NNI, which allows support for an expanded number of virtual paths that are internal to the network.

Virtual Path Identifier

The VPI field is 8 bits long across the UNI and 12 bits long for NNI addressing. In an unassigned cell, the VPI field is set to all zeros (see “unassigned cells” in the glossary section provided with this manual for an explanation of unassigned cells). This is the default value of the VPI.

Non-zero values of the VPI are used for various meta-signaling and other operations, administration, and maintenance functions (OAM). OAM functions provide network fault indication and give performance data.

Virtual Circuit Identifier

The VCI, which is a 16-bit field, identifies virtual circuits across either a UNI or a NNI. The default value of the VCI for unassigned cells is all zeros. Other VCI values (1-31) are reserved for functions like broadcasting and signaling.

End devices specify the value of the VPI:VCI used when requesting a connection to an end system. The network assigns VPI:VCI values across all other links.

Payload Type Indicator

The payload type field (PT and PTI for payload type indicator) is 3-bits long. It indicates whether the cell is a user cell (containing user information) or a non-user cell, such as an OAM cell. The payload type field is also used to indicate a network congestion state or for network resource management. Part of the meaning of the payload type is the setting for the service data unit (SDU). The SDU is a unit of interface information that is carried across the connection intact.

PTI Binary Value	Payload Type
000	User data cell, congestion not experienced; SDU = 0
001	User data cell, congestion not experienced; SDU = 1 (EOF for AAL 5)
010	User data cell, congestion experienced; SDU = 0
011	User data cell; congestion experienced; SDU = 1 (EOF for AAL 5)
100	Segment OAM F5 flow cell
101	End-to-end OAM F5 flow cell
110	Traffic control and resource management
111	Reserved for future functions

Cell Loss Priority Bit

The cell loss priority bit (CLP) indicates the relative importance of a cell and provides guidance to the network in the event of congestion. A CLP bit that is equal to zero indicates a higher priority cell and a CLP bit that is equal to one indicates a lower priority cell. When a cell enters a network and has a CLP bit set to one, the cell may be discarded (depending upon network traffic conditions). This allows certain types of traffic to take priority in congested networks.

The CLP bit may also be set by the network if cells entering the network exceed the customer's committed information rate.

Header Error Control

The header error control field (HEC), which uses the fifth octet of the cell header, provides a checksum for the other four octets of the cell header. The HEC field provides the ability to detect and correct bit errors in the cell header using a cyclic redundancy code (CRC) check algorithm. This algorithm computes a value based on the bits in the data. The value is carried with the data for checking after the data reaches the final destination.

It is important that errors in the ATM cell headers be detected, because an error in a VPI:VCI value can lead to not only the loss of a cell and its data but also to the possible corruption of the data flow in other virtual circuits. This can happen if the corrupted value of the VPI:VCI corresponds to that of another active circuit.

Although the HEC field is part of the ATM cell (within the header), the HEC field is computed and used by the physical layer, since HEC is also used for cell delineation. Cell delineation is the process of determining the starting and ending points of individual cells in the bit stream. This is an important facet of ATM. The physical layer encapsulates the ATM layer.

1.2. Distinguishing the ATM Layers

The ATM protocol reference model defines three major layers; from top to bottom, these are:

- The ATM adaptation layer
- The ATM layer
- The physical layer

In addition, the physical layer includes the physical medium dependent sublayer (PMD) and the transmission convergence sublayer (TC). The convergence sublayer (CS) and the segmentation and reassembly sublayer (SAR) reside within the ATM adaptation layer. The management plane extends across the layers. This section provides an overview of these layers and sublayers.

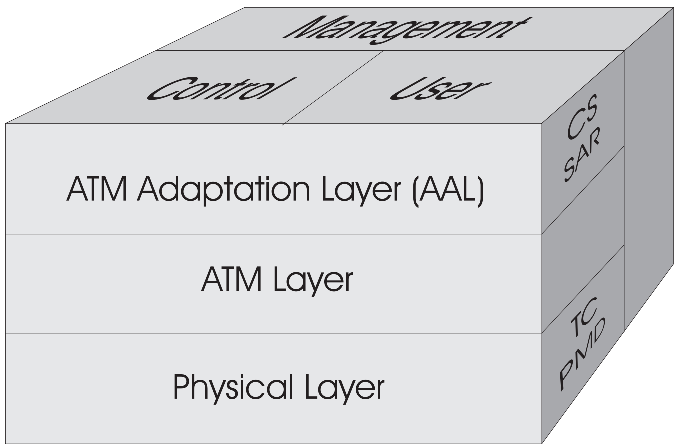


Figure 1-2. The Three Major ATM Layers and the Sublayers and Planes

Physical Layer

The physical layer defines the interfaces and transport protocols for the ATM network. The PMD sublayer provides bit transfer functions that are specific to the physical medium being used. The TC sublayer controls the transmission of frames over the physical medium. The physical layer functions include:

- Transmission convergence
- HEC
- Cell delineation
- Bit timing

ATM Layer

The ATM layer is responsible for the transfer of cells. It defines the cell structure and signaling over the logical connections in an ATM network. This layer also creates the ATM cells and enables the setup and clearing of virtual connections in the network. The ATM layer functions include:

- Generating and removing the cell header
- Translating the cell address
- Multiplexing and demultiplexing the cell

ATM Adaptation Layer

The ATM adaptation layer (AAL) is required to support information-transfer protocols that are not based on ATM. This layer maps and converts the higher-layer information, such as variable-length data packets, to fixed-length ATM cells. This layer also manages timing control for transmissions and handles lost or mis-sequenced cells.

There are four classes of service in this layer. Their definitions are based on whether a timing relationship must be maintained between the sending and receiving stations, whether the application requires a constant bit-rate, and whether the transfer is connection-oriented or connectionless.

Class A: Constant bit-rate, connection-oriented services that require a timing relationship between the sending and receiving stations (for example, circuit emulation, fixed bit-rate video).
Class B: Variable bit-rate, connection-oriented services that require a timing relationship between the sending and receiving stations (for example, variable bit-rate video and audio). This class is not fully defined by the various ATM standards organizations.
Class C: Variable bit-rate, connection-oriented services that do not require a timing relationship between the sending and receiving stations (for example, simple data transfer).
Class D: Variable bit-rate, connectionless services that do not require a timing relationship between the sending and receiving stations (for example, connectionless data transfer applications).

1.2.1. Details of the AAL Types

To support the four classes of services, the ATM protocol reference model defines various types (sets) of protocols at the AAL. The AAL functions are organized into two logical sublayers.

For AAL Type 1 the sublayers are convergence specific (CS) and segmentation and reassembly (SAR). See section 1.2, "Distinguishing the ATM Layers" on page 1-6.

Under AAL Type 3/4 and under AAL Type 5, the CS sublayer is called the common part convergence sublayer (CPCS). Both the CS and the CPCS provide the functions needed to support specific applications using AAL.

Each application attaches to AAL at a service access point, which is simply the address of the application. The CS or CPCS operate at the service access point and encapsulate data of any type into a format compatible for ATM called a CS-PDU (protocol data unit). The configuration is dependent upon the access service (for example, Frame Relay or SMDS). The CS-PDU is then passed to the SAR sublayer, which then passes the SAR-PDU to the ATM layer for transmission.

The management plane (M-plane) provides fault management features, through the operations, administration, and maintenance functions (OAM). In addition, performance data and some diagnosis data is provided through OAM functions.

AAL Type	Class of Service Commonly Supported
AAL 1	Class A Provides sequence information for the easy monitoring of cell loss or mis-sequencing.
AAL 2	Class B Still under development; the standards organizations have not finished the specifications.
AAL 3/4	Class C and Class D (these were once separated)
AAL 5	Class C Simplified and more efficient version of AAL 3/4 that limits the transport to connection-oriented and single-frame-at-a-time. Used to transport variable length frames with error detection.

The following sections provide a basic review of these layers.

1.2.1.1. Overview of the AAL 1

The ATM adaptation layer 1 (AAL 1) performs the functions necessary to adapt constant bit rate (CBR) services. For CBR services, there is a strong timing dependency between the ATM layer services and the source and destination.

The characteristics of CBR traffic include:

- Blocks of data appearing at known and periodic intervals.
- Intolerance of mis-sequenced data.
- Intolerance of variation in delay.
- Minimal tolerance of absolute delay.

Examples of such traffic include CBR voice, video, and circuit emulation.

The basic AAL 1 protocol contains a one-byte header preceding 47 bytes of data. The header's main job is to provide error-protected sequence information for easy monitoring of cell loss or mis-sequencing.

What the AAL 1 Type Does

The AAL 1 receives data from a higher layer at a constant bit rate (CBR); this data must then be delivered to the destination at the same rate. At the AAL 1 layer, the received data is placed into an AAL 1 SAR-PDU. The 48-byte SAR-PDU is passed down to the ATM layer, where it is included as the information field for an ATM cell. At the ATM layer, test equipment can monitor for cell delay variation, cell loss, and cell mis-sequencing to verify the quality of service across a network for AAL 1.

Note that there is no requirement that all 47 bytes of the information payload be used; the amount can vary, depending on how much packet delay can be tolerated.

How the AAL 1 Works

The AAL 1 uses a sequence number (SN), which is a 4-bit counter that is cycled through for each SAR-PDU that is passed to the ATM Layer; this helps to detect the loss or mis-ordering of cells. The SN field contains two subfields.

Subfield	Description
Convergence sublayer indicator	Reserved for uses that are to be determined by service-specific functions of the AAL Layer 1 CS.
Sequence count	Reserved for the transport of a binary-encoded sequence count value between peer AAL Layer 1 CS entities.

AAL 1 also uses a sequence number protection (SNP) field, which is a 4-bit CRC that is calculated over the sequence number field only. It does not cover the payload header, because it is generally thought that bit errors in CBR data are of little importance. For instance, a bit error in a single pulse code modulation (PCM) sample of voice traffic is generally unnoticeable.

SN 4 bits	SNP 4 bits	SAR PDU Payload
1	Byte	47 Bytes

The sequence number protection field contains two subfields, described in the following table.

Subfield	Description
CRC control	A three-bit subfield appended to the sequence number field during CRC processing which generates a seven-bit code word.
Parity	A one-bit subfield that provides parity checking as a method of error detection.

1.2.1.2. Overview of the AAL 3/4

The ATM adaptation layer 3/4 provides the transport of variable length frames with error detection. The AAL 3/4 SAR primarily deals with segmenting and reassembling data units so that they can be mapped into the fixed-length payloads of the ATM cells. The PDU formats support Classes C and D. See page 1-7 for information about the classes. Because ATM is a connection-oriented technology, AAL 3/4 most naturally provides connection-oriented service, but it can also be used to provide connectionless service with the aid of a connectionless server.

The characteristics typical of AAL 3/4 traffic are:

- It is bursty LAN traffic.
- It carries data that is reasonably tolerant of variation in delay.
- It is used with a router that may have several simultaneous datagrams to send across a single VC.

The AAL 3/4 SAR fields are:

- Segment type (ST)
- Sequence number (SN)
- Multiplexing identification (MID)
- Information payload
- Length indicator (LI)
- Cyclic redundancy code (CRC) check

The payload of the AAL 3/4 CPCS-PDU frame is broken down into AAL 3/4 SAR-PDU frames (usually called cells).

AAL 3/4 CPCS - PDU Frame						
Common Part Indicator 1 byte	Beginning Tag 1 byte	Buffer Allocation Size Indicator 2 bytes	User Payload (inc. pad)	Align ment 1 byte	End Tag 1 byte	Length Indicator
4 bytes			Size: 0-65535	2 bytes		2 bytes

AAL 3/4 SAR - PDU Frame					
ST 2 bits	SN 4 bits	MID 10 bits	SAR-PDU Information Payload	LI 6 bits	CRC 10 bits
2 bytes			44 bytes	2 bytes	

Segment type

The segment type field is a two-bit field that indicates whether a particular SAR-PDU is carrying the first piece of a CS-PDU, an intermediate piece, the final piece, or whether the entire CS-PDU is in the single SAR-PDU. The table below describes the possible values of the ST field.

Value	Description
BOM	Beginning of message. Indicates that the SAR-PDU is carrying the first piece of a CS-PDU.
COM	Continuation of message. Indicates that the SAR-PDU is carrying an intermediate piece of a CS-PDU.
EOM	End of message. Indicates that the SAR-PDU is carrying the final piece of a CS-PDU.
SSM	Single segment message. Indicates that the entire CS-PDU is in the single SAR-PDU.

Sequence number

The sequence number is a four-bit field that identifies the sequential position of each SAR-PDU associated with the same CS-PDU that is sent over a single user-to-user connection (called an AUU connection).

The sequence number is incremented for each successive SAR-PDU for a given CS-PDU, and is used to detect the loss or mis-ordering of a SAR-PDU.

Multiplexing identification

The multiplexing identification (MID) field is a 10-bit field that differentiates between multiple CS-PDUs that may be in transit at the same time over the same ATM connection.

The same MID value must appear in all of the SAR-PDUs of a single CS-PDU. In distributed queue dual bus (DQDB) environments, MID is the message identifier.

Information payload

The information payload of an AAL 3/4 SAR-PDU is 44 bytes long and contains the segmented pieces of a CS-PDU. See Section 1.2.1, “Details of the AAL Types,” on page 1-8 for general information about the CS-PDU.

The information payload contains two subfields: user information and fill. Their descriptions are provided in the following table.

Subfield	Description
User Information	Contains up to 44 bytes of a SAR-PDU, which may be an entire CS-PDU or a segment of a CS-PDU.
Fill	Used in EOM and SSM SAR-PDUs to fill up the 44-byte information payload field of the SAR-PDU. The length of this field varies depending on the number of bytes contained in the user information field.

Length indicator

The six-bit length indicator field indicates how many of the 44 bytes of payload actually contain user data (part of a CS-PDU). BOM or COM SAR-PDUs always contain 44 bytes of data while EOM or SSM SAR-PDUs can contain between 4 and 44 bytes of data; however, the data portion must be a multiple of four bytes.

Cyclic Redundancy Check

The 10-bit cyclic redundancy code (CRC) check field indicates the result of the CRC-10 calculation, which is performed on the entire SAR-PDU. The CRC is used to detect bit errors.

See Section 1.1.2, “The Six Fields of the Five-Byte UNI Cell Header,” for more information about the CRC.

1.2.1.3. Overview of the AAL 5

The most commonly used protocol is the ATM adaptation layer 5, which is a simplification of AAL 3/4. Using AAL 5 limits the transport to connection-oriented and single-frame-at-a-time transmission. This removes the need for MID, COM, BOM, SSM, and EOM, which increases the efficiency of the protocol and makes its implementation much easier (see Section 1.2.1.2, “Overview of the AAL 3/4” for descriptions of MID, COM, BOM, SSM , and EOM).

With AAL 5, there is still a need to recognize the frame boundaries; this is done by using one of the payload type bits in the header.

Under basic conditions, one AAL-SDU is converted to one CPCS-PDU. This is done with non-assured operation, whereby if errors are detected, the data is discarded. Both of those conditions exist when there is no service specific convergence sublayer (SSCS). The SSCS, when present, handles assured operation, which means that data is present if errors are detected.

In most ways, AAL 5 is considered significantly less complicated than AAL 3/4. However, with a more simplified approach comes the potential for data transmission problems to be slightly more common with AAL 5. This tendency centers on the fact that with AAL 5, the method of detecting errors is limited to the CRC, in conjunction with the data length fields. In contrast, the AAL 3/4 approach to detecting errors includes using the sequence number and segment type in addition to other checks.

The AAL 5 CPCS fields are:

- Payload
- Pad
- User-to-user
- Common part indicator
- Length
- Cyclic redundancy code (code-32) check.

CPCS-PDU for AAL 5					
CPCS-PDU Payload	Pad	CPCS-UU 1 byte	CPI 1 byte	Length 2 bytes	CRC 4 bytes
Variable Length (1 to 65,535 bytes)	0 to 47 bytes	Trailer of 8 bytes			

It is important to note that for AAL 5, there is no SAR header or trailer data within the SAR-PDU (in contrast to the CPCS-PDU shown above).

Payload

The payload field contains the AAL SDU. This field is octet-aligned; its length can range from 0 to 65,535 bytes. If the implementation of AAL 5 includes SSCS, the payload can include some overhead function, such as blocking.

Pad

Also octet-aligned, the pad field ensures that the CS-PDU is a multiple of 48 bytes (required since there is no length indication in the SAR-PDU). It varies between 0 and 47 bytes. The pad is placed between the payload and the trailer, so that the trailer consistently occurs in the same position after reassembly.

User-to-user

The user-to-user (UU) field can take on any value. The contents of this field are transparently transferred between AAL 5 users.

Common part indicator

The one-byte common part indicator field is reserved for supporting future AAL 5 functions. This field is coded as all zeros.

Length

The length field indicates the length of the AAL 5 SDU in the AAL 5 CS-PDU. It indicates, to the receiver, the boundary between the user data field and the pad field. The value for this field is two bytes.

The length field can also serve as a check for cell loss in transmission.

Cyclic redundancy code-32

The four-byte cyclic redundancy code field contains a 32-bit CRC calculated over the CS-PDU, which is used to detect bit errors. See Section 1.1.1.1, “The Six Fields of the Five-Byte UNI Cell Header,” for more CRC information.

1.2.2. Understanding User-Network Traffic Contracts and QoS

During a call setup, the calling party must indicate the traffic parameters to the network. They are contained in three information elements:

- Traffic descriptor
- Broadband bearer capability
- Quality of Service (QoS).

These parameters are somewhat confusing because they partially overlap each other. This results form parts of the specifications being defined by the ITU and other parts defined by the ATM Forum. For compatibility reasons, they are all defined as information elements.

The traffic descriptor parameters are:

- Forward peak cell rate (CLP=0)
- Forward peak cell rate (CLP=0+1)
- Backward peak cell rate (CLP=0)
- Backward peak cell rate (CLP=0+1)
- Forward sustainable cell rate (CLP=0)
- Forward sustainable cell rate (CLP=0+1)
- Backward sustainable cell rate (CLP=0)
- Backward sustainable cell rate (CLP=0+1)
- Forward maximum burst size (CLP=0)
- Forward maximum burst size (CLP=0+1)
- Backward maximum burst size (CLP=0)
- Backward maximum burst size (CLP=0+1)
- Best effort indicator
- Tagging forward
- Tagging backward

The broadband bearer capability information element is used to describe the type of connection required.

QoS parameters are a key part of ATM technology. Part of the importance of QoS centers on the need to have a common understanding for measuring what is expected and what is received between service providers and customers. Refer to the ATM Forum specifications for more details about QoS.

1.2.2.1. Details of the QoS Parameters

QoS parameters can be used to assess the behavior of the ATM network as well as the behavior of an individual switch. The key performance parameters are defined as follows.

Name	Performance Area	Formula
Cell error ratio (CER)	Accuracy	Errored cells divided by: successfully transferred cells plus errored cells (successfully transferred cells and errored cells contained in cell blocks counted as severely errored cell blocks should be excluded).
Severely-errored cell block ratio (SECBR)	Accuracy	Severely errored cell blocks divided by the total of transmitted cell blocks.
Cell loss ratio (CLR)	Dependability	Lost cells divided by the total of transmitted cells.
Cell misinsertion rate (CMR)	Accuracy	Misinserted cells divided by the time interval.
Cell transfer delay (CTD)	Speed	This is the time difference between a cell exit event at one measurement location and the related cell entry event at a second measurement location for a specific connection. The CTD between two locations is the sum of the total inter-ATM node transmission delay and the total ATM node processing delay between the two points.
Mean cell transfer delay (mean CTD)	Speed	This is the arithmetic average of a given number of cell transfer delays for one or more connections.
1-Point cell delay variation (1-point CDV)	Speed	This is the difference between a cell's reference arrival time and actual arrive time at a given measurement location. Positive values of this measurement indicate cell clumping and negative values indicate gaps in the cell stream.
2-Point cell delay variation (2-point CDV)	Speed	This is the difference between (a) the absolute cell transfer delay of a given cell between two measurement locations and (b) a defined reference cell transfer delay between the same two locations.

The CLR, CTD, and CDV parameters are negotiated through signaling (on a per-VC basis). The CER, SECBR, and CMR parameters are inherent to a network.

1.2.2.2. QoS Classes and AAL Classes

These relationships exist between QoS and AAL class types:

- QoS class 0 is an unspecified QoS class.
- QoS class 1 supports class A performance requirements.
- QoS class 2 supports class B performance requirements.
- QoS class 3 supports class C performance requirements.
- QoS class 4 supports class D performance requirements.

A user can request a QoS class that is not supported by the network. In addition, the precise performance objectives of the specified QoS classes are not defined. The QoS definitions are specified by individual network providers.

1.2.2.3. Degradation of QoS Parameters

The following table summarizes how various sources of degradation can impair the performance parameters.

Attribute	CER	CLR	CMR	MCTD	CDV
Propagation delay				X	
Media error statistics	X	X	X		
Switch architecture		X		X	X
Buffer capacity		X		X	X
Number of tandem nodes	X	X	X	X	X
Traffic load		X	X	X	X
Failures		X			
Resource allocation		X		X	X

1.3. Address Formats

There are three address formats specified for ATM:

- Public ATM networks are required to support E.164 formats. This system is based on the telephone numbering scheme.
- OSI standards specify the ISO format.
- The IEEE 802 (LAN) recommendations specify the data country code (DCC) format.

E.164 Format					
Authority and Format Identifier	ISDN Address (E.164)	Routing Domain	Area Identifer	End System Identifier (ESI)	Selector (SEL)
1 byte	8 bytes	2 bytes	2 bytes	6 bytes	1 byte

OSI Format								
Authority and Format Identifier	Internat. Code Designator (ICD)	Domain Specific Part Format Identifier (DFI)	Admin. Authority	Reser.	Routing Domain	Area Identifier	End System Identifier (ESI)	Selector (SEL)
1 byte	2 bytes	1 byte	3 bytes	2 bytes	2 bytes	2 bytes	6 bytes	1 byte

DCC Format								
Authority and Format Identifier	Data Country Code (DCC)	Domain Specific Part Format Identifier (DFI)	Admin. Authority	Reser.	Routing Domain	Area Identifier	End System Identifier (ESI)	Selector (SEL)
1 byte	2 bytes	1 byte	3 bytes	2 bytes	2 bytes	2 bytes	6 bytes	1 byte

1.4. Applying ATM Technology

Having established the basic definition of ATM operation, with its layers, we can now review some ways in which ATM technology is implemented. This section first defines some of the major signaling protocols associated with ATM and then explains how the whole package is applied in today's networks.

1.4.1. Signaling Protocols

The higher layers of the AAL include components of the signaling protocols. The protocols of the UNI specifications are maintained in the signaling ATM adaptation layer (SAAL). The SAAL has two parts (sublayers).

- The ITU-TSS specifies one sublayer as being home to the service specific connection-oriented protocol (SSCOP). Functions of the SSCOP include error correction, keep-alive messaging, assured or unassured data transfer, and status reporting to and from peer machines.
- The second sublayer is the service specific coordination function (SSCF), which handles the signaling aspects of the AAL. Functions of the SSCF include unacknowledged data transfer, connection establishment, and mapping.

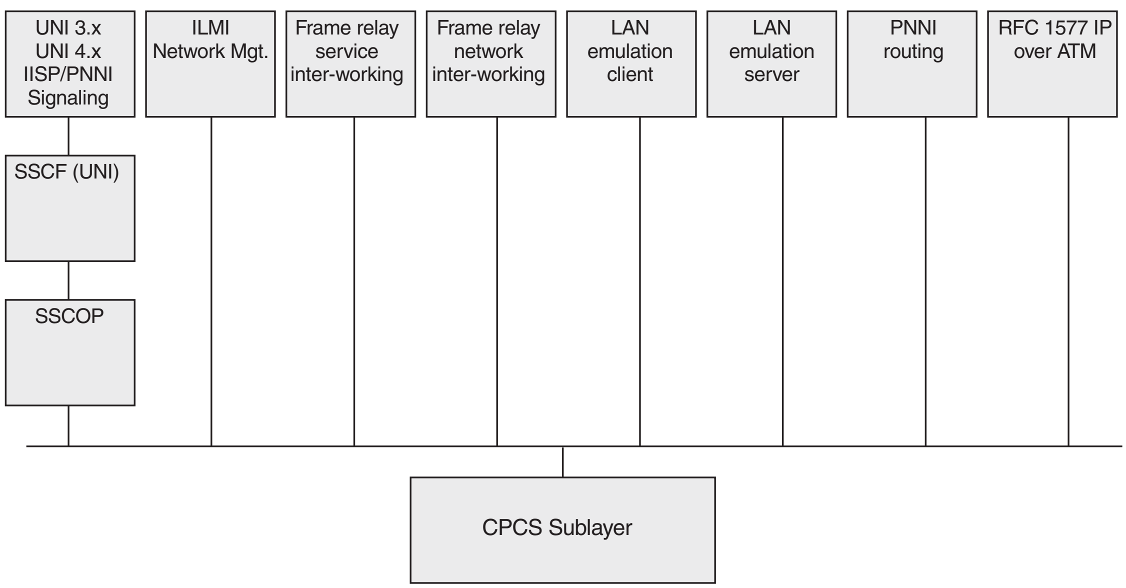


Figure 1-2. ATM architecture.

1.4.1.1. SSCOP

The SSCOP is used with AAL 3/4 and AAL 5 as a translator for the signaling functions of ATM. The SSCOP provides assured data transfer through sending PDUs in a complex set of formats. (See Section 1.2.1, “Details of the AAL Types” for information about PDUs.) Both the NNI signaling set and the UNI signaling set use the SSCOP.

The SSCOP maintains PDUs for:

- Managing data transfer (both unassured and assured)
- Rejecting an initialization request
- Resynchronization commands and acknowledgments
- Disconnect commands and acknowledgments (for releasing)
- Request initialization and acknowledgments (for establishing)

In addition, the SSCOP has four timers:

- POLL timer
- KEEP-ALIVE timer
- NO RESPONSE timer
- CC (connection control) timer.

1.4.1.2. UNI, NNI, and PNNI

The UNI specifications are designed to facilitate end-system connection for ATM users. There are three UNI specifications: UNI 3.0, UNI 3.1, and UNI 4.0. These are used for both public and private networks, but distinctions are made between a public UNI and a private UNI. It should be noted that the UNI 4.0 specification offers several important features that are not available in UNI 3.0 or UNI 3.1, such as enhanced QoS parameters, leaf initiated joins (as opposed to only root-initiated joins), ABR signaling for point-to-point calls, generic identifier transport, and virtual UNIs.

Connections that encompass an entire networking system are network-to-network interface (NNI) connections. The ATM specifications anticipate that a NNI is for the connection between two public ATM switching devices. When one side of the connection is private, then the connection is a private NNI, which is abbreviated as a PNNI. The PNNI protocols are routing protocols for proper integration of multi-vendor ATM switches.

1.5. Reviewing Layer Management and the ILMI

SSCOP and SSCF are protocol models for what is called the control plane. (See Section 1.4.1, “Signaling Protocols” for information about the planes.) In contrast, the management plane handles the layer and plane responsibilities.

- Layer management involves monitoring faults, creating alarms, and monitoring performance levels.
- Plane management involves virtually all layers and planes but interfaces directly with the layer management plane.

The ITU-TSS has not concentrated on the management plane (often called the “M-plane”). As of the fall of 1999, the simple network management protocol (SNMP) and ATM UNI management information base (MIB) are used for channel connection data and other status and operational issues for both public and private UNIs. In this case, the SNMP is specified without User Datagram Protocols (UDP) and Internet Protocol (IP) addressing. The name for this “ATM version” M-plane is integrated local management interface (ILMI).

The ILMI works between UNI management entities (UMEs). UMEs are the management software packages that exist on both the user and network side of a UNI. Characteristics of the UNI ILMI include:

- The ILMI uses SNMP/AAL as the communication protocol and access method.
- Each ATM device:
  - Supports one or more UNIs
  - Has a UNI UME associated with each UNI for supporting the ILMI for that UNI.
- There is one MIB per ATM device and the MIB structure is separated from the access method.

The ILMI uses the ATM UNI MIB for the following management information:

- Physical layer
- ATM layer
- ATM layer statistics
- VP connections
- VC connections
- Address registration information

1.5.1. Local Area Network Emulation

AAL 5 with LAN emulation (LANE) is a common way that ATM is used. In 1995, the ATM Forum Technical Committee released the specifications for LANE over ATM. Through this method, workstations, concentrators, servers, bridging devices, and other end system devices can maintain their current network software while operating as an ATM network. This is done by enabling the switching devices of ATM to emulate the MAC layer (specifically the NDIS and ODI MAC drivers). This can be applied to both Ethernet and token-ring networks. LANE uses AAL 5 to carry frames across the ATM network.

The ATM Forum maintains five “LAN-specific” characteristics that are emulated through LANE. These follow.

Characteristic	Description
Connectionless services	LANE makes it appear that the traditional connectionless service of the LAN is maintained seamlessly.
Multi-cast services	LANE supports broadcast messaging as needed; however, by implementing a screen or filter, LANE is not required to send a multi-cast MAC address across the entire LAN.
MAC driver interfaces	LANE mimics the MAC driver interfaces for the upper layers. This is a crucial point of LANE. The ATM network appears to be simply an additional MAC sublayer.
Emulated LANs	LANE defines an emulated LAN as a group of ATM-attached devices. As such, an end system could be part of more than one emulated LAN, since the physical location of the device is not part of the definition of its use.
Interconnection with existing LANs	LANE supports LAN-station-to-LAN station connections, in addition to ATM-station-to-LAN-station connections. The bridging is done through transparent bridging and source routing bridging.

It is important to note that with LANE, interconnection communication from LAN to LAN is still done through standard routers and bridges.

1.6. UNI Physical Formats

There are many potential physical link formats for ATM. The formats offer different rates, physical media, and drive distances, as described in the table below.

Frame Format	Bit Rate kbit/s	Media	Distance	Line Code
STS	622 080	single mode fiber	15 km at UB	NRZ
		single mode fiber	2 km at TB	NRZ
		multi-mode fiber	300 m	NRZ
STM-1	155 520	single mode fiber	15 km at UB	NRZ
		multi-mode fiber	2 km	NRZ
		UTP-5	100 m	NRZ
		coax	150 m	code mark
STS-3c	155 520	single mode fiber	15 km at UB	NRZ
		single mode fiber	2 km at TB	NRZ
		multi-mode fiber	2 km	NRZ
		UTP-5	100 m	NRZ
		Coax	150 m	code mark
STS-1	51 840	single mode fiber	15 km at UB	NRZ
		single mode fiber	2 km at TB	NRZ
		multi-mode fiber	2 km	NRZ
		UTP-3	100 m	CAP
		coax	300 m	B3ZS, AMI
E4	139 264	coax	no standard	code mark
E3	34 368	coax	no standard	HDB3
E1	2 048	coax	no standard	HDB3
		twisted-pair	no standard	HDB3
DS3	44 736	coax	300 m	B3ZS
DS1 ESF	1 544	twisted-pair	9 km	B8ZS
J2	6 312	coax	no standard	B8ZS
Cell stream	25 600	UTP-3	100 m	4B/5B
Cell stream	155 520	multi-mode fiber	2 km	8B/10B
		shielded twisted-pair	2 km	8B/10B
		coax	100 m	code mark
TAXI	100 000	multi-mode fiber	100 m	4B/5B

2. Installing ATM on a PC for Domino

The following two hardware modules must be in place before you can successfully install the required software:

- An ATM interface module in the top slot
- A Broadband Analyzer Module (BAM) in the bottom slot.

If the necessary modules are already installed in your analyzer, continue to the next section. If the necessary modules are not installed in your analyzer or if you are not sure, refer to the installation guide provided with your ATM analyzer.

2.1. Software Installation

The application operates with Windows 95, Windows 98, or Windows NT 4.0. If you are using Windows NT 4.0, you must have administrative privileges for installation. See the *WWG DominoNAS Release Note* for installation instructions and for system requirements.

2.1.1. Installing Other Software

In addition to the ATM Analysis Application, you may want to install other WWG software provided on the WWG DominoNAS CD. Please refer to the DominoNAS Release Note for information about other programs and utility software that you may want to install for use with the ATM Analysis Application.

2.2. After Completing Hardware and Software Installation

Continue to Chapter 3, "Getting Started with the Application" for information about using the ATM Analysis Application. Refer to the appropriate chapter in this guide for information about the ATM interface module that you are using.

3. Getting Started with the Application

This chapter provides general information about using the ATM Analysis Application, such as navigation techniques and central product features.

If you have not already installed the application, please see the previous installation chapter. After the application is installed, continue here. We suggest that you explore the application while you read this chapter. When you are comfortable with the basics of using this application, continue to the next chapter, “Using the WG Examine Application.” That chapter introduces the WG Examine application, which allows you to perform post-capture analysis.

3.1. Starting the Application

To start the application:

1. From the Windows Start menu, select Programs, followed by ATM Analysis Application (program group).
2. Select ATM Analysis Application.

The Welcome screen (Figure 3-1) appears each time that you start the application. It offers four options. If this is the first time that you are using the product, select the first button: Create a new configuration.

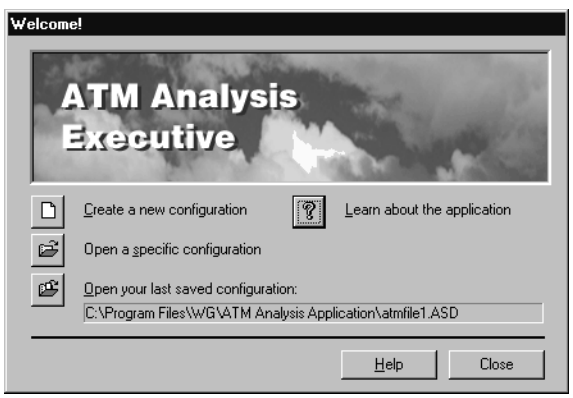


Figure 3-1. The Welcome Screen

The first page of the Analyzer Setup Wizard appears on your screen.

After you read the Introduction page of the Analyzer Setup Wizard and click Next, the first of several wizard pages opens; that first page allows you to select the analyzer. The next wizard page offers various options for how to operate your application for this particular configuration. For example, you can monitor and generate traffic through either of the emulation modes. By making different selections in the Analyzer Setup Wizard and in other wizards, you can specify a variety of parameters.

Note that you can select Help for further guidance and details about the options available to you on any of the wizard pages throughout the application. This Help can be selected by pressing F1, clicking the Help button, or accessing the Help using the Help menu, located on the application menu bar.

If after reading the online Help you are still unsure about what selections to make on a wizard page, make a “best guess” for now. You will not harm any equipment through your choices in the Analyzer Setup Wizard, and you can easily return to this wizard later. Additional details about using the Analyzer Setup Wizard and other key components of this application are available in Chapter 5, “Advanced Tasks.”

After you complete the Analyzer Setup Wizard, the main window of the application appears (Figure 3-2).

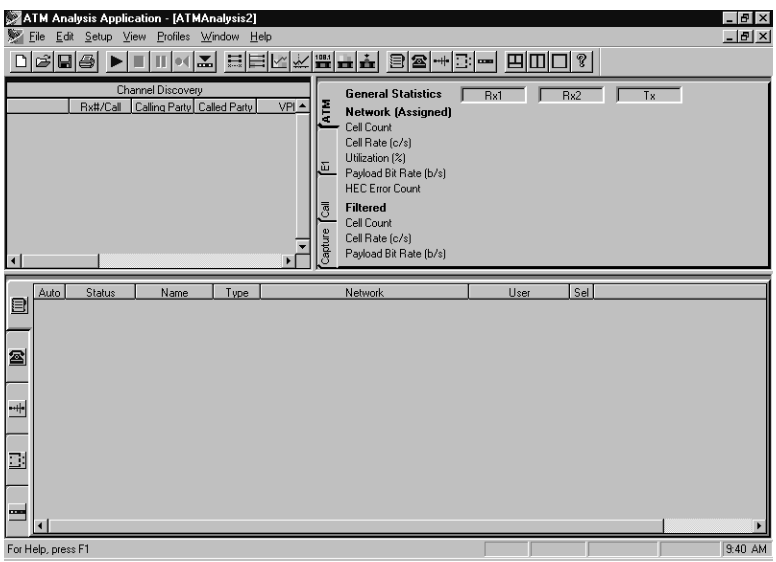


Figure 3-2. Main window of the application.

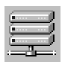
Explore the application as you read the next section.

3.2. Starting the Analyzer

When you start the application, the analyzer is not running. This gives you the opportunity to establish any desired parameters or profiles in the Analyzer Setup Wizard before analyzing. To start the analyzer, click the Start Analyzer icon in the toolbar . (For more information about using the toolbar functions, see Section 3.7, “The ATM Analysis Application Toolbar.”)

3.3. Checking the Status Bar and Icon Tray Information

When you start the analyzer, the WG Analyzer Server icon changes. This icon is located in the bottom right area of your screen. When the analyzer is not running the icon appears like this:



When the analyzer is running, the icon changes to a small horizontal representation of colored lights on a panel. This signifies that the analyzer is active. In either condition (running or not running) you can check the status of the registered analyzers.

To check the status of the registered analyzers:

1. Click the right mouse button on the WG Analyzer Server icon.
2. Select View.

Notice that you can also reset the status of your analyzers and shut down the WG Analyzer Server from the same menu. If you modify, add, or remove any hardware component from your analyzers, you must reset the WG Analyzer Server for the WG analyzer server to recognize the change.

Above the WG Analyzer Server icon is the status bar. When the analyzer starts, the status bar begins to show the status of three conditions, which are provided in each of the recessed boxes.

The first box indicates that the analyzer is running. In the above example, the ILMI status is “Down.” If your network does not send polling messages frequently, the application may show ILMI as Down. The third box shows the status of SSCOP as Up or Down. The fourth box, which is empty when you first start the application, changes to “Transmitting” when you begin transmission (either onto the network or through loopback).

3.4. Reviewing the Major Parts of the Application

The two major parts of the application are the views and the wizards. This section provides a brief overview about how to access those features.

3.4.1. Using the Views

The main window of the application (Figure 3-2) contains three separate views. A left, a right, and a bottom view are present in the default setting for the application. The left and right views provide feedback about general network statistics, quality of service measurements, and several other measurement features. The bottom view has five options, including call setup features, filtering and triggering features, and transmit profile features. Splitter bars appear between the views in the main window. The views can be resized by clicking and dragging the splitter bars. If all views are blank, the analyzer may not be running; see Section 3.2, “Starting the Analyzer.”

To use the left and right views:

1. Make one of the left or right views active by clicking within the boundaries of the splitter bars. A thin colored bar at the top of the view displays your active window color.
2. Click the right mouse button; a shortcut menu appears with several options.
3. Notice the options on the shortcut menu, such as View for changing to a different view or Properties for customizing the nature of the presented data in some of the views.
4. Place your cursor over View and note the names of the other views.

Some of the left and right views, such as the General Statistics View, have labeled tabs that you can click to switch to between them.

To use the bottom view:

1. Place your cursor over each icon for each one of the five features of the bottom view; note the feature names as your cursor passes over the icons.
2. Select the Call Setups icon by clicking it. (The Call Setups icon is represented by a phone symbol). Notice that the bottom view is now active.
3. Click the right mouse button; a shortcut menu appears with several options.
4. Notice the options on the menu, such as View for changing the type of data that is presented in that view or New for starting the wizard associated with the selected feature of the bottom view.
5. Select New to start the Call Setup Wizard. When the Introduction page appears. Click Cancel to exit the wizard for now.

3.4.2. Using the Wizards

There are several wizards in the application. Each wizard is used in the day-to-day operations of the application. When you complete any wizard, the choices that you made are accepted, and the resulting data appear in the left, right, or bottom view.

Purpose	Wizard and Access	Key View
Setting up an analyzer session includes defining the role it plays in the network and specifying settings for the ATM layer, the physical layer, and signaling.	Analyzer Setup Wizard Select Setup Analyzer from the Setup Menu.	Analyzer Settings View
Setting up a call ensures that all required and optional information elements are entered correctly.	Call Setup Wizard Select Setup Call from the Setup Menu.	Call Setup View
Setting up measurements include in-service delay measurements, in-service misinsertion measurements, or out-of-service measurements.	Quality of Service Wizard Select QoS Setup Wizard from the Setup Menu.	Quality of Service Views
Setting up parameters to control transmission onto your ATM network allows you to establish a cell sequence to transmit, a rate at which to transmit, and the number of times to transmit.	Transmit Profile Wizard Select New from the shortcut menu (reached by clicking the right mouse button while the Transmit View is active; also, note the frame builder feature listed there).	Transmit Profile View
Setting up your filtering and triggering parameters allows you to specify what type of filter or trigger you want to use and specify the detailed parameters.	Filter and Trigger Wizard Select New from the shortcut menu (reached by clicking the right mouse button while the Filter and Trigger View is active).	Filter and Trigger View
Initiating the addition of a party to a pre-selected point-to-multi-point call enables the application to use the connection VPI:VCI specified in the original Call Setup and for you to include optional information elements established earlier.	Add Party Wizard Select Add party from the Channel Discovery View while a point-to-multi-point call is active in the Channel Discovery View.	Channel Discovery View

3.5. Using the Views and Wizards to Perform Key Functions

The ATM Analysis Application has five central functions:

- Monitoring (when monitoring is selected in the Analyzer Setup Wizard)
- Measuring
- Filtering (including capturing data)
- Emulating (when emulation is selected in the Analyzer Setup Wizard)
- Examining

To establish the options and parameters for how the application performs these tasks, use the wizards and, if desired, the frame builder. The application displays the resulting data in the various views of the product. The following sections outline the five central functions and how to begin performing these tasks.

3.5.1. Monitoring

The analyzer actively monitors a line to track statistics on a per-VC basis, in addition to network history and channel data. The signal received on Rx1 is retransmitted on Tx2. The signal received on Rx2 is retransmitted on Tx1. The application automatically discovers the VPI/VCIs that are in use.

General Statistics View

The General Statistics View has several tabs, such as the Call tab and the ATM tab, that provide calculations relative to the current analysis session. An analysis session begins when you start the analyzer and continues until you stop the analyzer. This view includes information about the cell rate, the cell count, utilization, indicator alarms, bit-interleaved parity errors, call initiation and duration, call failures, capture buffer utilization, line errors, and line alarms.

Network History View

The Network History View has options for monitoring utilization, cell rate, and the payload bit rate for network data and filtered data.

Channel Discovery View

The Channel Discovery View provides a complete list of channels with extensive information about the definition and status of those channels. This information includes call origin identification, the VPI, the VCI, the specified AAL type, the traffic type (CBR, VBR, or ABR), the setup time, and other data. By clicking the right mouse button, other features can be accessed from the shortcut menu commands, such as adding a call to a profiles list, tearing down a call, adding a party, and dropping a party.

3.5.2. Measuring

Quality of Service (QoS)

The QoS measurements are seen in the QoS Graphs View and the two QoS Statistics Views. One statistics view is for in-service measurements and one is for out-of-service (OOS) measurements. The OOS measurements are seen on two tabs (a delay tab and an error tab). Any QoS view can be displayed in the upper left or upper right views. The following advanced QoS measurements can be established through the QoS Wizard and observed in the views:

- 1-point cell delay variation (1-pt CDV)
- 2-point cell delay variation (2-pt CDV)
- Cell transfer delay (CTD)
- Cell loss ratio (CLR)
- Cell error ratio (CER)
- Cell mis-sequence ratio (CSR)
- Cell mis-insertion rate (CMR)
- Severely errored seconds ratio.

There are three modes of operation for QoS:

- For in-service (delay) measuring, the test equipment passively monitors the network and performs measurements without affecting the traffic on the network in any way. In this mode, the 1-pt CDV measurement is the only measurement that can be performed.
- For in-service (mis-insertion) measuring, the test equipment passively monitors the network and counts the number of cells seen on the test channel. These cells are used to determine the CMR measurement, because it is assumed that cells showing up on the test channel are mis-inserted cells.
- For out-of-service (OOS) measuring, the test equipment transmits test traffic on the specified test channel, measures the traffic as it is transmitted (measurement point 1), and then measures the traffic when it comes back (measurement point 2). The transmitted traffic is continuous traffic. The 2-pt CDV, CTD, CER, CLR, CSR, and severely errored seconds ratio measurements are all performed in OOS mode.

More information about these measurements can be found within the application and in section 1.2.2, “Understanding User-Network Traffic Contracts and QoS” on page 1-16.

General Statistics View

The Call tab of the General Statistics View includes some key measuring statistics, such as rates for call initiation, success, duration, and failure.

3.5.3. Filtering

By default, the analyzer captures all traffic that appears on the line. However, in many situations, you may only want to look at a subset of the traffic. In these cases, you should set a filter. You can define a filter based on the following criteria:

- An ATM address
    - Called party address
    - Called party subaddress
    - Calling party address
    - Calling party subaddress
- Cell content
    - Content of the header
    - Content of the payload
- Cell header content only
    - Generic flow control (GFC)
    - Virtual path identifier (VPI)
    - Virtual channel identifier (VCI)
    - Payload type indicator (PTI)
    - Cell loss priority (CLP)
- A sliding window, filtering on an eight-byte pattern anywhere within the incoming data stream.

For example, a common filter is one that centers the analyzer on a particular channel (a particular VPI:VCI). This can be done by building a filter based on the cell header.

3.5.4. Emulating

To setup the analyzer for emulating, start the Analyzer Setup Wizard and select one of the following emulation options:

- Emulate a user

The analyzer generates traffic on Tx1 and receives traffic on Rx1. If loopback is enabled, the generated traffic is internally looped back to Rx2 to permit internal monitoring (even if a signal is applied at the Rx2 connector).

- Emulate a network (not available for E1 users)

The analyzer generates traffic on Tx2 and receives traffic on Rx2. If loopback is enabled, the generated traffic is internally looped back to Rx1 to permit internal monitoring (even if a signal at the Rx1 connector exists). If you leave Rx1 connected to the network while operating in this mode, the statistics recorded on Rx1 are from the cell transmitter and not the network.

Emulation Signaling

The application's emulation features include specifying a signaling type, which is specified in the Analyzer Setup Wizard. You can specify these options:

- UNI signaling 3.0, which corresponds to that specification.
- UNI signaling 3.1, which corresponds to that specification.
- PVC Only for UNI or NNI environments.

UNI signaling can be in either public or private conditions. A public UNI usually interconnects an ATM user with an ATM switch of a service provider. A private UNI usually interconnects an ATM user with an ATM switch within the same corporation or campus. The drive distances associated with a public UNI are generally longer than those commonly found in private UNI signaling.

Transmit Profile Wizard

Through the Transmit Profile Wizard you can set all of the parameters to control transmission onto your ATM network. This includes establishing the cell sequence to transmit and the number of times to transmit.

You can define both the header and the individual payload bytes for transmitting an ATM cell through the Cell Editor of the Transmit Profile Wizard. You can select the addressing type (UNI or NNI) and specify a path for the cell by entering a desired VPI:VCI. You can also group cells to form a cell sequence.

Frame Builder

The frame builder feature allows you to set up a protocol stack, specify protocol overhead fields, and give detailed inputs for the payload (common protocols are supported). Created frames are sent through the Transmit Profile Wizard.

Call Setup Wizard

The Call Setup Wizard guides you through the steps for setting up an ATM call and ensures that all information elements that are required by the UNI 3.0 or UNI 3.1 specification are entered correctly. The connection type (point-to-point or point-to-multipoint), the required and optional information elements, the AAL parameters, and other options can all be established through the Call Setup Wizard.

Alarm/Error Insertion View

With the analyzer active in either Emulate User or Emulate Network mode, you can insert errors and establish alarms by using the Alarm/Error Insertion View and setting insertion to “on.” This view enables you to insert errors and alarms for the particular physical interface you are using. The Alarm/Error Insertion View is one of the left and right views.

Add Party Wizard

The Add Party Wizard initiates the addition of a party using the connection identifier (VPI:VCI) specified in the original Call Setup. Using the wizard, you can include optional information elements within the parameters that you established in the Call Setup Wizard.

3.5.5. Examining

Access the WG Examine application by selecting File/Examine from the menu bar of the ATM Analysis Application. When you are finished examining the captured data, you return to the ATM Analysis Application by exiting the WG Examine application.

The WG Examine application provides options for post-capture examination of network traffic. To allow for post-capture examination of network traffic, the contents of the RAM capture buffer must be saved to a file (File/Save Capture Buffer). You can save a specified percent of the most recently arrived portion of the data in the capture buffer when you save a capture file. The WG Examine features include:

- Displaying frame information
- Searching for specific frames and jumping to specific frames
- Filtering captured files
- Working with captured data
- Printing data
- Exporting the captured file

Chapter 4 provides basic instructions for using the WG Examine application.

3.6. Other Features

Note the availability of the three general functions described in the sections below.

3.6.1. Saving Data

You can save the configuration of your current analyzer session by selecting File/Save or File/Save As from the menu command bar. Doing so enables you to establish different profiles, options, and parameters in different files.

You can also save additional information by selecting File/Save Capture Buffer and then choosing either:

- The Save Captured Data sub-option to save the data portion of the capture buffer to a designated file, or
- The Save Reserved Channels sub-option to save signaling and network management information to a designated file.

In addition, from the short-cut menus (accessible by clicking the right mouse button while the desired view is active) of most of the views, you can copy or export the selected data to the Clipboard.

3.6.2. Printing

You can print most of the left and right views when they are active by selecting File/Print; you cannot print any of the five bottom views.

3.6.3. Using the Help

The ATM Analysis Application provides online Help for the current view when you press F1; specific information about the currently active view is provided. In addition, Help is available from any of the wizard pages and most of the other application dialogs.

The Help menu command displays the table of contents for the Help. In addition, you can browse through the index of the Help and search for a specific word through the Find feature.

You can print a Help topic by selecting the Print button while any topic is displayed. You can also bookmark topics and use the online glossary from within the Help.

3.7. The ATM Analysis Application Toolbar

	New	Creates a new configuration.
	Open	Opens an existing configuration.
	Save	Saves the active configuration.
	Print	Prints the current view.
	Start Analyzer	Starts the analyzer.
	Stop Analyzer	Stops the analyzer.
	Pause	Pauses the views.
	Reset	Resets all data.
	Setup Analyzer	Starts the Analyzer Setup Wizard.
	Channel Discovery	Shows the channels discovered on the network.
	Per Channel	Shows statistics for a set of VPI:VCIs.
	General Statistics	Shows the statistics gathered for the network.
	History	Shows network and captured statistics.
	QoS Statistics	Shows the Quality of Service parameters.
	QoS Graphs	Shows several graphs of the Quality of Service.
	Alarm/Error Insertion	Inserts errors and alarms onto the network.
	Addresses	Enters addresses, names, and ILMI registration.
	Call Setups	Create and use call profiles for SVC emulation.
	Transmit	Create and edit transmit profiles.
	Filters	Create, edit, and use filters and triggers.
	Analyzer Settings	View the current analyzer settings.
	Split 3 Ways	Split the window into three views.
	Split Vertically	Split the window vertically into two views.
	Single View	Show only the currently active view.
	Help Topics	Shows the Help table of contents.

3.8. ATM Application Menu Commands

The menu commands serve as quick ways to access and use various features.

File Menu

Command	Description
New	Starts the Analyzer Setup Wizard for configuring the analyzer.
Open	Displays the Open dialog box to select an existing analyzer configuration (.ASD) file.
Close	Closes the currently active analyzer configuration. You are provided the option to save any changes.
Save	Opens the Save As dialog box to save the currently active analyzer configuration file. Any configuration changes you have made during the current session are saved.
Save As	Opens the Save As dialog box to save the currently active analyzer configuration under a new name.
Save Capture Buffer	Saves the current capture buffer content to a .CAP file. **Save Captured Data** - Saves the data portion of the capture buffer to a designated file. **Save Reserved Channels** - Saves the reserved ATM channels (containing signaling and ILMI information) to a designated file.
Examine	Starts the WG Examine application for analyzing captured data.
Examine from RAM	**Examine Captured Data** - Examine the data currently in the capture buffer. **Examine Reserved Data** - Examine the reserved channel data currently in the capture buffer.
Print	Prints the currently active view.
Export	Exports the data from the current view to the clipboard.
Import Profiles	Enables you to select the target file and specify what type of profiles to import.
Recent File	Opens the last configuration.
Exit	Quits the application. You will be prompted to save.

Edit Menu

Command	Description
Copy	Copies a selection to the clipboard.
Paste	Pastes text from the clipboard into a text field.
Delete	Deletes the current selection.
Delete All	Deletes all items in the current view.

Setup Menu

Command	Description
Setup Analyzer	Starts the Analyzer Setup Wizard to change any of the Analyzer setup choices that you made earlier.
Start Analyzer	Starts the analyzer to begin analysis.
Stop Analyzer	Stops analysis.
Pause	Immediately pauses all of the analyzer views. Click Pause again to resume data gathering for all views or click the Pause toolbar button to resume gathering data.
Reset Statistics	Returns all counters in all views to zero.
Clear Capture Buffer	Clears the capture buffer instantly.
Setup Call	Starts the Call Setup Wizard or sets up the currently selected call in the Call Setup View.
Add Party	Adds a party to the selected point-to-multipoint call.
QoS Setup Wizard	Starts the QoS Setup Wizard to set quality of service measurement.
Start QoS	Starts the QoS analysis function.
Options	Opens the Options dialog box for you to establish how to view addresses, rates, and the VPI/VCI (decimal or hex).
Display in 3D	Shows graphs in three dimensional format.
Split	Splits the views that are visible in the main window at one time; the available options are: **Single View** - Show only the current view. **Split Vertically** - Show two views side-by-side. **Split 3 Ways** - Show three views.

View Menu

Command	Description
Channel Discovery	Displays the Channel Discovery view, which shows the channels that the analyzer has discovered on the link.
Per Channel Statistics	Displays the Per Channel Statistics view, which shows statistics for a selected set of VPI:VCIs.
General Statistics	Displays the General Statistics view, which shows the statistics gathered from the link.
Network History	Displays the Network History view, which shows statistics captured over time.
QoS Statistics	Displays the QoS Statistics view, which shows a set of quality of service parameters.
QoS Graphs	Displays the QoS Graphs view, which shows quality of service information in graphical format.
Alarm/Error Insertion	Displays the Alarm/Error Insertion window, which allows you to insert various alarms and errors onto the network.
Addresses	Displays the Address View, which allows you to specify ATM addresses, names, and ILMI registration.
Call Setups	Displays the Call Setup Profile View, which lists all of the profiles that you have created and their status.
Transmit Profiles	Displays the Transmit View, which allows you to create, edit, and use transmit profiles.
Filters and Triggers	Displays the Filters and Triggers View, which allows you to set up filters and triggers for monitoring traffic (through the Filter and Trigger Wizard).
Analyzer Settings	Displays the Analyzer Settings View, which gives you an overview of the current conditions of the analyzer and allows you to edit the settings for changes.
Properties	Displays the property sheet for the current view, which allows you to customize the properties of the active view.
Toolbar	Shows or hides the application toolbar.
Status Bar	Shows or hides the application status bar.

Profiles Menu

Command	Description
New	Starts the wizard associated with the active view to create a new profile or item.
Edit	Enables you to modify the selected profile or item.
Rename	Enables you to modify the name of the selected profile.
Details	Shows the details of the selected profile.
Register Address	Registers the selected address.
Unregister Address	Unregisters the selected address.
Transmit	Sends the selected profile onto the network.
Set Filter	Establishes the selected profile as a filter.
Set Trigger	Establishes the selected profile as a trigger.
Unset Filter/Trigger	Unsets the profile for filtering and triggering.
Filter/Trigger Settings	Enables you to edit the filter and trigger settings, if active.

Window Menu

Command	Description
Cascade	Shows the current views in an overlapping arrangement.
Tile	Shows the current views in a horizontally tiled arrangement.
Arrange Icons	Arranges minimized icons at the bottom of the window.

Help Menu

Command	Description
Help Topics	Shows a list of Help topics.
About ATM Analysis	Shows the version number of the application.

4. Using the WG Examine Application

This chapter provides the following information:

- An overview of the central features of the WG Examine application
- Instructions for accessing the WG Examine application and using it with ATM networks.

4.1. Overview of the WG Examine Application

The WG Examine application enables you to perform off-line analysis of captured network traffic at the frame level. The application uses capture buffers to provide options for examining a file of captured frames of network traffic. When you open a capture file in WG Examine, you can:

- Display summary frame information.
- Search for and jump to specific frames.
- Filter on any combination of frame number, frame size, character string, hex string, attribute, protocol, or any protocol field.
- Customize the data display in any of the following ways:
    - Modify the protocol stack
    - Select the character code
    - Enable packet reassembly
    - Enable protocol scanning
    - Choose timestamps to view, including absolute, relative (to a user-selected time) and delta (interframe gap)
    - Select any combination of protocol fields to view (for example, source and destination addressed only) and viewing format, such as mnemonic, hex, decimal, and binary
    - Select the protocol display format and colors
    - Synchronize displays
- Print the contents of the capture buffer
- Export the contents of the file to a spreadsheet program for further analysis.

4.2. Accessing The WG Examine Application

The WG Examine application is provided with the NAS CD and is also included as a part of the Domino Core software. Once installed, the WG Examine application can be accessed from within the ATM Analysis Application, as described in the section below.

If you are using the WG Examine application with a Domino system, you can also access the WG Examine application independent of the ATM Analysis Application. See the documentation for the Domino Core software or the WG Examine application for more information about using the application.

4.3. Saving ATM Analysis Application Traffic to a Capture File or RAM

Once the ATM Analysis Application starts running, all assigned cells are captured to a buffer unless a filter has been set to exclude them. If you wish to look at the contents of those cells, you can save the cells to a file.

To save cells to a file:

- From the File menu, select File/Save Capture Buffer.

In addition, you can select to view the traffic data currently in the RAM.

To examine capture data from the RAM:

- From the File menu, select File/Examine from RAM.

When using either method, If the configuration is for PVC, then the cells should be saved using the Save Captured Data option. Likewise, in an SVC environment, the Save Captured Data option only saves cells with a VCI of 0 or greater than 31. The reserved VCIs of 1 through 31 must be saved using Save Reserved Channels. Therefore, in an SVC environment, when you want to save the capture buffer, you must save each of these sections separately. The only way to correlate the data in the two files is by time stamp, but note that both buffers wrap at different rates, and the time stamps only have a resolution of 32 µsec.

If you wish to see the signaling messages and data frames in the same file, you can configure the analyzer for PVC even in an SVC environment. In that configuration, the analyzer does not interpret the signaling messages as such. Therefore, you cannot use the channel discovery features to monitor the progress of calls; however, all of the captured cells are saved in a single file.

4.4. Using the WG Examine Application for ATM Networks

Due to the nature of ATM technology, setting up the protocol stack for ATM data in the WG Examine application can be complicated. Follow the instructions below and be sure to reference the Help within the WG Examine application.

To modify the protocol stack for analyzing ATM data:

1. From the Examine menu bar, choose Buffer/Protocol Stack. The Protocol Stack dialog box appears. Check Custom Stack to customize the stack.

If the captured data comes from the ATM Analysis Application, the WG Examine application automatically specifies ATM Cells and AAL5. If the captured data is reserved data (from VCI 1-31), UNI Signaling is also automatically specified.

2. If the data is not from the ATM Analysis Application, select the Layer 1 Setup button and choose ATM Cells or one of the available options, using Figure 4-1 as a guide.

If the captured traffic is not from the ATM Analysis Application but the VCIs are well known, the application will automatically determine the appropriate protocol for Layer 2 (OAM or AAL5).

3. If the VCIs are not known, click the Layer 2 Setup button.

Choose one of the available options, using Figure 4-1 as a guide.

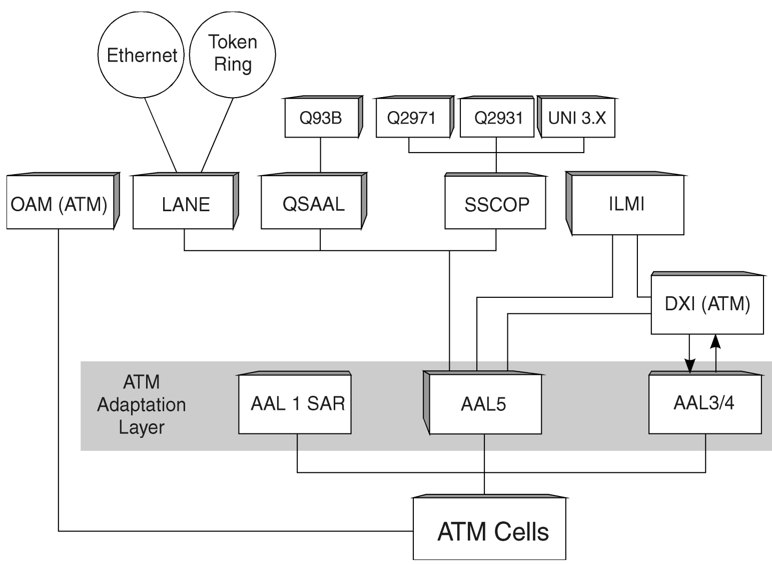


Figure 4-1 ATM Protocol Relationships

5. Advanced Tasks

This chapter provides instructions on how to perform the following tasks:

- Configuring the analyzer
- Obtaining general statistics and per channel statistics
- Getting channel information through channel discovery
- Addressing and working with addresses
- Making calls and adding parties to calls
- Transmitting cells
- Transmitting frames
- Filtering traffic.

5.1. Configuring the Analyzer

There are three major tasks associated with configuring the analyzer:

1. Installing and cabling the interface modules
2. Specifying how the application operates (within the application)
3. Saving analyzer configuration profiles (within the application).

5.1.1. Installing and Cabling the Interface Modules

If the analyzer is not already physically configured, see the documentation that came with your analyzer. Turn to the appropriate chapter of this guide for detailed instructions about cabling your particular interface module.

5.1.2. Specifying How the Application Operates

The Analyzer Setup Wizard presents the central options for specifying exactly how you want the application to operate.

To access the Analyzer Setup Wizard, do one of the following:

- Select “Create a new configuration” from the Welcome Screen.
- Click File\New from the command menu of the application.

5.1.2.1. The Analyzer Test Mode Page of the Analyzer Setup Wizard

The Analyzer Test Mode page of the Analyzer Setup Wizard allows you to establish the general testing mode for the analyzer.

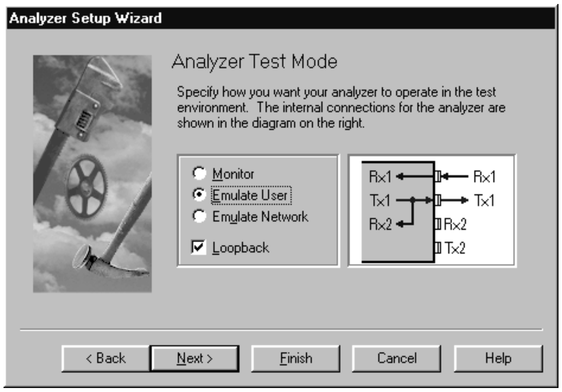


Figure 5-1. The Analyzer Test Mode Page of the Analyzer Setup Wizard

Monitor	Enables the analyzer to actively monitor both sides of a line. The signal received on Rx1 is looped back to Tx2. The signal received on Rx2 is looped back to Tx1.
Emulate User	Enables the analyzer to generate traffic on Tx1 and to receive traffic on Rx1. If loopback is enabled, the generated traffic is internally looped back to Rx2 to permit internal monitoring. It is important to note that if Tx loopback is enabled, the Tx1 signal is internally looped back to receiver Rx2, even if a signal is applied at the Rx2 connector. Therefore, if you leave Rx2 connected to the network while operating in this mode, the statistics recorded on Rx2 are coming from the cell transmitter and not from the network.
Emulate Network	Enables the analyzer to generate traffic on Tx2 and to receive traffic on Rx2. If loopback is enabled, the generated traffic is internally looped back to Rx1 to permit internal monitoring. Out-of-service functions of QoS are not available in this mode. The Tx2 signal is looped back to receiver Rx1 when the application is set for Emulate Network mode, even if a signal is applied at the Rx1 connector. Therefore, if you leave Rx1 connected to the network while operating in this mode, the statistics recorded on Rx1 are coming from the cell transmitter and not from the network.
Loopback	Selecting loopback specifies whether the output of the current transmitter is internally looped back. You can choose this option in an emulate mode only (either user or network).

The two wizard pages that follow the Analyzer Test Mode page are the Signaling page and the Hardware Settings page. On the Signaling page, you can configure the parameters that affect how cells are decoded. For example, UNI cells have an 8-bit VPI field, and NNI cells have a 12-bit VPI field. In the PVC environment, all captured cells can be saved into a single file. In the SVC environment, the captured cells are separated into data channels and reserved channels (VCI=1 to 31) and can be saved into separate files as well. If Public NNI is selected, the subaddress information element can be used.

The Hardware Settings page gives you additional control over timing, cell scrambling, and HEC Coset. These options normally do not need to be changed from the default settings.

5.1.2.2. Notes on Receiving and Transmitting

When the analyzer is in Emulate Network mode, the analyzer acts as if it were a piece of network equipment, such as a switch. The analyzer provides the network prefix part of the ATM address to any user who connects to it. You cannot setup a call or add a party to a call when the analyzer is set to Emulate Network mode, but you can transmit on a specified VPI:VCI.

For either emulation mode (Emulate User or Emulate Network) it is important to note which receiver is connected:

- Always connect the Rx/Tx 1 pair to the network side. (In Emulate User mode, connect Rx/Tx1 to the network.)
- Always connect Rx/Tx 2 to the user side (In Emulate Network mode, connect Rx/Tx2 to the end station.)

These conditions also apply when the analyzer is in monitor mode between an end station (user) and a switch (network).

If you are using OC-3 technology, you can connect to the OC-3 network using optical splitters.

5.1.2.3. Configuring Options for Disabling ILMI or Signaling

If your network is only running PVCs, it can be helpful to not run ILMI or signaling by selecting the “UNI PVC only” option or the “NNI PVC only” option on the Signaling page of the Analyzer Setup Wizard. In these modes, reserved channel information is interleaved with regular cell data in the capture buffer.

5.1.2.4. Common Problems with Analyzer Configuration Tasks

The following problems commonly occur when configuring the analyzer.

Statistics and Graphs Do Not Update

If you start the application and the statistics and graphs do not update, you might have configured the analyzer properly but forgotten to start the analyzer. Starting the application is different than starting the analyzer. To start the analyzer, select Setup/Start Analyzer from the command menu. The statistics and graphs should refresh themselves if you properly configured the analyzer hardware. If they still do not refresh, see Chapter 2, “Installing ATM on a PC for Domino.”

Incorrect Results

If the application is returning questionable results, you should check to make sure that you specified the right UNI version. The application does not detect which UNI version is operating on a given switch. This must be specified on the Signaling page of the Analyzer Setup Wizard. If desired, you can specify “permanent virtual circuits only” signaling for UNI environments or NNI environments.

It is important to note that UNI signaling can be for either public or private conditions. A public UNI usually interconnects an ATM user with an ATM switch of a service provider. A private UNI usually interconnects an ATM user with an ATM switch within the same corporation or campus. The drive distances associated with a public UNI are generally longer than those commonly found in private UNI signaling.

Incorrect Flash Version

If you try to start the analyzer and see a message stating that you have the wrong version of the FLASH, it is possible that the ATM FlashLoader application was not run when the ATM Analysis Application was installed. See Chapter 2, “Installing ATM on a PC for Domino.”

Saving Analyzer Configuration Profiles

After you specify how you want the analyzer to operate, using the wizards and other application options, you can save the settings. This is an important feature, because it enables different users of the application to have different configuration profiles stored on the same analyzer.

To save an analyzer configuration profile:

Click File\Save or File\Save As from the command menu.

5.2. Obtaining General Statistics and Per Channel Statistics

The General Statistics and Per Channel Statistics are two of the upper views of the application. In Figure 5-2 below, the general statistics information is in the right view, and the per channel statistics information is in the left view. To access either view, select the view from the View option of the command menu.

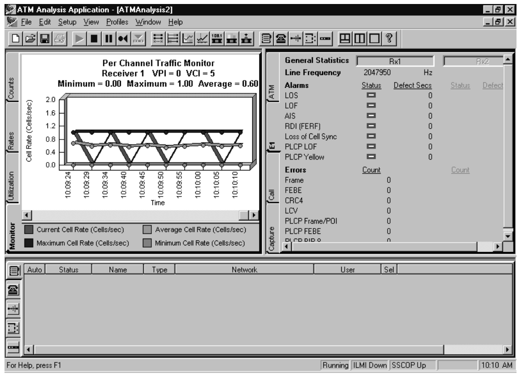


Figure 5-2. The General Statistics View and Per Channel Statistics View (Using E1)

The view on the right shows E1 data on one tab of the General Statistics view. Green, yellow, or red graphics under the Status column indicate the state of a given physical layer alarm:

- Green means that the alarm condition has not happened on the network since the analyzer was started.
- Yellow (or amber) indicates that the alarm condition has happened but is not happening currently.
- Red means that the alarm condition is currently occurring.

An important distinction to make regarding the ATM portion of the General Statistics view is the difference between network traffic and filtered traffic. Network traffic counts all assigned cells that are currently on the network. Filtered traffic is the traffic that is going into the analyzer capture buffer, which includes any traffic that passes the hardware filters.

When you change the channels that you are displaying on the Rates graph of the Per-Channel Statistics View, historical data that you were displaying is lost. The graph resets to begin at the time that the new channels were selected.

5.3. Getting Channel Information Through Channel Discovery

The Channel Discovery View shows a complete list of active channels, along with extensive information about their current status.

To narrow the information shown in the Channel Discovery View:

1. Make the Channel Discovery view active.
2. Click the right mouse button to access the short-cut menu for this view.
3. Select Properties.
4. Select which columns you want to view.
5. Click to sort in ascending order (click again to sort in descending order).

If you select to reset the Channel Discovery View, doing so also updates the information provided in the Per Channel Statistics View. If you establish calls and then select to reset the Channel Discovery View, some sections within the Call Tab of the General Statistics View will not reflect calls that have been torn down after the reset.

5.3.1. Common Problems Using Channel Discovery

The analyzer discovers SVCs by monitoring the signaling information that is exchanged on the link. All other connections are discovered by looking at cell headers for every cell on the link. If you connect your analyzer in passive monitoring mode (using optical splitters), it is likely that there are some SVCs already present on the link. Since the analyzer did not see the signaling information when these SVCs were set up, they are reported as "PVC/Unknown."

The analyzer can only look for PVCs on one receiver at a time because the header of every cell must be examined in real time. When you change the receiver being monitored, all of the connections that the channel discovery function has found will continue to be displayed. Any new connections discovered on the other receiver are also displayed. The discovery of SVCs is not affected, since this is done on traffic from both receivers simultaneously by the signaling stack.

5.4. Addressing and Working with Addresses

The addressing features of the ATM Analysis Application are an important component to many aspects of the product. The application cannot perform any meaningful signaling functions, such as making calls, until the analyzer is registered. With the application in monitor mode (established in the Analyzer Setup Wizard) you can watch the “conversation” between the network side and the user side of address registration. In emulate user mode or emulate network mode (either mode is selected in the Analyzer Setup Wizard), you can quickly register addresses and set the application for auto-registration upon initialization. All of the ATM addressing tasks are done through ILMI, and it is helpful to have an understanding of ILMI before working with addresses. If you are unfamiliar with ILMI, see Section 1.5, “Reviewing Layer Management and the ILMI” on page 1-22.

One of the most important functions of ILMI is address registration. The network side UME (usually a switch) needs to inform the user about which NSAP prefix to use. The user side then appends its ESI and SEL to the prefix to form the NSAP address. The user then needs to register the address with the network side UME. When the user side initializes, which typically happens at power up, the user side reinitializes its network prefix table and sends a ColdStart trap to the network side. The network side UME then reinitializes its address table. The network side UME then sets the address prefix on the user side by issuing the following message:

SetRequest { atmfNetPrefixStatus.port.prefix=valid(1) }

The user side then updates the network prefix table accordingly.

If NSAP addressing is used, ESI and SEL are appended to the prefix. If E.164 addressing is used, a null user part is appended to the prefix instead. This issues the following request to the network side:

SetRequest { atmfAddressStatus.port.address=valid(1) }

The network side then updates the address table accordingly. Note that in both cases, the prefix and the address appear as part of the OID. In SNMP terminology, they form part of the “index.”

The application can automatically track NSAP addresses. In addition, in Emulate mode, the application participates in the ILMI protocol as a UME, and the application can also automatically register its address with the network side. The application allows you to register two address types: public E.164 or ATM end station address. A Public E.164 address structure specifies ISDN numbers, which include telephone numbers and can have a maximum of 15 digits. An ATM end station address acts as a subnetwork point of attachment. Either type is selected from the ATM Address dialog box, which is where you enter the address information.

5.4.1. Entering and Viewing Addresses

The ATM Address dialog box is shown below.

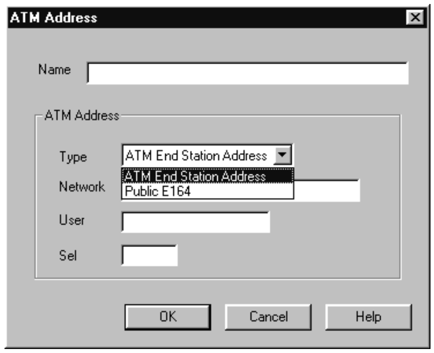


Figure 5-3. ATM Address Dialog Box

To enter an address in the ATM address box:

1. From the menu bar, select View\Addresses.

The ATM Address view, which is the first bottom view, becomes active.

2. Click the right-mouse button to access the shortcut menu for this view.
3. Select New, which is the first option.
4. Complete the ATM Address Dialog box. If the analyzer is in emulate user mode, type the user part, and the fully formatted address will be sent back to the analyzer upon registration. If the analyzer is in emulate network mode, type the network prefix address.

5.4.2. Registering an Address

Each time that you complete the ATM Address Dialog box, either on the network side or the user side, the results appear in the Address view. Each result is called a profile. You can use up to 100 characters to name each profile. It is much easier to work with addresses when you have applied substantive names to them. The application can discover the switch prefix; therefore, if you leave the network portion of the ATM Address dialog box blank, the application uses the switch prefix when the address is registered.

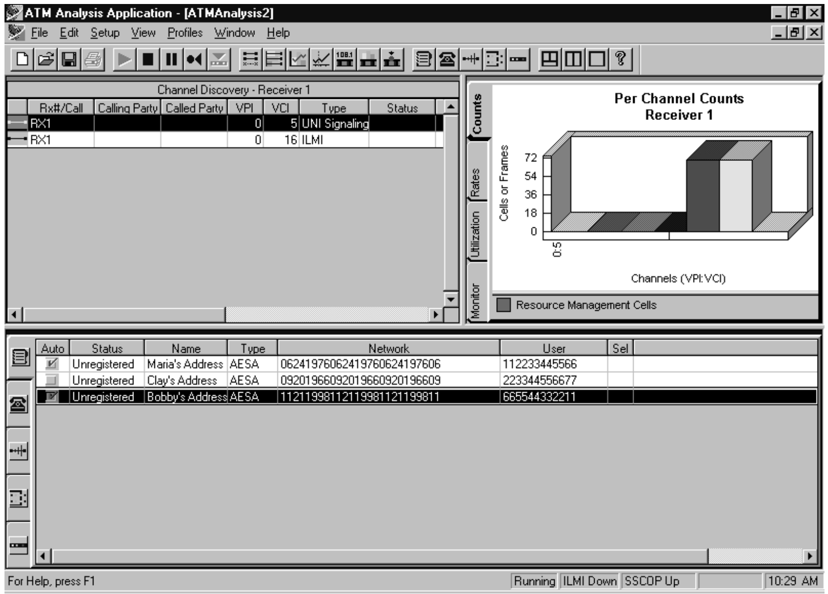


Figure 5-4. Resulting Profiles in the Address View

To register an address:

1. Select the profile with the address that you want to register.
2. Access the shortcut menu by clicking the right mouse button.
3. Select Register to register the address.

You can set any address to auto-register with the switch each time that you start analyzing, by selecting the Auto option.

To edit a profile:

1. Select the profile that you want to edit.
2. Access the shortcut menu by clicking the right mouse button.
3. Select Edit.

5.4.3. Notes on Addresses and Registration

The user part of the address that you specify gets registered with every network prefix that is currently registered with that switch. For each user part and network prefix combination, a new line is added to your list of addresses, if the network prefix area is blank.

The called party subaddress is used when a call transits between a public and private UNI. In a public UNI, an E.164 ATM address is used in a way that is very similar to how a telephone number is used. In a private UNI, a very different addressing format is used. When a call originates in a public UNI and the call must transit a private UNI, the private UNI encapsulates the E.164 address as the called party subaddress and assigns a private UNI address (called party address) for the call. When the call exits, the private UNI changes back to a public UNI, and the called party subaddress replaces the temporary called party address.

Using the Sel

The sel is the selector subfield. This is carried in the SETUP message, which is an element of the ATM endpoint address domain-specific part. This is defined by ISO 10589. It is not used for any routing in ATM networks. Instead, it is only used in ATM end systems.

5.4.4. Common Problems with ATM Addresses

If the switch rejects your registration request or if the switch does not respond at all to your address, you will not see any indication from the application. In this case, there are three things to check:

1. Check to make sure that ILMI is running, by looking at the icon tray in the lower right corner of the application and observing the status of ILMI.
2. Check to make sure that you are using a network prefix that the switch port recognizes by confirming your network prefix with your network documentation.
3. Check to make sure that all appropriate cables are connected properly.

It is important to note that the application does not have a network prefix table. Therefore, you must enter the network prefix manually.

The application cannot perform any meaningful signaling functions, such as making calls, until the analyzer is registered.

5.5. Making Calls and Adding Parties to Calls

Calls are made in the Call Setup Wizard and listed in the Call Setup view. The Call Setup view is represented by a telephone icon, and the Call Setup view is one of the five bottom views. The analyzer must be running and in emulate user mode for a call to be made.

To access the Call Setup Wizard:

Select Setup/Setup Call from the application menu. The first page of the Call Setup Wizard appears.

You can also access the Call Setup Wizard by clicking New from the shortcut menu for the Call Setup view. Click the right mouse button to access the shortcut menu of any view when that view is active. After you complete the wizard, the call is attempted if you completed the wizard by having accessed it through the Channel Discovery View. Otherwise, select the Setup Call option on the shortcut menu to finalize the call.

5.5.1. Notes on Making Calls

The first choice to make in the Call Setup Wizard is whether to make a point-to-point or point-to-multipoint call. If you establish a point-to-multipoint call, you can add a party later. You can not add a party to a point-to-point call.

The next wizard page offers choices about which optional information elements to include in the setup message. In most cases, you do not need to include any optional information elements. However, some information elements have end-to-end significance; some nodes reject an incoming call unless some information elements are coded correctly.

The next wizard pages allow you to specify the parameters for the mandatory information elements and any optional information elements that you elected to include in the call setup.

5.5.1.1. Setting Up Multiple Calls At the Same Time

To set up multiple calls at the same time:

1. Access the Call Setup Profile view.
2. Select a call profile by clicking on that line entry.
3. Click the right mouse button to access the shortcut menu.
4. Select Setup Call.
5. In the dialog box, enter the number of calls to set up with that profile.

5.5.1.2. Making a Call Based On One Seen in the Channel Discovery View

If you see a call in the Channel Discovery View and you would like to set up that call from your own analyzer, perform these steps:

1. Access the Channel Discovery View.

The Channel Discovery View is one of the upper views.

2. Click the right mouse button to access the shortcut menu for the Channel Discovery View.
3. Select “Add to Call Profiles List.”

The contents of that connection are copied to the Call Setup View. From there, you can edit any of the parameters, if desired, and then establish the call.

5.5.2. Adding a Party to a Point-to-Multipoint Call

Once you establish a point-to-multipoint call, you can add a party to the call.

To add a party to a call:

1. Access the Channel Discovery View.

   The Channel Discovery View is one of the upper views.

2. Select the call to which you want to add a party by clicking the line entry for that call.
3. Click the right mouse button to access the shortcut menu for the Channel Discovery View.
4. Select Add Party.

Note that there are other useful options in the shortcut menu of the Channel Discovery View related to calls.

5.5.3. Common Problems with Calls

Sometimes, when you are trying to setup a call through a switch, the call will fail. If the cause code text reads “No route to destination” or a similar message, the switch is rejecting your call. In this case, the switch indicates that it does not know how to forward your request. This normally happens if you have not yet registered your ATM address with the switch or if you have not configured the routing tables in one of the switches in the call path required for forwarding that address correctly.

5.6. Transmitting Cells

In emulation mode, it is often helpful to transmit cells to either the network or to a user. This is done by creating a profile through the Transmit Profile Wizard.

To access the Transmit Profile Wizard:

- Select Profiles/New from the application command menu (with the Transmit View active).

You can also access the Transmit Profile Wizard by clicking the right mouse button to access the shortcut menu while the Transmit View is active.

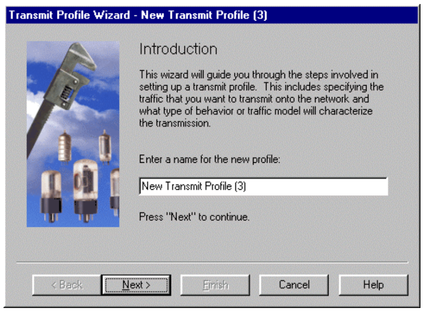


Figure 5-5. Introduction Page of the Transmit Profile Wizard

A transmit profile is a sequence of predefined cells. The cell sequence can be imported or manually defined using the cell editor (provided in the wizard).

5.6.1. Transmitting a Cell Sequence

To transmit a cell sequence:

1. Specify internal loopback in the Analyzer Setup Wizard for this test. (See section 5.1, “Configuring the Analyzer” on page 5-1.)
2. Access the Transmit Profile Wizard as described above.
3. On the Introduction page, enter a name for the profile, and click Next.
4. On the Cell Sequence Data Source page, select New Cell Sequence and click Next.
5. On the Cell Sequence Data page, click Add.
6. Complete the Cell Editor page, remembering that loopback is on.
7. Complete the Transmission Characteristics page, as desired.
8. From the General Statistics view, look at the statistics.
9. From the Channel Discovery view, confirm that you see the target channel.

5.6.2. Notes on Transmitting Cells

If you need to create a large number of cells through the cell editor of the Transmit Profile Wizard, you should create an ASCII file of cells to transmit. Use any basic authoring application to make the ASCII file. On each line of the file, enter a name for the cell, followed by 53 bytes of cell data in hex format. For example:

cell1, 1,2,3,4,5,6,7,8,9,A,B,C,D...

cell2, 1,2,3,4,5,6,7,8,9,A,B,C,D...

The transmitter ignores the fifth byte of data (the HEC) and automatically generates a good HEC for each cell.

It can be helpful to retransmit data that you captured and maintain the timing of the data. To retransmit data:

1. Access the Transmit Profile Wizard as described in section 5.6, “Transmitting Cells,” on page 5-13.
2. On the Cell Sequence Data Source page, select “Import cells from a capture file.”

This allows you to import cells from any ATM cell capture file. These cells appear in the cell list on the next page of the Transmit Profile Wizard. From there, you can edit them and retransmit them. If you had unassigned cells in the capture file, then the cell timing is maintained; otherwise, the unassigned cells are filtered out.

The inter-cell spacing describes how many unassigned cells follow each cell that you defined in a given cell sequence. Inter-cell spacing is a useful way to generate constant bit rate (CBR) traffic.

5.6.3. Common Problems with Cell Transmission

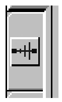
Sometimes, when you transmit data at a specified rate, you can occasionally see minor fluctuations in the inter-arrival cell spacing of the received traffic. This happens when the analyzer is in SVC mode. The signaling, ILMI, and SSCOP traffic is being transmitted “on demand.” This means that when traffic needs to go out, such traffic takes priority over the background transmission. This affects the traffic model of your transmitted background traffic.

5.7. Transmitting Frames

In emulation mode, it is often helpful to transmit frames to either the network or to a user. This is done by building desired frames through the Frame Builder.

To access the Frame Builder:

- Make the Transmit Profile View active by clicking the Transmit Profile View icon in the bottom view. The Transmit Profile icon looks like this:



- Click the right mouse button to access the shortcut menu.

You can also access the Transmit Profile Wizard from within the Transmit Profile Wizard (which is where you will use the frames that you build) by selecting the frames option on the Transmit Profile type page. The Frame Sequence Data wizard page will follow.

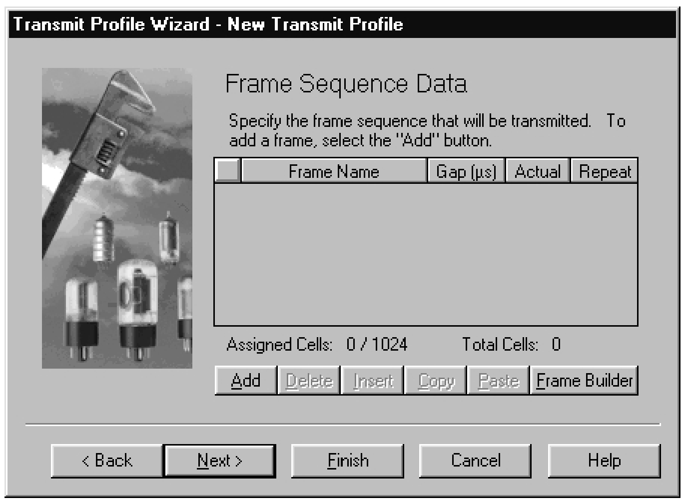


Figure 5.6. The Frame Sequence Data page of the Transmit Profile Wizard

By selecting the Frame Builder button, you can access that tool for tailoring specific frame characteristics.

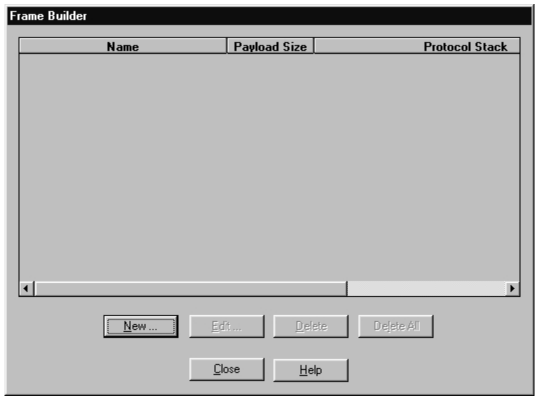


Figure 5-7. Main dialog box of the Frame Builder

5.7.1. Transmitting a Frame Sequence

To transmit a frame sequence:

1. Access the Frame Builder main dialog box, as described above.
2. Select New on the main dialog box of the Frame Builder.
3. In the Protocol Stack dialog box, select Insert After and Insert Before, as desired, to build the stack for the frame.
4. When the desired stack is complete, press OK.
5. At the Settings tab, enter the name of the frame.
6. Click the various tabs and complete the overhead and other sections for your frame.
7. Click the Payload tab and enter any tailoring of the payload, as desired.
8. Click OK to return to the Frame Builder main dialog box.
9. Note the name of the newly created frame and click OK.
10. In the Frame Sequence Data page of the Transmit Profile Wizard, select Add. (See Figure 5.6.)
11. A pull down option appears under the Frame Name column in the Frame Sequence Data page. Click the pull down option and select the name of the frame that you want to transmit.
12. Select the desired gap (if any) and the number of times to repeat the transmission (if any).
13. When you are finished, click New to continue to the next wizard page.

5.7.2. Notes on Transmitting Frames

When completing the Protocol Stack dialog box of the Frame Builder tool, remember that the protocol stack should be built according to the OSI model of layers. That is, layer 1 protocols belong on the bottom of the stack and subsequent above layers should be situated higher in the stack.

As you make selections in the overhead options of the frames that you build, these options will apply to all frames in a transmission. However, the ATM cells payload type value of zero is always overwritten for the last frame; the last frame requires a PT value of one. For ATM cells, keeping the PT value of zero (the default value) will not change the PT for the last frame.

While you can easily edit the overhead options and payload characteristics of an existing frame that you have built, you cannot edit the protocol stack options of an existing frame. You would need to build a new frame in that condition.

The maximum number of bytes that you can specify for the payload is 49,152; and this maximum number would be the case if you are only using ATM cells (exclusively). Other stack choices may result in a lower maximum payload. That is, the maximum number of assigned cells that you can have is 1024. This is the case due to transmission limitations.

5.7.3. Common Problems with Frame Transmission

Due to the nature of physical transmission rates, there can be a rounding up when gaps are inserted. For example, if you are transmitting with an E1 interface module, the data is being sent at 2,048 kbits/second. If you are transmitting one cell and you enter a gap value of 100 microseconds, the actual gap will be 220 microseconds. If you enter a gap value of 200 microseconds, the actual gap will likewise be 220 microseconds. Entering a gap value of 300 microseconds will result in a gap of 441 microseconds. This rounding will be most clearly evident with the DS1 and E1 interface modules and is a necessary part of transmitting frames with gaps under some data rate formats.

Note that in the example above, the total cells transmitted was two when a gap of 100 or 200 was asked for and three when a gap of 300 was asked for.

The repeat option of the Frame Sequence Data page of the Transmit Profile Wizard is for repeating both the data and the actual gap, if any, based on what gap you might have asked for.

5.8. Filtering Traffic

Filtering allows you to concentrate on a specific data area, and the application offers several powerful filtering features. See section 3.5.3, “Filtering,” on page 3-8, for general information about what can be filtered.

The Filters and Triggers View is one of the five bottom views.

To establish and activate a filter:

1. Make the Filters and Triggers View active by clicking on the Filters and Triggers icon. The Filters and Triggers icon is next to the last icon of the bottom view. You can also make this view active by clicking the Filters and Triggers icon on the application toolbar.
2. Access the short-cut menu for the Filters and Triggers View by clicking the right mouse button.
3. Select New, which is the first item in the shortcut menu.
4. The first page of the Filter and Trigger Wizard appears.
5. The next page allows you to establish what kind of filter to establish.

Figure 5-7. Filter Type Page of the Filter and Trigger Wizard

6. Complete the Filter and Trigger Wizard.
7. Click Set in the shortcut menu of the Filter and Trigger View to establish a filter, a trigger, or a filter and trigger combination.

5.8.1. Notes on Filtering Traffic

Using the Filter and Trigger Wizard, you have several options, including:

- Setting a filter to be “in” or “out.” A setting of “in” means that cells that meet your filtering selections accumulate in the capture buffer for you to examine. A setting of “out” means that cells not meeting the selections accumulate.
- Setting for a “bit-level” filtering capability, which allows you to set a filter for specific bits in a frame, along with “don’t care” conditions at the bit level. As part of this feature, you can enter filter parameters in binary format.

When you set an ATM address filter, the application begins scanning all of the Call Setup messages that occur on your network for the ATM address that you specified. When one of those call setups matches your criteria, a hardware filter is set for the VPI:VCI for that call. That VPI:VCI shows up on your filter list, along with the text “Applied VPI:VCI.” The application looks for new calls that meet the address criteria; VPI:VCI filters are set as connections are found. If you establish several filters and then select to filter, based on the various criteria, all of the filters are handled with a logical OR methodology for meeting the filter criteria. If any one of the filter criteria is met, the filter is applied. The application allows you to set a filter on a reserved channel, but in any of the SVC modes of operation, this filter has no effect. All of the reserved channels are redirected into a special partition of the capture buffer so that they can be reassembled and further processed.

5.8.2. Common Problems with Filtering

There are eight physical hardware filters in the equipment, and each of these eight can match any or all of the bytes in a full ATM cell (in addition to the sliding window filter). An ATM address filter does not use one of the hardware filters until the address criteria are met. Once met, the ATM address filter uses one of the pattern filters to match the VPI:VCI for each of the connections that met that address criteria. New connections that meet your ATM address criteria are not filtered after you have used all eight of the hardware filters. You can set a filter on a reserved channel (VPI:xxVCI:1-31), but all of the reserved channels are always redirected into a partition in the capture buffer when you are running in SVC mode, so that they can be reassembled and further processed. This allows for protocol emulation in real time. The filters are applied after those channels are redirected; therefore, reserved channels never show up in the regular capture buffer. You can save those reserved channels to a capture file and use the WG Examine application to perform protocol decoding. You cannot filter on a MAC or IP address. The analyzer provides for cell-based analysis. To perform MAC or IP filtering, reassembled frames must be available. To filter on MAC or IP addresses, use the WG Examine application on a file that you captured.

6. QoS Measurements

You should familiar yourself with the QoS sections of the ATM Forum specification before taking and using QoS measurements.

6.1. Obtaining and Using QoS Measurements

QoS measurements are a key component of ATM technology, but obtaining and using them can be complicated. See section 1.2.2, “Understanding User-Network Traffic Contracts and QoS” on page 1-16 and see section 3.5.2, “Measuring” on page 4-7 before reading this section.

There are three major components associated with obtaining QoS parameters and measurements through the application: the QoS Setup Wizard, the QoS Statistics View, and the QoS Graphs View. What you see in the QoS Statistics View and the QoS Graphs View depends on the choices that you made in the QoS Setup Wizard. Begin by completing the QoS Setup Wizard.

To access the QoS Setup Wizard:

Click Setup/QoS Setup Wizard from the application command menu.

The first page of the QoS Setup Wizard appears.

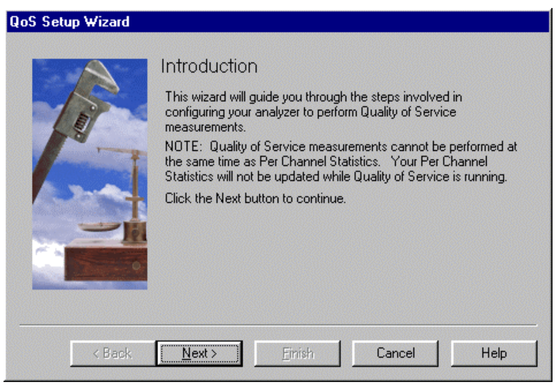


Figure 6-1. First Page of the QoS Setup Wizard

Click Next. The Measurement Type page appears, as shown on the next page.

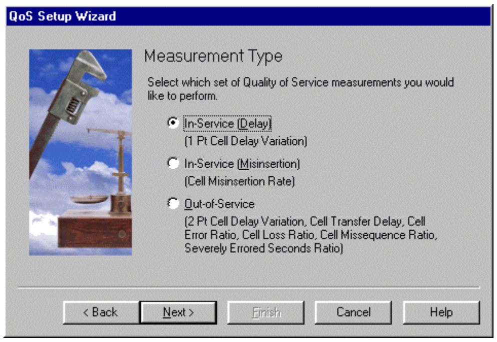


Figure 6-2. The Measurement Type Page of the QoS Setup Wizard

Your choices on the Measurement Type page determine what kind of QoS measurements the application performs:

- In-Service (also called “Delay”)
- In-Service Misinsertion
- Out-of-Service (OOS).

In-Service (Delay)

For the In-Service (Delay) option, a 1-pt CDV test is performed. In this test, a traffic source is assumed to be transmitting a CBR cell stream on a certain VPI:VCI. Therefore, if you select this type of test, a later wizard page allows you to select the incoming VPI:VCI. In addition, the final wizard page for 1-pt CDV tests asks for the peak cell rate (PCR). The PCR is used to calculate the reference inter-arrival cell time. For example, if you specify 8000 cells per second, at OC-3 line rate, there is one cell for every 44.151 cells. Since this is not an integer value, there is CDV. In contrast, if you specify the cell spacing as 43 cells (that is, one in 44 cells), the test expects a cell rate of roughly 8027 cells per second. If you specify the cell spacing to be 44 cells (that would be one in 45 cells), the test expects the cell rate to be roughly 8749 cells per second.

This passive measurement is only defined for constant bit rate (CBR) traffic and is performed at one measurement location without affecting traffic. Under 1 Pt CDV, positive results indicate cells that are early, and negative results indicate cells that are late.

In-Service Misinsertion

If you select the misinsertion option, a later wizard page allows you to select a certain VPI:VCI. For this test, the VPI:VCI should be one that is not expected to receive any cells. Any cells received on that channel are counted as misinserted cells. The cell misinsertion rate (CMR) is the total number of misinserted cells observed during a specified time interval divided by the time interval duration. A misinserted cell is a cell that has appeared on a channel incorrectly, mistakenly placed there by the network equipment.

Out-of-Service

The measurements are performed with the out-of-service (OOS) option are available in Emulate User mode as selected in the Analyzer Setup Wizard. If you selected Monitor or Emulate Network mode in the Analyzer Setup Wizard, the Out-of-Service measurements section will not be available.

Cell Transfer Delay (CTD) is a raw delay measurement that measures how much time is required for each cell to travel from one point to another point.

The 2 Pt Cell Delay Variation (2 pt CDV) is a shift of the cell transfer delay data around a reference point or expected cell delay. This expected cell delay is determined at the beginning of the test by sending out a test cell and monitoring how long it takes to arrive at the measurement point; the data then shows how many cells were early or late relative to that reference delay (thus, using two measurement points). Through 2-Pt cell delay variation, positive results indicate late arriving cells, and negative results indicate early arriving cells.

The ATM User-Network Interface Specification (v3.1) provides the equations used for out-of-service QoS measurements. See section A.3.4.2.1 “1-Point CDV” and section A.3.4.2.2 “2-Point CDV” of that ATM specification.

6.1.1. Notes on Using the QoS Setup Wizard for OOS Use

Cells are transmitted on Tx1 and received on Rx1, and you must specify the VPI:VCI for transmit and receive in the wizard. If a VCC is looped back at the far end, then the transmit and receive channels should be the same. The cells that are transmitted on the test channel include a timestamp (with 66ns accuracy), a sequence number, and a CRC. This allows the second measurement point (on the receive channel) to measure parameters like CTD.

You can specify the load to put on the transmit side. This allows you to measure the behavior of the network under different load conditions.

You can also specify the scale factor and the definition of a severe error threshold. Note that in the ITU I.35B, the concept of a severely errored block was introduced but that the size of such a block was not defined. Through the Specify Extra Parameters page of the QoS Setup Wizard, you can define what constitutes a severe error.

6.1.2. Observing QoS Results Through the QoS Views

After you complete the QoS Setup Wizard, select Setup/Start QoS from the menu bar to begin QoS measuring. Then, make either or both of the QoS Views active to observe the results. The QoS Statistics View shows a variety of statistics that are divided into sub-categories.

It is important to note that the content of the QoS views varies depending on what selections you made in the QoS Setup Wizard. For example, if you selected “In-Service (Delay)” on the Measurement Type page of the QoS Setup Wizard, you are not going to see out-of-service statistics in the QoS Statistics View until you modify your choices in the QoS Setup Wizard to obtain those types of statistics.

To observe the QoS results:

1. Configure your switch so that it passes data out of the same port in which data entered. (This enables the analyzer to receive the data to measure.)
2. If the analyzer is running, select Setup/Stop Analyzer from the application command bar.
3. Select Setup/Setup Analyzer from the command menu to start the Analyzer Setup Wizard.
4. Switch to “Emulate User” mode on the Analyzer Test Mode page, if that option is not already selected.
5. Complete the Analyzer Setup Wizard.
6. Select Setup/QoS Setup Wizard from the command menu.
7. Specify Out-of-Service measurements on the Measurement Type page.
8. Complete the Quality of Service Wizard.
9. If the QoS Statistics View or the QoS Graphs View is not one of the left or right upper views, click in the view to make it active, access the shortcut menu by clicking the right mouse button, and select one of the QoS views.
10. If desired, modify the properties for the QoS Graphs View by accessing the short-cut menu and selecting the Properties option.

6.1.2.1. Overview of the QoS Graphs View

If you specify out-of-service measuring on the Measurement Type page of the QoS Setup Wizard, the QoS Graphs View has three tabs: CTD, 2-pt CDV, and Delay. At the start of a test, a reference cell is first transmitted to establish the reference CTD. On the 2-pt CDV graph, this is indicated as REF. The 2-pt CDV graph then shows the distribution of CTD relative to the reference CTD. For example, perhaps the distribution will indicate that the majority of cells under test are experiencing longer CTD than the reference cell. If you specify in-service measuring on the Measurement Type page of the QoS Setup Wizard, the QoS Graphs View shows the 1-pt CDV results. The X axis shows the time in microseconds, and the Y axis shows the number of cells.

6.1.2.2. Overview of the QoS Statistics View

If you specify out-of service measuring on the Measurement Type page of the QoS Setup Wizard, the QoS Statistics View has two tabs: Delay and Error. The delay statistics show both the CTD and 2-pt CDV statistics. Note that on the Delay tab, the difference between the earliest arrival and latest arrival is the range of the 2-pt CDV; this is the peak-to-peak CDV. On the Error tab, the results of the CLR, CER, CSR, and severely-errored-seconds measurements are all shown. If you specify either of the in-service measuring options on the Measurement Type page of the QoS Setup Wizard, the QoS Statistics View shows the in-service statistics. In-service measurements are non-intrusive measurements that passively monitor existing traffic on a particular connection. The results are provided in microseconds.

6.1.3. Common Problems with QoS Measuring

If you are obtaining unexpected QoS statistics, consider all factors associated with the QoS results. For example, long propagation delays can cause reference problems for the 2 point CDV results. When you begin QoS measurements while a cell stream is already running, the application uses that cell stream for QoS measurements. The original QoS cells that were active on the line prior to the start of QoS measurements can cause invalid reference values. To avoid this particular problem, conclude cell transmission prior to starting QoS measurements. When you start a cell transmission through QoS, a new cell stream is originated. If you need to continue cell transmission while starting QoS measurements, perform these steps:

1. Start QoS measurements.
2. Wait for five seconds (or up to 10 seconds, if you suspect very long propagation delays).
3. Restart the QoS measurements.

7. The OC-3/STM-1 Single Mode and Multi-Mode Interface Modules

This chapter provides information regarding the characteristics of the single mode and multi-mode OC-3/STM-1 interface modules, including hardware connection and LED descriptions. This chapter also explains how to specify the OC-3/STM-1 interface module physical layer hardware settings within the ATM Analysis Application.

For information about the 155 UTP interface module, see Chapter 8.

7.1. Overview of the OC-3/STM-1 Interface Modules

The OC-3/STM-1 interface modules and the ATM Analysis Application enable your analyzer to perform network analysis of ATM traffic carried over OC-3/STM-1 transmission facilities. The interface makes your analyzer suitable for monitoring, troubleshooting, simulating and testing ATM networks. You can verify the functionality of any LAN traffic running on an ATM link, such as Ethernet or FDDI, or you can measure the performance of any ATM networking device, such as a switch.

7.1.1. Installation

To perform testing, the OC-3/STM-1 interface module must be paired with a Broadband Analyzer Module (BAM). See Chapter 2, “Installing ATM on a PC for Domino” and see the hardware guide that came with your ATM analyzer for further information.

7.1.2. Interface Modules Specifications

OC-3 ATM Multi-mode Interface	**OC-3 ATM Single Mode Interface**
Part No.: B/N 9305/90.62	Part No.: B/N 9305/90.63
Duplex SC Connectors (two receive and two transmit)	ST Connectors (two receive, two transmit)
2 km reach, 1310 nm framing OC-3 or STM-1	15 km reach, 1310 nm Class 1 Laser product
Bellcore TA-NWT-000253	Bellcore TA-NWT-000253

For information about the 155 UTP interface module, see Chapter 8.

7.1.3. Safety Information for the Single-mode Modules

The OC3-/STM-1 interface modules meet the following safety specifications:

- FDA 21 CFR 1040.10/11
- CAN No. C22.2 1010.1-92
- UL 3111-1
- EN-61010-1
- IEC-825 and IEC-1010-1

CLASS 1 LASER PRODUCT	**OC-3/STM-1 INTERFACE MODULE** **B/N 9305/90.63**

Warning: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Warning: The use of optical instruments with this product will increase eye hazard.

Warning: The external terminals of this interface module are not intended for direct connection to outside plant leads and TNV circuits.

7.1.4. Equipment Necessary to Ensure Compliance with EMC Directive

WG tested and declared the 155 UTP 9305/90.68 as the worst case example of the OC-3/STM-1 family for EMI/EMC testing. This interface module is CE compliant when used with the DominoPLUS analyzer. The following equipment was used for this determination:

- DominoATM analyzer, BN 9316/02
- 155 UTP Line Interface Module, B0003, P/N 9305/90.68
- Ferrite kit for use with 155 UTP, P/N 9315-8490.142
- Broadband Analyzer Module 155, C0029, P/N 9305/90.69
- Laptop: IBM Thinkpad, Type 2620-20F with associated power supply P/N 84G2098, S/N 9408103047; FCC ID of ANO2620CS.

The following accessories were used for CE Mark compliance testing.

BN Number	Part Number	Equipment Description
K9139	9314-8537.002	110v power cable for North America
K9140	9314-8538.001	220v power cable for Europe
K9123	9314-8520.006	0.45 m PC-to-Domino cable
K9127	9314-8523.003	Domino-to-Domino cable (This cable is now BN K9194)
K9125	9314-8521.005	1 m Domino-to-printer cable
None	None	Category 5 STP patch cable 100 Ohm to loopback box

Note:
The DominoATM analyzer is CE compliant from Series A.

7.1.5. Rear Panel Connectors

The rear panel of the OC-3/STM-1 interface module provides four external connections to the network or device under test. The port connections are either ST for single-mode fiber or SC for multi-mode fiber. The card ejector button is located at the bottom of the rear panel. Use it to remove the interface module. The connectors are labeled as follows:

- Tx1 (Transmitter #1)
- Rx1 (Receiver #1)
- Tx2 (Transmitter #2)
- Rx2 (Receiver #2)

7.2. Connecting to the Network

Connectors located on the rear panel of the OC-3/STM-1 interface module allow for connection to the network for ATM monitoring or emulation. The following sections describe some of the network connection options.

7.2.1. Connecting for Emulation of an ATM End Station

To emulate an OC-3/STM-1 fiber-coupled interconnect device:

1. Connect the Tx1 port on the OC-3/STM-1 interface module to the receive port of the ATM device under test.
2. Connect the Rx1 port on the OC-3/STM-1 interface module to the transmit port of the ATM device under test.

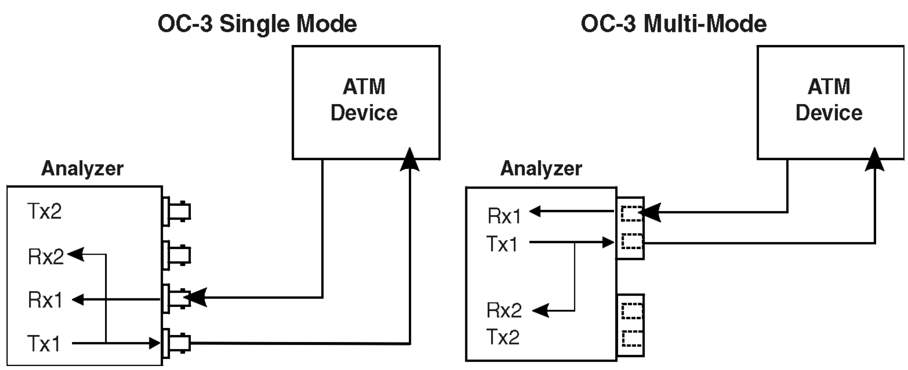


Figure 7-1. Connecting for Emulation for an ATM End Station (Loopback Shown)

Note:

All transmitted data on Tx1 can be looped back if this option is selected in the Analyzer Setup Wizard within the application.

7.2.1.1. Connecting for Emulation of an ATM Network Device

Use the following procedures to emulate an OC-3/STM-1 fiber device:

1. Connect the Tx2 port on the OC-3/STM-1 interface module to the receive port of the ATM device under test.
2. Connect the Rx2 port on the OC-3/STM-1 interface module to the transmit port of the ATM device under test.

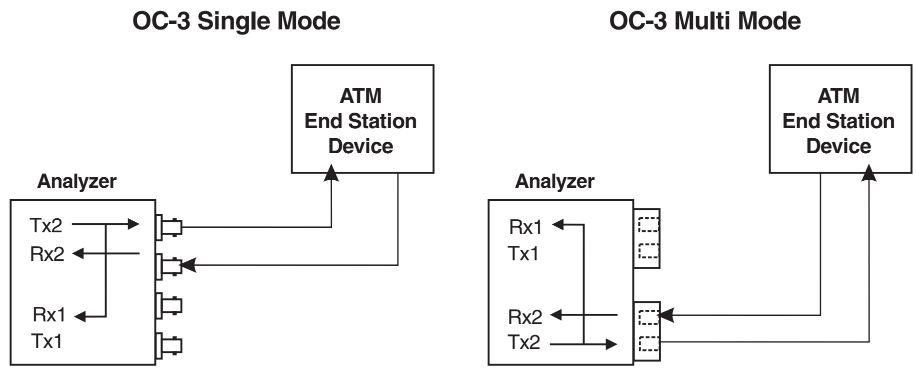


Figure 7-2. Connecting for Emulation for an ATM Network Device (Loopback Shown)

Note:
Transmitted data on Tx2 can be internally looped back to Rx1 if the loopback option is selected on the Analyzer Setup Wizard within the application.

7.2.2. Connecting for Monitoring

There are two basic monitoring topologies:

- **Monitoring between ATM devices**. This topology allows you to monitor and decode full-duplex data exchanges at the Network Layer (and higher) of the OSI reference model. See Figure 7-3. It is ideal for analyzing both sides of the conversation between two devices.
- **Monitoring across ATM interconnect devices**. This topology allows you to monitor data exchanges going through an interconnect device. It is ideal for analyzing part of the conversation between two ATM devices. See Figure 7-4.

In both topologies, the analyzer can be connected in an in-service or out-of-service mode.

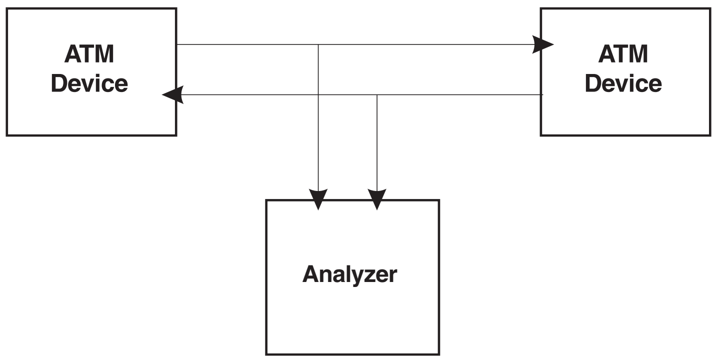


Figure 7-3. Monitoring Between ATM Devices.

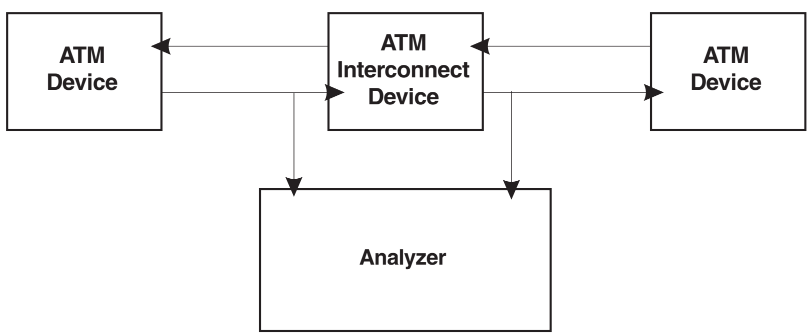


Figure 7-4. Monitoring Across ATM Interconnect Devices.

7.2.2.1. In-Service and Out-of-Service Monitoring

When monitoring, note the distinction between in-service and out-of-service monitoring:

- "In-service" refers to the monitoring of ATM equipment in a live network, where the network is not brought down when making test connections. In such situations, the monitor points and connection method should be carefully planned. These connections are generally made with fiber taps for the OC-3/STM-1 equipment. See Figure 7-5.
- "Out-of-service" refers to the monitoring of ATM equipment where the connections are broken to insert the analyzer in a through mode, as shown in figure 7-6. When the OC-3/STM-1 interface module is configured for monitoring, both receivers are enabled and the data from each is internally repeated to the transmitters (Rx1 is repeated on Tx2; Rx2 is repeated on Tx1).

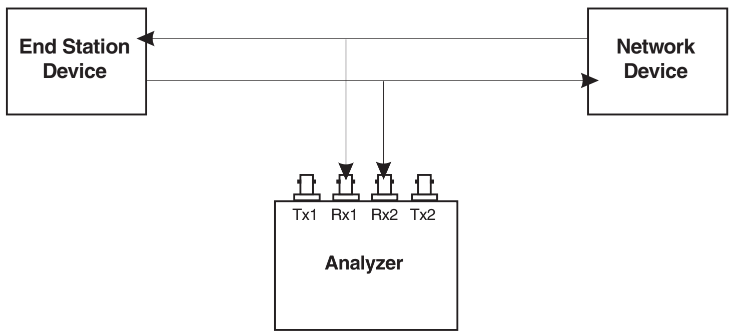


Figure 7-5. In-service monitoring with an OC-3/STM-1 Interface Module (Multi-mode)

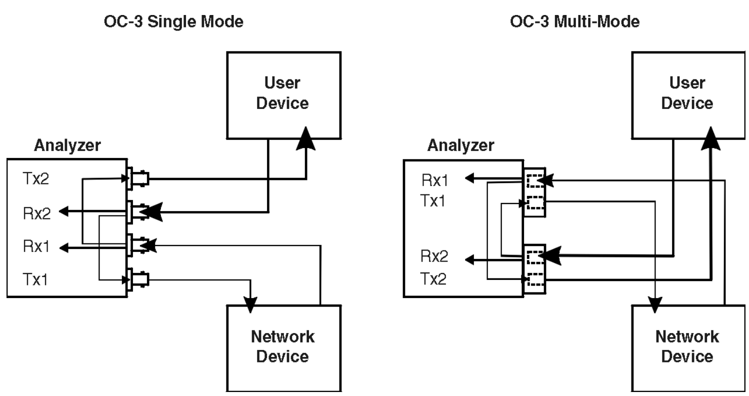


Figure 7-6. Out-of-service Monitoring with the OC-3/STM-1 Interface Modules.

7.2.2.2. Connecting for Out-of-Service Monitoring Between ATM Devices

The following procedure shows you how to make a basic out-of-service connection for monitoring traffic between two ATM devices.

To monitor between two fiber coupled OC-3/STM-1 ATM interconnect devices (out-of-service):

1. Disconnect both links between the two devices.
2. Connect a suitable cable from the Rx1 port on the OC-3/STM-1 interface module to the transmit port on the first interconnect device.
3. Connect a suitable cable from the Tx1 port on the OC-3/STM-1 interface module to the receive port on the first interconnect device.
4. Connect a suitable cable from the Rx2 port on the OC-3/STM-1 interface module to the transmit port on the second interconnect device.
5. Connect a suitable cable from the Tx2 port on the OC-3/STM-1 interface module to the receive port on the second interconnect device.

7.2.2.3. Connecting for In-Service Monitoring Between ATM Devices

For in-service monitoring, the fiber taps are pre-installed in the network for connection to the test equipment.

1. Connect one tap to the Rx1 on the analyzer.
2. Connector the second tap to the Rx2 on the analyzer.

7.3. Using the Light Emitting Diode (LED) Indicators

The front panel LED indicators report signal and synchronization status. They are directly controlled by the OC-3/STM-1 interface module. The indicators are divided into two groups. There is one for each receiver (Rx1 and Rx2) as seen on the LED overlay. The LEDs report status through one of three colors. Green indicates that no signal or synchronization defects are occurring or have occurred since testing began. The orange color represents a history status. It indicates that a defect occurred. Red indicates that such a defect is occurring.

This history data is cleared whenever testing is restarted or network statistics are reset.

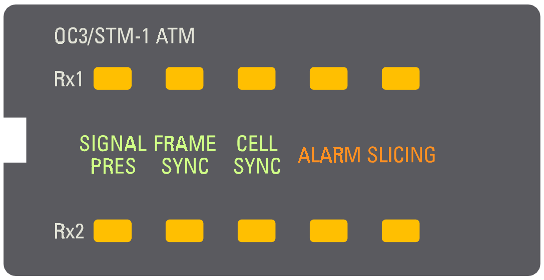


Figure 7-7. LED Overlay

7.3.1. Signal Present

The Signal Present LED reports the status of the signal. There is a loss of signal when the incoming data has no transitions (either all ones or all zeros) for at least 14 to 28 ms.

Green	OC-3/STM-1 signal is present. No defects.
Red	There is a loss of signal currently being detected.
Orange	One or more loss of signal defects occurred since testing began or since the last reset of network statistics.

7.3.2. Frame Sync

The Frame Sync LED reports the synchronization status of the frame.

Green	No OC-3/STM-1 frame synchronization defects.
Red	One or more OC-3/STM-1 frame synchronization defects (out of frame) is currently being detected.
Orange	One or more OC-3/STM-1 frame synchronization defects (out of frame) occurred since testing began or since the last reset of network statistics.

7.3.3. Cell Sync

The Cell Sync LED reports the synchronization status of the cell. The loss of cell synchronization is indicated when cell delineation is lost for 4 milliseconds.

Green	No OC-3/STM-1 cell synchronization defects.
Red	One or more OC-3/STM-1 cell synchronization defects (cell delineation has been lost) are currently being detected, causing an out-of-cell delineation error.
Orange	One or more OC-3/STM-1 cell synchronization defects have occurred since testing began or since the last time network statistics were reset.

7.3.4. Alarm

The Alarm LED reports alarm conditions. The detected conditions are line alarm indicator signal (AIS), line remote defect indicator (RDI), path AIS, path RDI, path C2, line LOP, and OOF. An AIS condition occurs when an unframed pattern of all ones with less than three zeros in two consecutive frames has been detected. The RDI condition occurs when the remote end sends a remote AIS. The path C2 alarm is generated when an unequipped signal label code is present. The LOP is noted when a loss of pointer error is present. When frame delineation is lost, an out of frame condition is noted.

Off	No alarm conditions have occurred since the last time network statistics were reset.
Red	An alarm condition is currently active.
Orange	One or more alarm conditions have occurred since testing began or since the last time that network statistics were reset.

7.3.5. Slicing

The Slicing LED reports the frame slicing status. Slicing takes place when the full duplex utilization (Rx1 plus Rx2) line rate exceeds 114%. The analyzer truncates certain payload bytes to reduce the effective bandwidth captured.

Off	No slicing has occurred since the last time network statistics were reset.
Red	A slicing condition is present.
Orange	One or more slicing conditions has occurred since testing began or since the last time network statistics were reset.

7.4. Specifying An OC-3/STM-1 Interface Module in the Application

To use one of the OC-3/STM-1 interface modules with the ATM Analysis Application, you must specify the physical layer hardware settings for the interface module from within the application. The last page of the Analyzer Setup Wizard allows you to:

- Filter out unassigned and idle cells that are being received on the selected port.
- Apply SONET section cell scrambling.

To access the Analyzer Setup Wizard:

- Click Setup\Setup Analyzer from the command menu of the application.

More information about the OC-3/STM-1 Settings page of the Analyzer Setup Wizard can be found by clicking Help on that page. Other details related to the OC-3/STM-1 interface module can be accessed through the online Help.

8. The 155 UTP ATM Interface Module

This chapter provides information regarding the characteristics of the 155 UTP ATM interface module, including hardware connection and LED descriptions. This chapter also explains how to specify the 155 UTP ATM interface module physical layer hardware settings within the ATM Analysis Application.

Throughout the ATM Analysis Application, the 155 UTP ATM interface module is represented as OC-3/STM-1.

8.1. Overview of the 155 UTP ATM Interface Module

The 155 UTP ATM interface modules and the ATM Analysis Application enable your analyzer to perform network analysis of ATM traffic carried over 155 UTP ATM transmission facilities. The interface makes your analyzer suitable for monitoring, troubleshooting, simulating and testing ATM networks. You can verify the functionality of any LAN traffic running on an ATM link, such as Ethernet or FDDI, or you can measure the performance of any ATM networking device, such as a switch.

Note:

There are no in-service monitoring options when using the 155 UTP ATM interface module.

8.1.1. Installation

To perform testing, the 155 UTP ATM interface module must be paired with a Broadband Analyzer Module (BAM). See Chapter 2, “Installing ATM on a PC for Domino” and see the hardware guide that came with your ATM analyzer for further information.

8.1.2. Interface Module Specifications

UTP

Part No.	B/N 9309/90.68
Connectors	RJ-45 (two)
Cabling	100 m reach Category 5
Specification	ATM Forum af-phy-0015.000

8.1.3. Safety Information for the 155 UTP ATM Interface

The 155 UTP ATM interface module meets the following safety specifications:

- FDA 21 CFR 1040.10/11
- CAN No. C22.2 1010.1-92
- UL 3111-1
- EN-61010-1
- IEC-825 and IEC-1010-1

Warning: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Warning: The external terminals of this interface module are not intended for direct connection to outside plant leads and TNV circuits.

8.1.4. Equipment Necessary to Ensure Compliance with EMC Directive

WG tested and declared the 155 UTP 9305/90.68 as the worst case example of the OC-3/STM-1 family for EMI/EMC testing. This interface module is CE compliant when used with either the DominoPLUS analyzer or DA-30C analyzer. The following equipment was used for this determination:

- DominoATM analyzer, BN 9316/02
- 155 UTP Line Interface Module, B0003, P/N 9305/90.68
- Ferrite kit for use with the 155 UTP, P/N 9315-8490.142
- Broadband Analyzer Module 155, C0029, P/N 9305/90.69
- Laptop: IBM Thinkpad, Type 2620-20F with associated power supply P/N 84G2098, S/N 9408103047; FCC ID of ANO2620CS.

The following accessories were used for CE Mark compliance testing.

BN Number	Part Number	Equipment Description
K9139	9314-8537.002	110v power cable for North America
K9140	9314-8538.001	220v power cable for Europe
K9123	9314-8520.006	0.45 m PC-to-Domino cable
K9127	9314-8523.003	Domino-to-Domino cable (This cable is now BN K9194)
K9125	9314-8521.005	1 m Domino-to-printer cable
None	None	Category 5 STP patch cable 100 Ohm to loopback box

Note:
The DominoATM analyzer is CE compliant from Series A.

8.1.5. Rear Panel Connectors

The rear panel of the 155 UTP interface module provides two external connections to the network or device under test. The card ejector button is located at the bottom of the rear panel. Use it to remove the interface module. The connectors are labeled:

- User Device (which is Rx1 and Tx1)
- Network Equipment (which is Rx2 and Tx2).

8.2. Connecting to the Network

Connectors located on the rear panel of the 155 UTP ATM interface module allow for connection to the network for ATM monitoring or emulation.

The following sections describe some of the options for how to connect the 155 UTP ATM interface module to the network.

8.2.1. Connecting for Emulation of an ATM End Station

Use the following procedure to emulate a 155 UTP ATM interconnect device:

- Connect the User Device port (Rx1/Tx1) on the 155 UTP interface module to the transmit port of the ATM device under test.

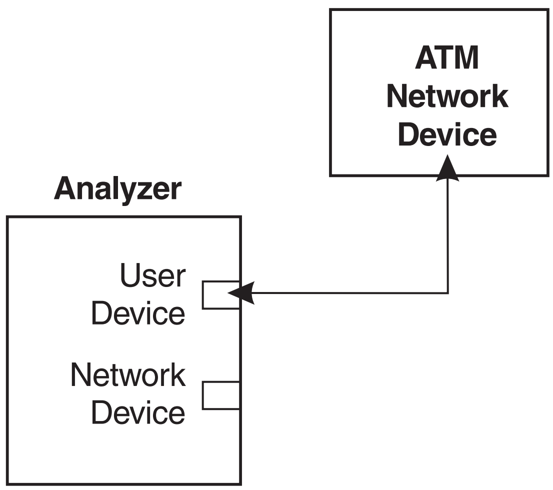


Figure 8-1. Connecting for Emulation for an ATM End Station (straight-through cable)

Note:

All transmitted data on Tx1 can be internally looped back to Rx2 if the loopback option is selected in the Analyzer Setup Wizard within the application.

8.2.2. Connecting for Emulation of an ATM Network Device

Use the following procedures to emulate a 155 UTP interconnect device:

- Connect the Network Device port (Rx2/Tx2) on the 155 UTP interface module to the receive port of the ATM device under test.

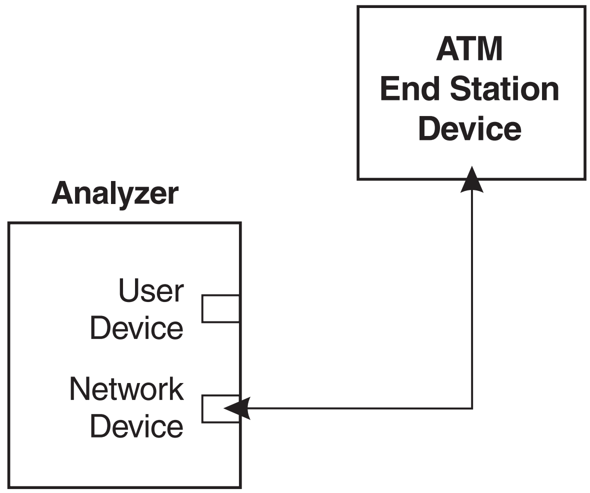


Figure 8-2. Connecting for Emulation for an ATM Network Device (straight-through cable)

Note:

Transmitted data on Tx2 can be looped back to Rx1 if the loopback option is selected in the Analyzer Setup Wizard within the application.

8.2.3. Connecting for Monitoring

When the 155 UTP ATM interface module is configured for monitoring, both receivers are enabled and the data from each is internally repeated to the transmitters (Rx1 is repeated on Tx2; Rx2 is repeated on Tx1). There are two basic monitoring topologies:

- **Monitoring between ATM devices**. This topology allows you to monitor and decode full-duplex data exchanges at the Network Layer (and higher) of the OSI reference model. See Figure 8-3. It is ideal for analyzing both sides of the conversation between two devices.
- **Monitoring across ATM interconnect devices**. This topology allows you to monitor data exchanges going through an interconnect device. It is ideal for analyzing part of the conversation between two ATM devices. See Figure 8-4.

In both topologies, the analyzer must be connected in an out-of-service mode. This refers to the monitoring of ATM equipment that where the connection can be broken in order to make test connections, such as in a lab environment.

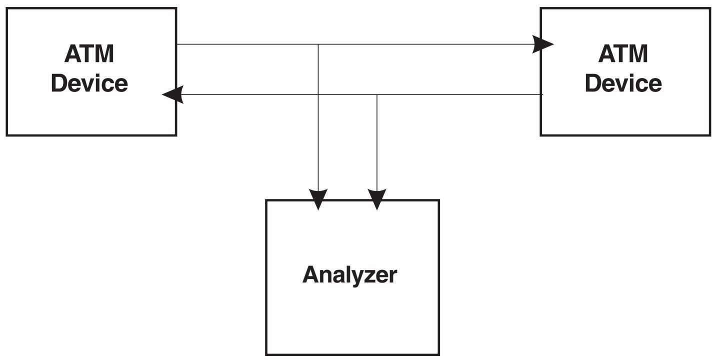


Figure 8-3. Monitoring Between ATM Devices.

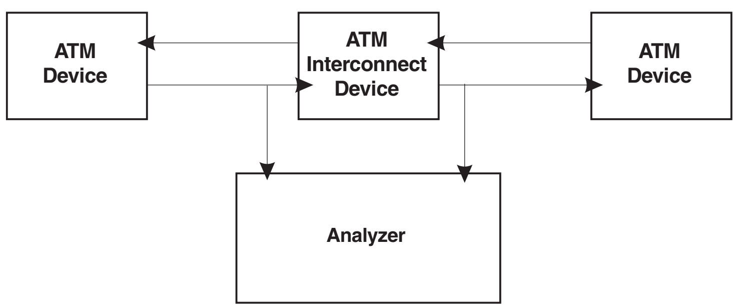


Figure 8-4. Monitoring Across ATM Interconnect Devices.

8.2.3.1. Connecting for Out-of-service Monitoring Between ATM Devices

The following procedure explains how to make a basic out-of-service connection for monitoring traffic between two ATM devices.

To monitor between two 155 UTP ATM interconnect devices (out-of-service):

1. Disconnect both links between the two devices.
2. Connect a suitable cable from the user device (Rx1/Tx1) port on the 155 UTP ATM interface module to the network device under test.
3. Connect a suitable cable from the network equipment (Rx2/Tx2) port on the 155 UTP ATM interface module to the user device under test.

8.2.3.2. Monitoring with RJ-48C Connections

Refer to the figures below and on the next page before connecting the analyzer to the network for monitoring with RJ-48C connections.

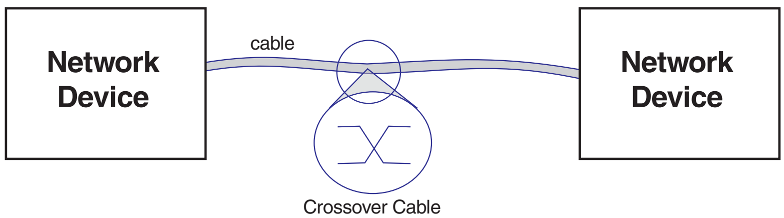


Figure 8-5. Example of a network using a 155 UTP crossover cable.

This network shown in Figure 8-5 is using an RJ-48C crossover cable. If you are using the analyzer to monitor such a network, use one RJ-48C cross-over cable and one RJ-48C straight-through cable, as shown in Figure 8-6.

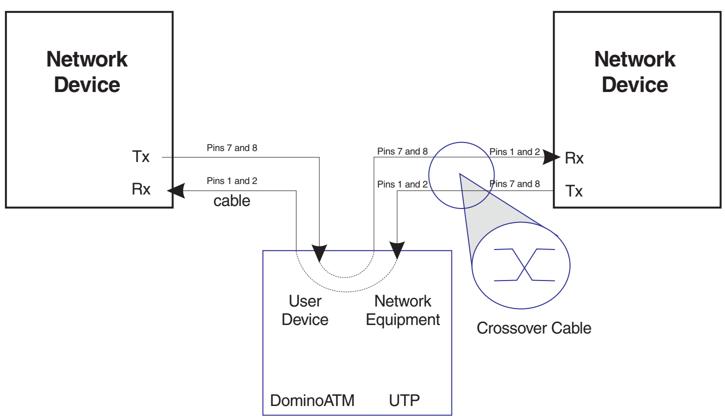


Figure 8-6. Monitoring with the 155 UTP ATM Interface Module Using RJ-48C Connectors and a Crossover Network

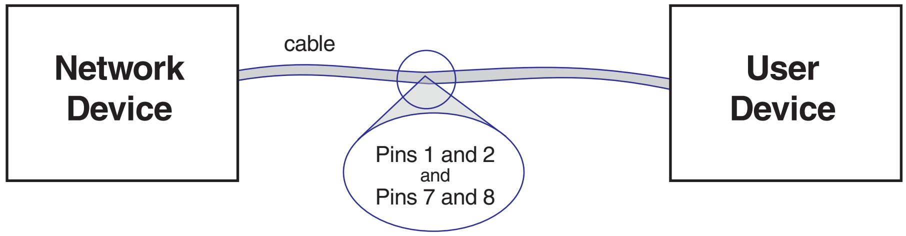


Figure 8-7. Example of a Network Using a 155 UTP Straight-through Cable.

This network shown in Figure 8-7 is using an RJ-48C straight-through cable. If you are using the analyzer to monitor such a network, use two RJ-48C straight-through cables, as shown in Figure 8-8.

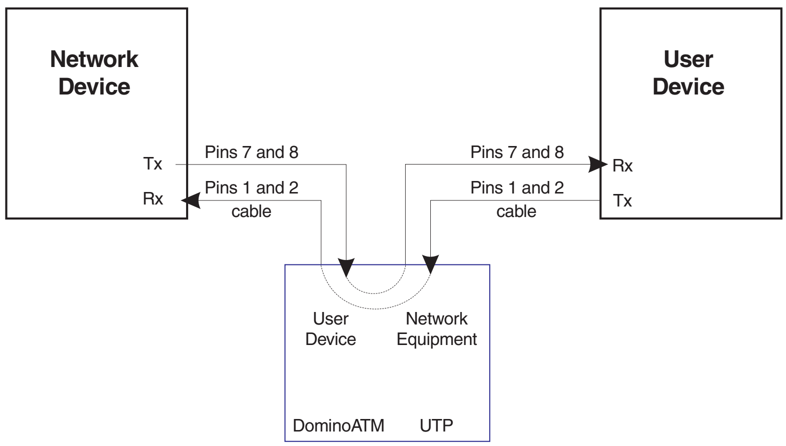


Figure 8-8. Monitoring with the 155 UTP Using RJ-48C and Straight-Through Cables

8.3. Using the Light Emitting Diode (LED) Indicators

The front panel LED indicators report signal and synchronization status. They are directly controlled by the interface module. The indicators are divided into two groups. There is one for each receiver (Rx1 and Rx2) as seen on the LED overlay.

The LEDs report status through one of three colors. Green indicates that no signal or synchronization defects are occurring or have occurred since testing began. The orange color represents a history status. It indicates that a defect occurred. Red indicates that such a defect is occurring.

This history data is cleared whenever testing is restarted or network statistics are reset.

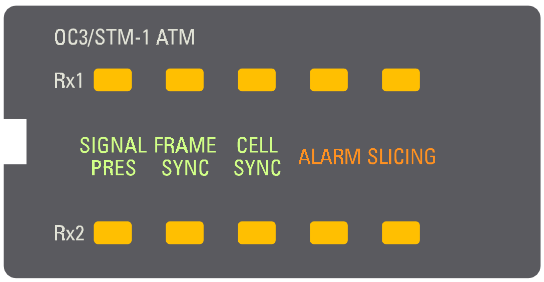


Figure 8-9. The OC-3 LED Overlay Is Used for UTP.

8.3.1. Signal Present

The Signal Present LED reports the status of the signal. There is a loss of signal when the incoming data has no transitions (either all ones or all zeros).

Green	OC-3/STM-1 signal is present. No defects.
Red	There is a loss of signal currently being detected.
Orange	One or more loss of signal defects occurred since testing began or since the last reset of network statistics.

8.3.2. Frame Sync

The Frame Sync LED reports the synchronization status of the frame.

Green	No OC-3/STM-1 frame synchronization defects.
Red	One or more OC-3/STM-1 frame synchronization defects (out of frame) is currently being detected.
Orange	One or more OC-3/STM-1 frame synchronization defects (out of frame) occurred since testing began or since the last reset of network statistics, but the condition was corrected.

8.3.3. Cell Sync

The Cell Sync LED reports the synchronization status of the cell. The loss of cell synchronization is indicated when cell delineation is lost for 4 milliseconds.

Green	No OC-3/STM-1 cell synchronization defects.
Red	One or more OC-3/STM-1 cell synchronization defects (cell delineation has been lost) are currently being detected, causing an out-of-cell delineation error.
Orange	One or more OC-3/STM-1 cell synchronization defects have occurred since testing began or since the last time network statistics were reset, but the condition was corrected.

8.3.4. Alarm

The Alarm LED reports alarm conditions. The detected conditions are line alarm indicator signal (AIS), line remote defect indicator (RDI), path AIS, path RDI, path C2, line LOP, and OOF. An AIS condition occurs when an unframed pattern of all ones with less than three zeros in two consecutive frames has been detected. The RDI condition occurs when the remote end sends a remote AIS. The path C2 alarm is generated when an unequipped signal label code is present. The LOP is noted when a loss of pointer error is present. When frame delineation is lost, an out of frame condition is noted.

Off	No alarm conditions have occurred since the last time network statistics were reset.
Red	An alarm condition is currently active.
Orange	One or more alarm conditions have occurred since testing began or since the last time network statistics were reset, but the condition was corrected.

8.3.5. Slicing

The Slicing LED reports the frame slicing status. Slicing takes place when the full duplex utilization (Rx1 plus Rx2) line rate exceeds 114%. The analyzer truncates certain payload bytes to reduce the effective bandwidth captured.

Off	No slicing has occurred since testing began or since the last time network statistics were reset.
Red	A slicing condition is present.
Orange	One or more slicing conditions have occurred since testing began or since the last time that network statistics were reset.

8.4. Specifying the OC-3/STM-1 Interface Module in the Application

To use the 155 UTP ATM interface module with the ATM Analysis Application, you must specify the physical layer hardware settings for the OC-3/STM-1 interface module from within the application. The last page of the Analyzer Setup Wizard allows you to:

- Filter out unassigned and idle cells that are being received on the selected port.
- Apply SONET section cell scrambling.

To access the Analyzer Setup Wizard:

- Click Setup\Setup Analyzer from the command menu of the application.

More information about the OC-3/STM-1 Settings page of the Analyzer Setup Wizard can be found by clicking Help on that page. Other details related to the OC-3/STM-1 interface module can be accessed through the online Help; that information applies to the 155 UTP ATM interface module.

9. The E1 ATM Interface Module

This chapter provides information regarding the characteristics of the E1 ATM interface module, including hardware installation and LED descriptions. This chapter also explains how to specify the E1 ATM interface module physical layer hardware settings within the ATM Analysis Application.

9.1. Overview of the E1 ATM Interface Module

The E1 ATM interface module and the ATM Analysis Application enable your analyzer to perform network analysis of ATM traffic carried over E1 transmission facilities. The interface makes your analyzer suitable for monitoring, troubleshooting, simulating and testing ATM networks. You can verify the functionality of any LAN traffic running on an ATM link, such as Ethernet or FDDI, or you can measure the performance of any ATM networking device, such as a switch.

9.1.1. Installation

To perform testing, the E1 interface module must be paired with a Broadband Analyzer Module (BAM). See Chapter 2, “Installing ATM on a PC for Domino” and see the hardware guide that came with your ATM analyzer for further information.

9.1.2. Interface Module Specifications

E1 ATM interface module	Part Number: B/N 9305/90.73
Requires: 155 Mbps Broadband Analyzer Module	Part Number: B/N 9305/90.63
Interface connectors:	BNC 75-ohm connectors (two receive and two transmit)
Optional equipment: E1 75/120 ohm Balun (E1 BNC 75 ohm unbalanced to LEMO 120-ohm balanced converter box)	Part Number: B/N 9305/90.74
Optional equipment: TF/LEMO Cable (for the E1 75/120-ohm Balun)	Order Number: K-9111

9.1.3. Safety Information

The E1 ATM interface module meets these safety specifications:

- CAN No. C22.2 1010-1
- UL 3111-1
- EN-61010-1
- IEC-1010-1

> **Warning:** The external terminals of this interface module are not intended for direct connection to outside plant leads and TNV circuits.

9.1.4. Equipment Necessary to Ensure Compliance with EMC Directive

WG used the following equipment to determine the worst-case setup for EMI/EMC testing for the E1 ATM interface module:

- DA-30C Analyzer, W-0022
- E1 ATM interface module
- 4-foot 75Ω coaxial cable (npn) generic
- Broadband Analyzer Module, C0029 , P/N 9305/90.69 D0021
- Protocol Analyzer Module P/N 9305/00.26 F0016

The following accessories were used for CE Mark compliance testing.

BN Number	Part Number	Equipment Description
K9139	9314-8537.002	110v power cable for North America
K9140	9314-8538.001	220v power cable for Europe

This interface module is CE compliant when used with either the DominoPLUS analyzer or DA-30C analyzer.

Note:

The DominoATM analyzer is CE compliant from Series A.

9.1.5. Rear Panel Connectors

The rear panel of the E1 ATM interface module provides four external E1 connections to the network or device under test:

- Tx1 (Transmitter #1)
- Rx1 (Receiver #1)
- Tx2 (Transmitter #2)
- Rx2 (Receiver #2)

The card ejector button is located at the bottom of the rear panel. Use it to remove the interface module.

9.2. Connecting to the Network

Connectors located on the rear panel of the E1 ATM interface module allow for connection to the network for ATM monitoring or emulation.

9.2.1. Connecting for Emulation of an ATM End Station

To emulate an E1 interconnect device:

1. Connect the Tx1 port on the E1 ATM interface module to the receive port of the ATM device under test.
2. Connect the Rx1 port on the E1 ATM interface module to the transmit port of the ATM device under test.

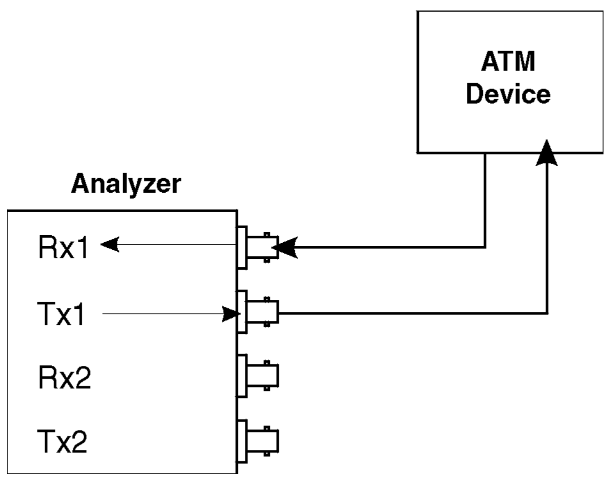


Figure 9-1. Connecting for Emulation for an ATM End Station

Note:

All transmitted data on Tx1 can be internally looped back to Rx2 if the loopback option is selected in the Analyzer Setup Wizard within the application.

9.2.2. Connecting for Monitoring

There are two basic monitoring topologies:

- **Monitoring between ATM devices**. This topology allows you to monitor and decode full-duplex data exchanges at the Network Layer (and higher) of the OSI reference model. See Figure 9-2. It is ideal for analyzing both sides of the conversation between two devices.
- **Monitoring across ATM interconnect devices**. This topology allows you to monitor data exchanges going through an interconnect device. It is ideal for analyzing part of the conversation between two ATM devices. See Figure 9-3.

In both topologies, the analyzer can be connected in an in-service or out-of-service mode.

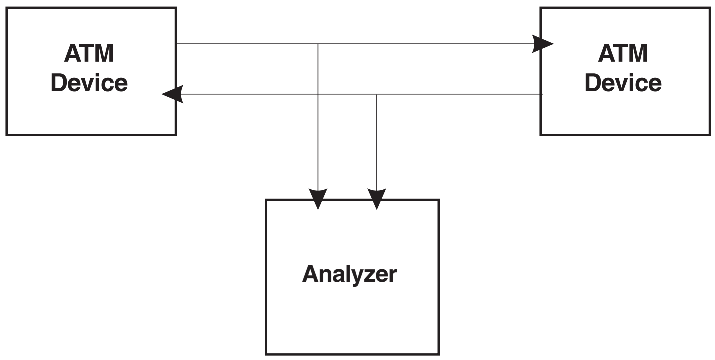


Figure 9-2. Monitoring Between ATM Devices.

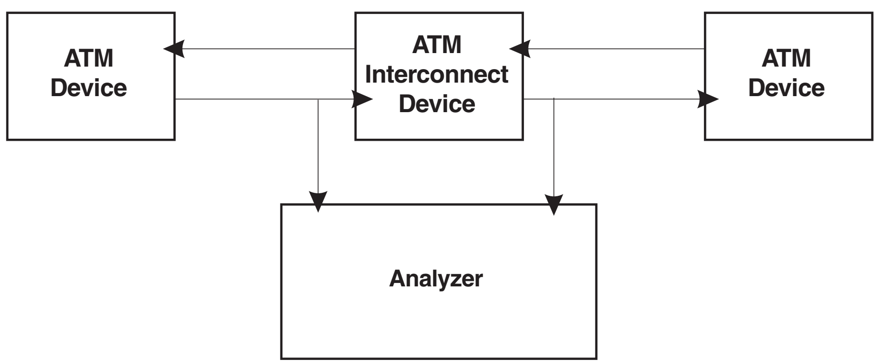


Figure 9-3. Monitoring Across ATM Interconnect Devices.

9.2.2.1. In-Service and Out-of-Service Monitoring

When monitoring, note the distinction between in-service and out-of-service monitoring:

- "In-service" refers to the monitoring of ATM equipment in a live network, where the network is not brought down when making test connections. In such situations, the monitor points and connection method should be carefully planned. These connections are generally made using the monitor jacks provided by most network terminating equipment.
- "Out-of-service" refers to the monitoring of ATM equipment where the connections are broken to insert the analyzer in a through mode. See Figure 9-4. When the E1 ATM interface module is configured for passive high impedance monitoring, both receivers are enabled and the data from each is internally connected to transmitter connectors through copper paths (Rx1 connected to Tx2; Rx2 connected to Tx1).

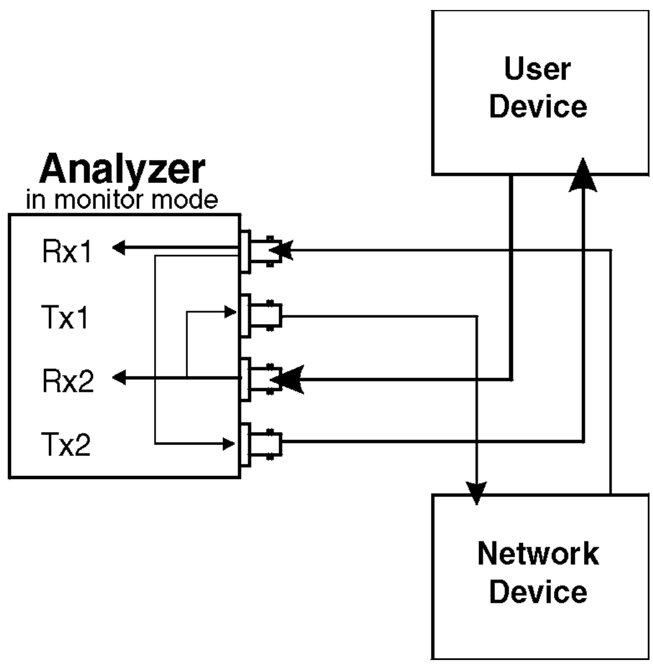


Figure 9-4. E1 ATM Interface Module Monitoring Connections

9.2.2.2. Connecting for Out-of-Service Monitoring Between ATM Devices

The following procedure shows you how to make a basic out-of-service connection for monitoring traffic between two ATM devices.

To monitor between two E1 ATM interconnect devices (out-of-service):

1. Disconnect both links between the two devices.
2. Connect a suitable cable from the Rx1 port on the E1 ATM interface module to the Tx port on the first interconnect device.
3. Connect a suitable cable from the Tx1 port on the E1 ATM interface module to the Rx port on the first interconnect device.
4. Connect a suitable cable from the Rx2 port on the E1 ATM interface module to the Tx port on the second interconnect device.
5. Connect a suitable cable from the Tx2 port on the E1 ATM interface module to the Rx port on the second interconnect device.

9.3. Using the Light Emitting Diode (LED) Indicators

The front panel LED indicators report signal and synchronization status. They are directly controlled by the E1 interface module. The indicators are divided into two groups: one for each receiver (Rx1 and Rx2) as seen on the LED overlay.

The LEDs report status through one of three colors. Green indicates that no signal or synchronization defects are occurring or have occurred since testing began. The orange color represents a history status. It indicates that a defect occurred. Red indicates that such a defect is occurring.

This history data is cleared whenever testing is restarted or network statistics are reset.

The LED overlay for the DA-30C analyzer has a vertical orientation, and the LED overlay for the Domino analyzer has a horizontal orientation.

Figure 9-5. LED Overlay

9.3.1. LOS

The LOS LED indicates whether an E1 line signal is detected. Loss of signal is declared whenever 32 consecutive zeros are received.

Off	Signal is present (a carrier is present).
Red	There is no signal present.

9.3.2. FAS

The FAS LED indicates whether an E1 frame alignment signal has been detected. There is an FAS error when the 7-bit (FAS) is incorrect in time lost zero.

Green	E1 framing has been achieved.
Off	An out-of-frame condition exists. There are excessive CRC errors or CRC multi-frame alignment was not obtained within 8 milliseconds.

9.3.3. MFAS

The MFAS LED indicates whether multi-frame alignment signal framing was detected within 8 milliseconds. The MFAS signal error is indicated when 4 consecutive CRC MFAS alignment signals have been received in error or when frame alignment (FAS) is lost. The MFAS LED is only valid in CRC4 mode.

Green	Multi-frame alignment has been achieved.
Red	Multi-frame alignment has not been achieved.
Off	Multi-frame alignment not selected.

9.3.4. CRC4

The CRC4 LED indicates the selection of cyclical redundancy checking. See specification G.703 (transmission) and specification G.704 (framing) for a detailed explanation of CRC4 errors.

Green	CRC4 mode is selected, and no error has occurred.
Red	CRC4 errors are occurring.
Orange	One or more CRC4 errors have occurred since testing began or since the last time network statistics were reset, but the condition was corrected.
Off	CRC4 mode is not selected.

9.3.5. AIS/Alarms

The AIS/Alarms LED indicates whether or not alarm indication signal is detected. Alarms include AIS, RDI, and PLCP Yellow. The application notes an AIS condition when an unframed pattern of all ones with less than three zeros in two consecutive frames has been detected. Similarly, the RDI condition occurs when the remote end sends a remote AIS. The PLCP Yellow is noted when 10 or more consecutive frames have a yellow bit in the path status octet.

Off	No alarm has been detected since testing started.
Red	An alarm condition currently exists.
Orange	One or more alarm conditions have occurred since testing began or since the last time network statistics were reset, but the condition was corrected.

9.3.6. Cell Sync

The Cell Sync LED indicates cell synchronization or delineation. There is an out of cell delineation indicated when six consecutive cells containing HEC errors occur.

Green	No E1 cell synchronization defects.
Off	One or more cell defects were detected within the 100 ms sampling period.

9.4. Specifying the E1 ATM Interface Module in the Application

To use the module with the ATM Analysis Application, you must specify the physical layer hardware settings for the interface module from within the ATM Analysis Application. The last page of the Analyzer Setup Wizard allows you to:

- Filter out unassigned and idle cells being received on the selected port.
- Select a receiver termination.
- Select the type of cell delineation.
- Select the frame alignment.

To access the Analyzer Setup Wizard:

- Click Setup\Setup Analyzer from the command menu of the application.

More information about the E1 Settings page of the Analyzer Setup Wizard can be found by clicking Help on that page. Other details related to the E1 ATM interface module can be accessed through the online Help by searching for “E1” in the Help index.

10. The E3 ATM Interface Module

This chapter provides information regarding the characteristics of the E3 ATM interface module, including hardware installation and LED descriptions. This chapter also explains how to specify the E3 ATM interface module physical layer hardware settings within the ATM Analysis Application.

10.1. Overview of the E3 ATM Interface Module

The E3 ATM interface module and the ATM Analysis Application enable your analyzer to perform network analysis of ATM traffic carried over E3 transmission facilities. The interface makes your analyzer suitable for monitoring, troubleshooting, simulating and testing ATM networks. You can verify the functionality of any LAN traffic running on an ATM link, such as Ethernet or FDDI, or you can measure the performance of any ATM networking device.

10.1.1. Installation

To perform testing, the E3 interface module must be paired with a Broadband Analyzer Module (BAM). See Chapter 2, “Installing ATM on a PC for Domino” and see the hardware guide that came with your ATM analyzer for further information.

10.1.2. Interface Module Specifications

E3 ATM interface module	Part Number: B/N 9305/90.76
Requires: 155 Mbps Broadband Analyzer Module	Part Number: B/N 9305/90.63
Connectors (two receive and two transmit)	BNC 75 ohm connectors

10.1.3. Safety Information

The E3 ATM interface module meets these safety specifications:

- CAN No. C22.2 1010-1
- UL 3111-1
- EN-61010-1
- IEC-1010-1.

Warning: The external terminals of this interface module are not intended for direct connection to outside plant leads and TNV circuits.

10.1.4. Equipment Necessary to Ensure Compliance with EMC Directive

The following equipment was used to determine that the EMI/EMC results for the E3 ATM and DS3 ATM interface modules are compatible:

- DominoATM analyzer, BN 9316/02
- E3 ATM BN 9305/90.76, A-0016 and DS3 ATM BN 9305/90.39
- Broadband Analyzer Module 155, C0029, P/N 9305/90.69
- Laptop: IBM Thinkpad, Type 2620-20F with associated power supply P/N 84G2098, S/N 9408103047; FCC ID of ANO2620CS.
- The DominoATM analyzer is CE compliant from Series A.

BN Number	Part Number	Equipment Description
K9139	9314-8537.002	110v power cable for North America
K9140	9314-8538.001	220v power cable for Europe
K9123	9314-8520.006	0.45 m PC-to-Domino cable
K9127	9314-8523.003	Domino-to-Domino cable (now K9194)
K9125	9314-8521.005	1 m Domino-to-printer cable
K169	0376-8568.836	1 m coaxial cable

This interface module is CE compliant when used with either the DominoPLUS analyzer or DA-30C analyzer.

10.1.5. Rear Panel Connectors

The rear panel of the E3 ATM interface module provides four external E3 connections to the network or device under test:

- Tx1 (Transmitter #1)
- Rx1 (Receiver #1)
- Tx2 (Transmitter #2)
- Rx2 (Receiver #2).

The card ejector button is located at the bottom of the rear panel. Use it to remove the interface module.

10.2. Connecting to the Network

Connectors located on the rear panel of the E3 ATM interface module allow for connection to the network for ATM monitoring or emulation. The following sections describe some of the options for how to connect the interface module to the network.

10.2.1. Connecting for Emulation of an ATM End Station

Use the following procedures to emulate an E3 interconnect device:

1. Connect the Tx1 port on the E3 ATM interface module to the receive port of the ATM device under test.
2. Connect the Rx1 port on the E3 ATM interface module to the transmit port of the ATM device under test.

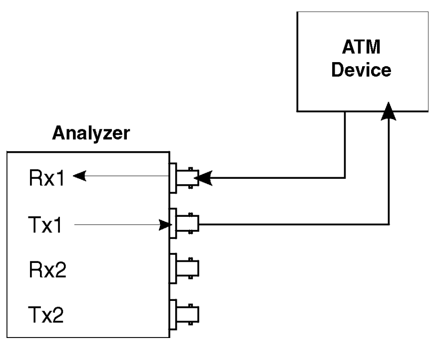


Figure 10-1. Connecting for Emulation for an ATM End Station

Note:

All transmitted data on Tx1 can be internally looped back to Rx2 if the loopback option is selected in the Analyzer Setup Wizard within the application.

10.2.1.1.Connecting for Emulation of an ATM Network Device

Use the following procedures to emulate an E3 interconnect device:

1. Connect the Tx2 port on the E3 ATM interface module to the receive port of the ATM device under test.
2. Connect the Rx2 port on the E3 ATM interface module to the transmit port of the ATM device under test.

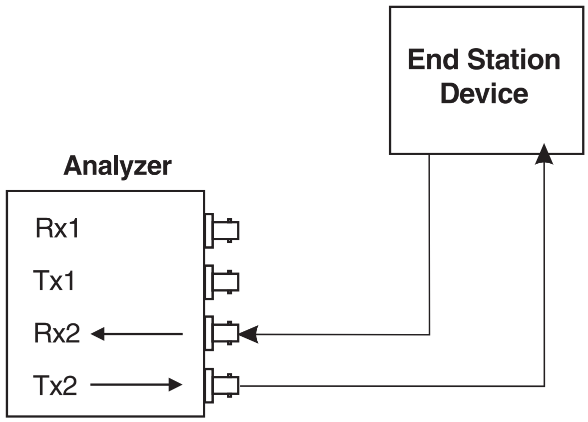


Figure 10-2. Connecting for Emulation for an ATM Network Device (loopback not shown)

Note:

The data from the network can be looped back to Rx1 to provide for full- duplex capture of transmitted and received frames if loopback is selected in the Analyzer Setup Wizard within the application.

10.2.2. Connecting for Monitoring

There are two basic monitoring topologies:

- **Monitoring between ATM devices**. This topology allows you to monitor and decode full-duplex data exchanges at the Network Layer (and higher) of the OSI reference model. See Figure 10-3. It is ideal for analyzing both sides of the conversation between two devices.
- **Monitoring across ATM interconnect devices**. This topology allows you to monitor data exchanges going through an interconnect device. It is ideal for analyzing part of the conversation between two ATM devices. See Figure 10-4.

In both topologies, the analyzer can connect in an in-service or out-of-service mode.

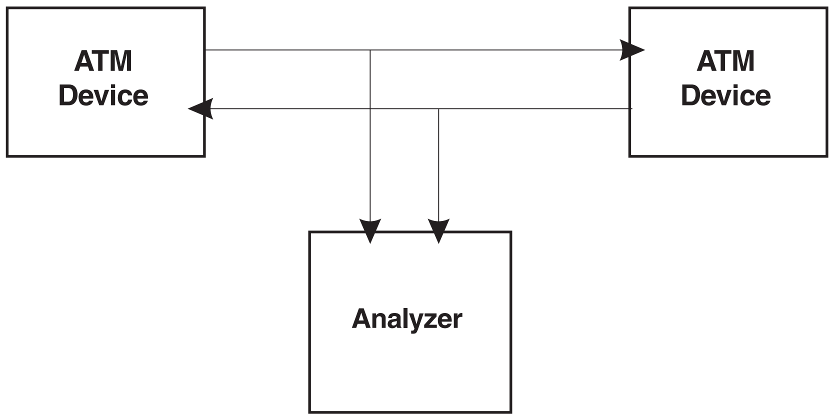


Figure 10-3. Monitoring Between ATM Devices.

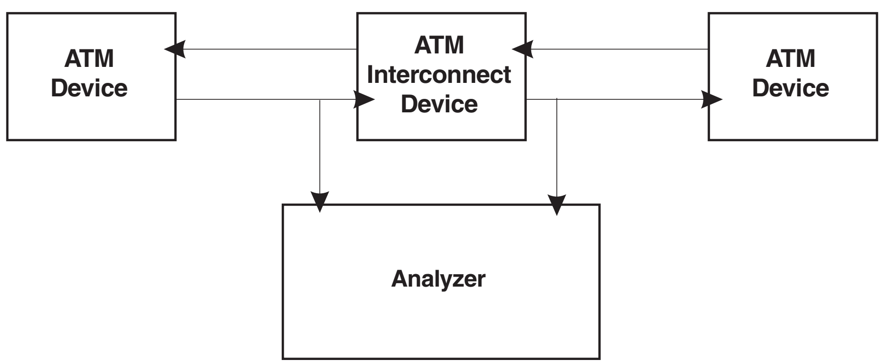


Figure 10-4. Monitoring Across ATM Interconnect Devices.

10.2.2.1.In-Service and Out-of-Service Monitoring

When monitoring, note the distinction between in-service and out-of-service monitoring:

- "In-service" refers to the monitoring of ATM equipment in a live network, where the network is not brought down when making test connections. In such situations, the monitor points and connection method should be carefully planned. These connections are generally made using the monitor jacks provided by most network terminating equipment.
- "Out-of-service" refers to the monitoring of ATM equipment where the connections are broken to insert the analyzer in a through mode. See Figure 10-5. When the E3 ATM interface module is configured for passive high impedance monitoring, both receivers are enabled and the data from each is internally connected to transmitter connectors through copper paths (Rx1 connected to Tx2; Rx2 connected to Tx1).

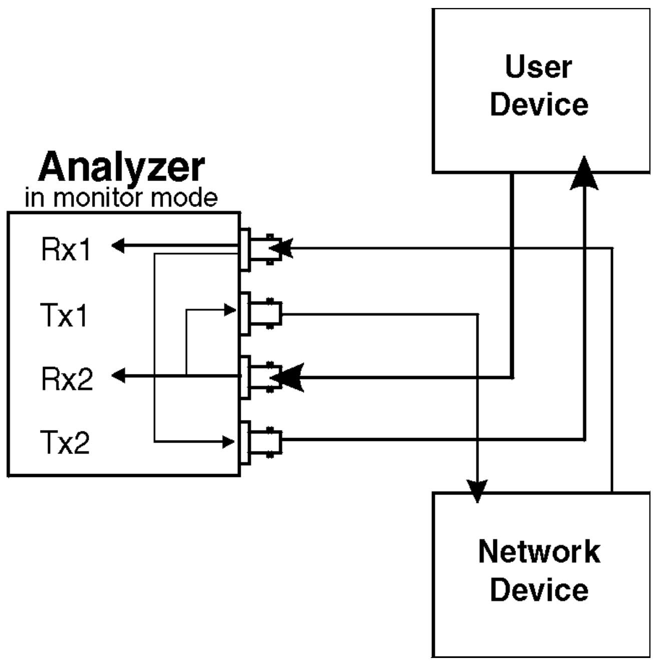


Figure 10-5. E3 ATM Interface Module Monitoring Connections

10.2.2.2.Connecting for Out-of-service Monitoring Between ATM Devices

The following procedure shows you how to make a basic out-of-service connection for monitoring traffic between two ATM devices.

To monitor between two E3 ATM interconnect devices (out-of-service):

1. Disconnect both links between the two devices.
2. Connect a suitable cable from the Rx1 port on the E3 ATM interface module to the Tx port on the first interconnect device.
3. Connect a suitable cable from the Tx1 port on the E3 ATM interface module to the Rx port on the first interconnect device.
4. Connect a suitable cable from the Rx2 port on the E3 ATM interface module to the Tx port on the second interconnect device.
5. Connect a suitable cable from the Tx2 port on the E3 ATM interface module to the Rx port on the second interconnect device.

10.3. Using the Light Emitting Diode (LED) Indicators

The front panel LED indicators report signal and synchronization status. They are directly controlled by the E3 interface module. The indicators are divided into two groups: one for each receiver (Rx1 and Rx2) as seen on the LED overlay.

The LEDs report status through one of three colors. Green indicates that no signal or synchronization defects are occurring or have occurred since testing began. The orange color represents a history status. It indicates that a defect occurred. Red indicates that such a defect is occurring.

This history data is cleared whenever testing is restarted or network statistics are reset.

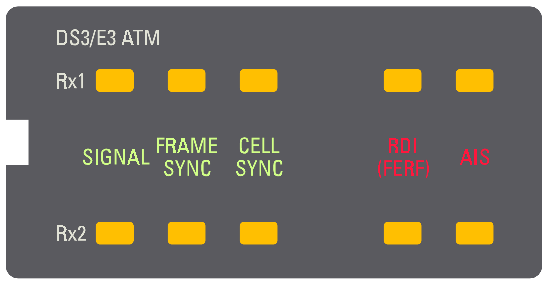


Figure 10-6. LED Overlay

10.3.1. Signal

The Signal LED reports the status of the signal. There is a loss of signal when no marks have been received for 32 consecutive bit periods.

Green	E3 signal is present. No defects.
Red	One or more E3 signal defects are being detected. There is a loss of signal (no signal present).
Orange	One or more E3 signal defects have occurred since testing began or since the last time network statistics were reset.

10.3.2. Frame Sync

The Frame Sync LED reports the synchronization status of the frame. The loss of frame (LOF) is indicated when the framing pattern is in error for four consecutive frames.

Green	No E3 frame synchronization defects.
Red	An out of frame alignment error is being detected. There is a loss of frame alignment currently present. For example, there are framing bit errors.
Orange	One or more E3 frame synchronization defects have occurred since testing began or since the last time network statistics were reset.

10.3.3. Cell Sync

The Cell Sync LED reports the synchronization status of the cell.

Green	No E3 cell synchronization defects.
Red	There is a loss of cell synchronization. A HEC error is being detected within seven consecutive cells.
Orange	One or more E3 cell synchronization defects have occurred since testing began or since the last time that network statistics were reset.

10.3.4. RDI (FERF)

The RDI (FERF) LED reports remote defect indicator for far end receive failures. The RDI signal indicates that all ones were detected.

Green	No remote defect indicator for far end receive failure errors.
Red	One or more far end receive failures indicated by the remote defect indicator are being detected.
Orange	One or more far end receive failures indicated by the remote defect indicator have occurred since testing began or since the last time that network statistics were reset.

10.3.5. AIS

The AIS LED indicates whether alarm indication signal is detected. The AIS indication is made when less than eight zeros in a frame were detected while in the OOF state.

Off	No alarm has been detected since testing started.
Red	An alarm currently exists.
Orange	One or more alarm signals have occurred since testing began or since the last time that network statistics were reset.

10.4. Specifying the E3 ATM Interface Module in the Application

To use the module with the ATM Analysis Application, you must specify the physical layer hardware settings for the interface module from within the ATM Analysis Application. The last page of the Analyzer Setup Wizard allows you to:

- Filter out unassigned and idle cells being received on the selected port.
- Select a receiver termination.
- Select the timing marker (traceable or not)
- Select to enable trail trace.

To access the Analyzer Setup Wizard:

- Click Setup\Setup Analyzer from the command menu of the application.

More information about the E3 Settings page of the Analyzer Setup Wizard can be found by clicking Help on that page. Other details related to the E3 ATM interface module can be accessed in the online Help.

11. The DS1 ATM Interface Module

This chapter provides information regarding the characteristics of the DS1 ATM interface module, including hardware installation and LED descriptions. This chapter also explains how to specify the DS1 ATM interface module physical layer hardware settings within the ATM Analysis Application.

11.1. Overview of the DS1 ATM interface module

The DS1 ATM interface module and the ATM Analysis Application enable your analyzer to perform network analysis of ATM traffic carried over DS1 transmission facilities. The interface makes your analyzer suitable for monitoring, troubleshooting, and simulating ATM networks. You can verify the functionality of any LAN traffic running on an ATM link, such as Ethernet or FDDI, or you can measure the performance of any ATM networking device.

11.1.1. Installation

To perform testing, the DS1 ATM interface module must be paired with a Broadband Analyzer Module (BAM). See Chapter 2, “Installing ATM on a PC for Domino” and see the hardware guide that came with your ATM analyzer for further information.

11.1.2. Interface Module Specifications

DS1 ATM interface module	Part Number: B/N 9305/90.38
Requires: 155 Mbps Broadband Analyzer Module	Part Number: B/N 9305/90.63
Interface connectors	Bantum and RJ-48/C

11.1.3. Safety Information

The DS1 ATM interface module meets these safety specifications:

- CAN No. C22.2 1010-1
- UL 3111-1
- EN-61010-1
- IEC-1010-1.

⚠ **Warning:** The external terminals of this interface module are not intended for direct connection to outside plant leads and TNV circuits.

11.1.4. Equipment Necessary to Ensure Compliance with EMC Directive

- DominoATM analyzer, BN 9316/02 with a DS1 ATM BN 9305/90, A-0016
- Broadband Analyzer Module 155, C0029, P/N 9305/90.69
- Laptop: IBM Thinkpad, Type 2620-20F with associated power supply P/N 84G2098, S/N 9408103047; FCC ID of ANO2620CS.

The following accessories were used for CE Mark compliance testing.

BN Number	Part Number	Equipment Description
K9139	9314-8537.002	110v power cable for North America
K9140	9314-8538.001	220v power cable for Europe
K9123	9314-8520.006	0.45 m PC-to-Domino cable
K9127	9314-8523.003	Domino-to-Domino cable (now K9194)
K9125	9314-8521.005	1 m Domino-to-printer cable
Black box	1-5580472	1 m UTP patch cable
None	None	Generic loopback box

This interface module is CE compliant when used with either the DominoPLUS analyzer or DA-30C analyzer.

Note:

The DominoATM analyzer is CE compliant from Series A.

11.1.5. Rear Panel Connectors

The rear panel of the DS1 ATM interface module provides four external Bantam DS1 connections or two RJ-48C connections. The card ejector button is located at the bottom of the rear panel. Use it to remove the interface module. Use these for connections to the network or device under test:

- Tx1 (Transmitter #1)
- Rx1 (Receiver #1)
- Tx2 (Transmitter #2)
- Rx2 (Receiver #2).

11.2. Connecting to the Network

Connectors located on the rear panel of the DS1 ATM interface module allow for connection to the network for ATM monitoring or emulation. The following sections describe some of the options for how to connect the interface module to the network.

11.2.1. Connecting for Emulation of an ATM End Station

Use the following procedure to emulate an DS1 interconnect device:

1. Connect the Tx1 port on the DS1 ATM interface module to the receive port of the ATM device under test.
2. Connect the Rx1 port on the DS1 ATM interface module to the transmit port of the ATM device under test.

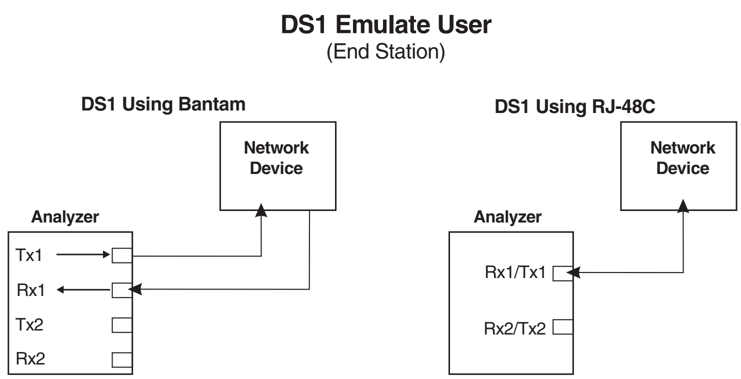


Figure 11-1. Connecting for Emulation for an ATM End Station

All transmitted data on Tx1 can be internally looped back to Rx2 if the loopback option is selected in the Analyzer Setup Wizard within the application.

11.2.2. Connecting for Emulation of an ATM Network Device

Use the following procedures to emulate a DS1 device if you are using Bantam connections:

1. Connect the Tx2 port on the DS1 ATM interface module to the receive port of the ATM device under test.
2. Connect the Rx2 port on the DS1 ATM interface module to the transmit port of the ATM device under test.

Use the following procedure to emulate a DS1 ATM device is you are using RJ-48C connections:

- Connect the Rx2/Tx2 port on the DS1 interface module to the receive port of the ATM device under test.

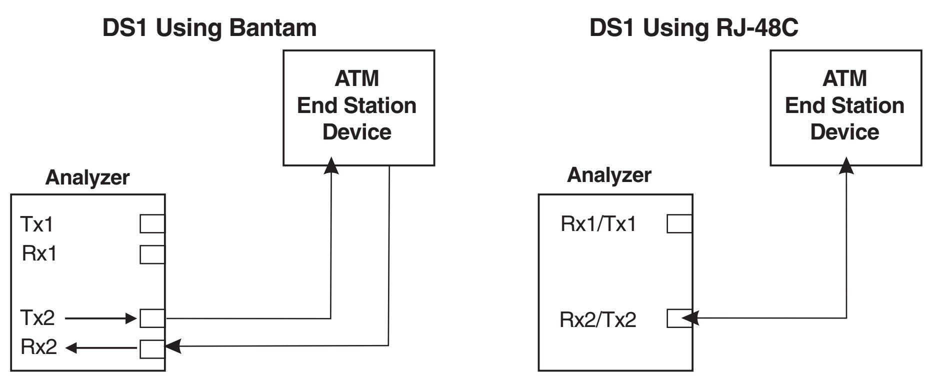


Figure 11-2. Connecting for Emulation for an ATM Network Device (loopback not shown)

Transmitted data on Tx2 can be looped back to Rx1 if the loopback option is selected in the Analyzer Setup Wizard within the application.

11.2.3. Connecting for Monitoring

There are two basic monitoring topologies:

- **Monitoring between ATM devices**. This topology allows you to monitor and decode full-duplex data exchanges at the Network Layer (and higher) of the OSI reference model. See Figure 11-3. It is ideal for analyzing both sides of the conversation between two devices.
- **Monitoring across ATM interconnect devices**. This topology allows you to monitor data exchanges going through an interconnect device. It is ideal for analyzing part of the conversation between two ATM devices. See Figure 11-4.

In both topologies, the analyzer can be connected in an in-service or out-of-service mode.

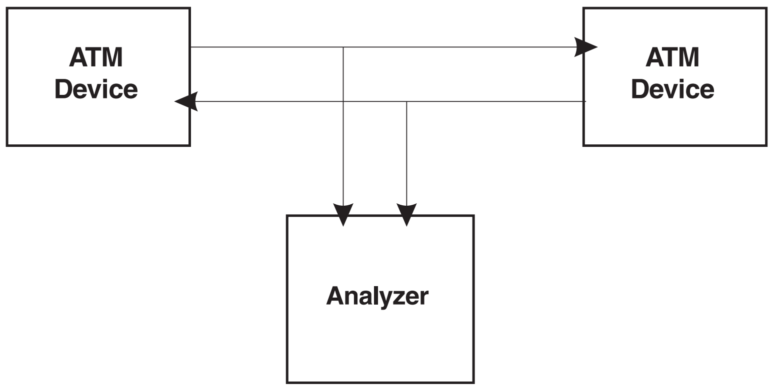


Figure 11-3. Monitoring Between ATM Devices.

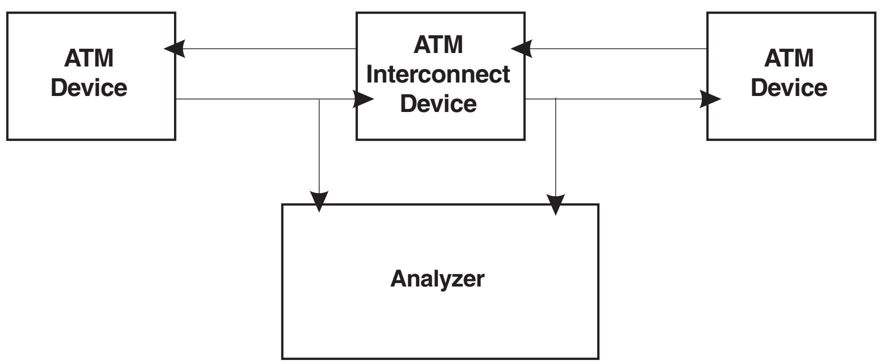


Figure 11-4. Monitoring Across ATM Interconnect Devices.

11.2.3.1.In-Service and Out-of-Service Monitoring

When monitoring, note the distinction between in-service and out-of-service monitoring:

- "In-service" refers to the monitoring of ATM equipment in a live network, where the network is not brought down when making test connections. In such situations, the monitor points and connection method should be carefully planned. These connections are generally made using the monitor jacks provided by most network terminating equipment.
- "Out-of-service" refers to the monitoring of ATM equipment where the connections are broken to insert the analyzer in a through mode. When the DS1 ATM interface module is configured for passive high impedance monitoring, both receivers are enabled and the data from each is internally connected to transmitter connectors through copper paths (Rx1 connected to Tx2; Rx2 connected to Tx1).

11.2.3.2.Connecting for Out-of-service Monitoring Between ATM Devices

The following procedure shows you how to make a basic out-of-service connection for monitoring traffic between two ATM devices.

To monitor between two DS1 ATM interconnect devices (out-of-service):

1. Disconnect both links between the two devices.
2. Connect a suitable cable from the Rx1 port on the DS1 ATM interface module to the Tx port on the first interconnect device.
3. Connect a suitable cable from the Tx1 port on the DS1 ATM interface module to the Rx port on the first interconnect device.
4. Connect a suitable cable from the Rx2 port on the DS1 ATM interface module to the Tx port on the second interconnect device.
5. Connect a suitable cable from the Tx2 port on the DS1 ATM interface module to the Rx port on the second interconnect device.

11.2.3.3.Monitoring with RJ-48C Connections

Monitoring a network with RJ-48C connections can be complicated. Study the figures below and on the next page carefully before connecting the analyzer to the network for monitoring with RJ-48C connections.

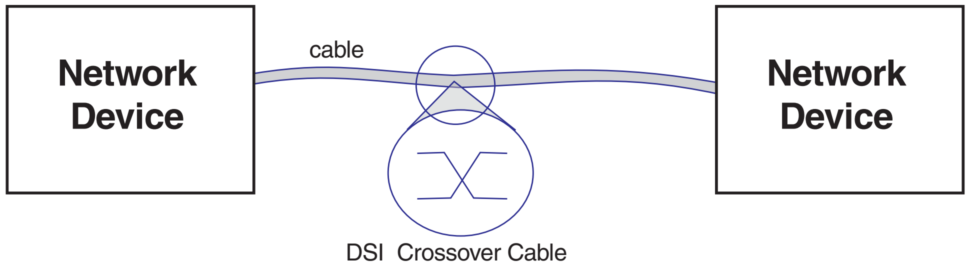


Figure 11-5. Example of a network using a DS1 crossover cable (network to network).

The network shown in Figure 11-5 is using an RJ-48C crossover cable. If you are using the analyzer to monitor such a network, use one RJ-48C cross-over cable and one RJ-48C straight-through cable, as shown in Figure 11-6.

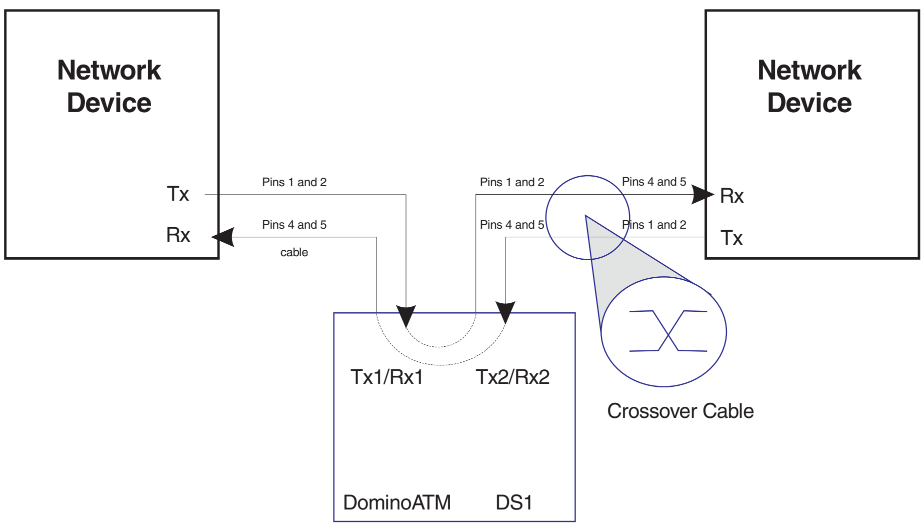


Figure 11-6. Monitoring with the DS1 ATM Interface Module Using RJ-48C Connectors and a Crossover Network

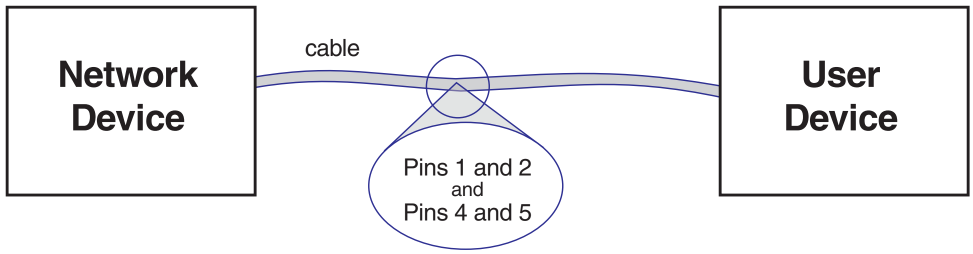


Figure 11-7. Example of a Network Using a DS1 Straight-through Cable (network to user).

The network shown in Figure 11-7 is using an RJ-48C straight-through cable. If you are using the analyzer to monitor such a network, use two RJ-48C straight-through cables, as shown in Figure 11-8.

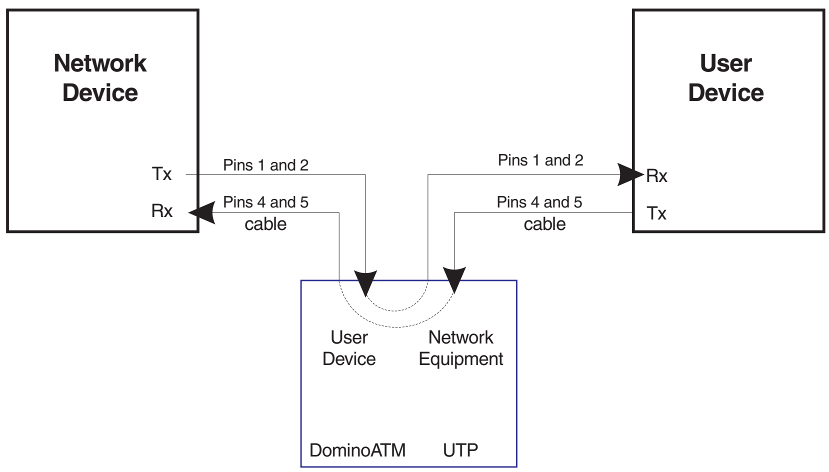


Figure 11-8. Monitoring with the DS1 ATM Interface Module Using RJ-48C and Straight-Through Cables

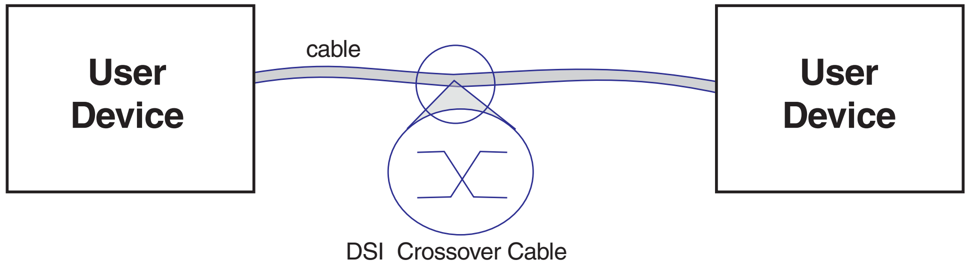


Figure 11-9. Example of a network using a DS1 crossover cable (user to user).

The network shown in Figure 11-9 is using an RJ-48C crossover cable. If you are using the analyzer to monitor such a network, use one RJ-48C cross-over cable and one RJ-48C straight-through cable, as shown in Figure 11-10.

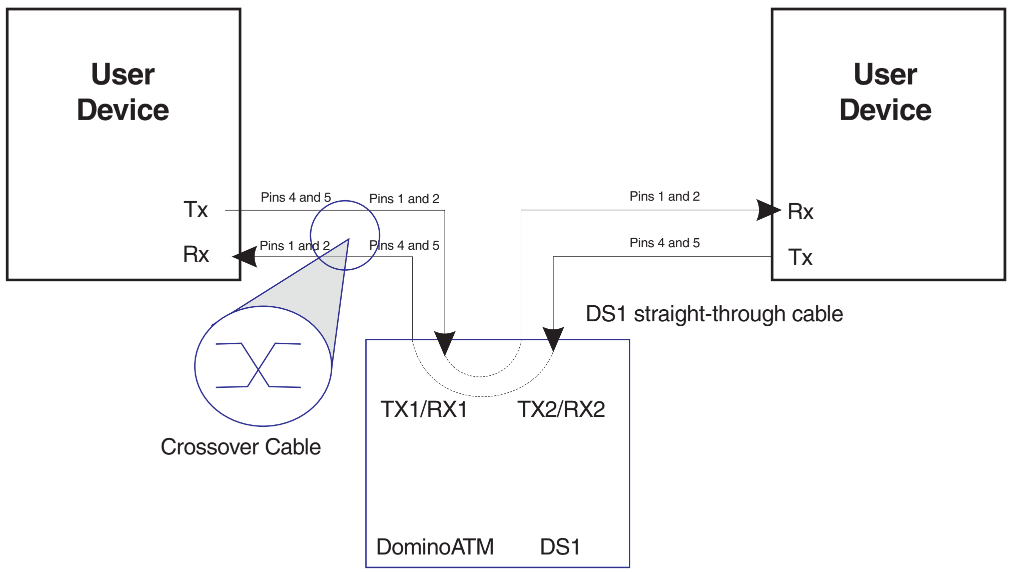


Figure 11-10. Monitoring with the DS1 ATM Interface Module Using RJ-48C Connectors and a Crossover Network

11.3. Using the Light Emitting Diode (LED) Indicators

The front panel LED indicators report signal and synchronization status. They are directly controlled by the DS1 interface module. The indicators are divided into two groups: one for each receiver (Rx1 and Rx2) as seen on the LED overlay.

The LEDs report status through one of three colors. Green indicates that no signal or synchronization defects are occurring or have occurred since testing began. The orange color represents a history status. It indicates that a defect occurred. Red indicates that such a defect is occurring.

This history data is cleared whenever testing is restarted or network statistics are reset.

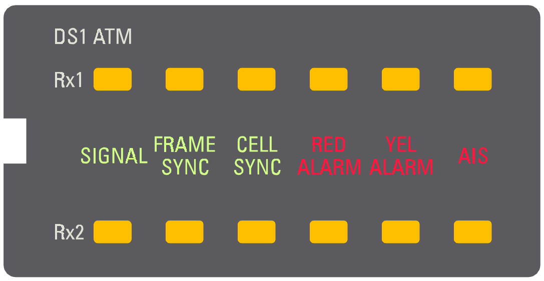


Figure 11-11. LED Overlay

11.3.1. Signal

The Signal LED indicates whether a DS1 signal is detected. Loss of signal occurs whenever 175 consecutive zeros are received.

Green	Signal is present.
Red	There is currently no signal present: loss of signal (LOS).
Orange	One or more DS1 signal defects have occurred since testing began or since the last time that network statistics were reset.

11.3.2. Frame Sync

The Frame Sync LED indicates whether frame alignment signal (FAS) framing has been achieved.

Green	DS1 framing has been achieved.
Red	There is currently a loss of frame alignment.
Orange	One or more DS1 frame synchronization defects (framing errors) have occurred since testing began or since the last time that network statistics were reset.

11.3.3. Cell Sync

The Cell Sync LED reports the synchronization status of the cell.

Green	No DS1 cell synchronization defects.
Red	Cell synchronization is currently lost.
Orange	One or more losses of cell delineation for more than four milliseconds have occurred since testing began or since the last time that network statistics were reset.

11.3.4. Red Alarm

The red alarm reports one or more out of frame events.

Green	No red alarm events are present.
Red	There is an out of frame condition currently in effect.
Orange	One or more loss of framing errors have occurred since testing began or since the last time that network statistics were reset.

11.3.5. Yel Alarm

A yellow alarm signal is sent when the 16-bit yellow code word is received four or more times during the extended super frame format.

Green	No yellow alarm signal has been detected since testing began or since the last time that network statistics were reset.
Red	An alarm signal currently exists.
Orange	One or more alarm signal errors have occurred since testing began or since the last time that network statistics were reset.

11.3.6. AIS

The AIS LED indicates whether or not alarm indication signal is detected. The AIS signal is present when there are unframed ones received for 60 milliseconds or more.

Off	No alarm has been detected since testing started.
Red	An alarm signal currently exists.
Orange	One or more alarms have occurred since testing began or since the last time that network statistics were reset.

11.4. Specifying the DS1 ATM Interface Module in the Application

To use the DS1 ATM interface module with the application, you must specify the physical layer hardware settings for the interface module from within the ATM Analysis Application. The last page of the Analyzer Setup Wizard allows you to:

- Select the monitor type.
- Select a receiver termination.
- Select the line build-out / receiver gain.
- Filter out unassigned and idle cells being received on the selected port.

To access the Analyzer Setup Wizard:

- Click Setup\Setup Analyzer from the command menu of the application.

More information about the DS1 Settings page of the Analyzer Setup Wizard can be found by clicking Help on that page. Other details related to the DS1 ATM interface module can be accessed in the online Help.

12. The DS3 ATM Interface Module

This chapter provides information regarding the characteristics of the DS3 ATM Interface module, including hardware installation and LED descriptions. This chapter also explains how to specify the DS3 ATM interface module physical layer hardware settings within the ATM Analysis Application.

12.1. Overview of the ATM DS3 Interface Module

The DS3 ATM interface module and the ATM Analysis Application enable your analyzer to perform network analysis of ATM traffic carried over DS3 transmission facilities. The interface makes your analyzer suitable for monitoring, troubleshooting, simulating and testing ATM networks. You can verify the functionality of any LAN traffic running on an ATM link, such as Ethernet or FDDI, or you can measure the performance of any ATM networking device, such as a switch.

12.1.1. Installation

To perform testing, the DS3 interface module must be paired with a Broadband Analyzer Module (BAM). See Chapter 2, “Installing ATM on a PC for Domino” and see the hardware guide that came with your ATM analyzer for further information.

12.1.2. Interface Module Specifications

DS3 ATM interface module	Part Number: B/N 9305/90.39
Requires: 155 Mbps Broadband Analyzer Module	Part Number: B/N 9305/90.63
Connectors (two receive and two transmit)	BNC 75 Ohm connectors

12.1.3. Safety Information

The ATM DS3 interface module meets these safety specifications:

- CAN No. C22.2 1010-1
- UL 3111-1
- EN-61010-1
- IEC-1010-1.

Warning: The external terminals of this interface module are not intended for direct connection to outside plant leads and TNV circuits.

12.1.4. Equipment Necessary to Ensure Compliance with EMC Directive

WG used the following equipment to determine that the EMI/EMC testing results for the E3 ATM and DS3 ATM interface modules are compatible:

- DominoATM analyzer, BN 9316/02
- E3 ATM BN 9305/90.76, A-0016 and DS3 ATM BN 9305/90.39
- Broadband Analyzer Module 155, C0029, P/N 9305/90.69
- Laptop: IBM Thinkpad, Type 2620-20F with associated power supply P/N 84G2098, S/N 9408103047; FCC ID of ANO2620CS.

The following accessories were used for CE Mark compliance testing.

BN Number	Part Number	Equipment Description
K9139	9314-8537.002	110v power cable for North America
K9140	9314-8538.001	220v power cable for Europe
K9123	9314-8520.006	0.45 m PC-to-Domino cable
K9127	9314-8523.003	Domino-to-Domino cable (now K9194)
K9125	9314-8521.005	1 m Domino-to-printer cable
K169	0376-8568.836	1 m coaxial cable

This interface module is CE compliant when used with either the DominoPLUS analyzer or DA-30C analyzer.

Note:

The DominoATM analyzer is CE compliant from Series A.

12.1.5. Rear Panel Connectors

The card ejector button is located at the bottom of the rear panel. Use it to remove the interface module. The rear panel of the DS3 ATM interface module provides four external DS3 connections to the network or device under test:

- Tx1 (Transmitter #1)
- Rx1 (Receiver #1)
- Tx2 (Transmitter #2)
- Rx2 (Receiver #2).

12.2. Connecting to the Network

Connectors located on the rear panel of the DS3 ATM interface module allow for connection to the network for ATM monitoring or emulation.

The following sections describe some of the options for how to connect the interface module to the network.

12.2.1. Connecting for Emulation of an ATM End Station

Use the following procedures to emulate a DS3 interconnect device:

1. Connect the Tx1 port on the DS3 ATM interface module to the receive port of the ATM device under test.
2. Connect the Rx1 port on the DS3 ATM interface module to the transmit port of the ATM device under test.

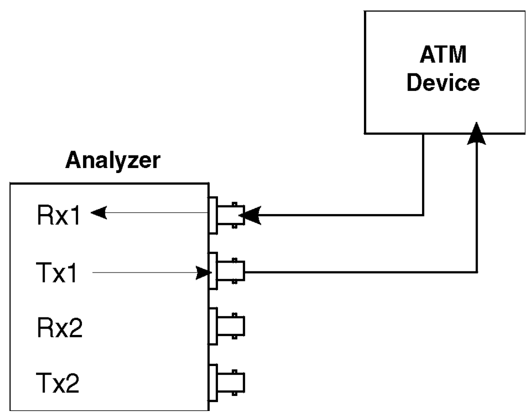


Figure 12-1. Connecting for Emulation for an ATM End Station

Note:

All transmitted data on Tx1 can be internally looped back to Rx2 if the loopback option is selected in the Analyzer Setup Wizard.

12.2.1.1.Connecting for Emulation of an ATM Network Device

Use the following procedures to emulate a DS3 interconnect device:

1. Connect the Tx2 port on the DS3 ATM interface module to the receive port of the ATM device under test.
2. Connect the Rx2 port on the DS3 ATM interface module to the transmit port of the ATM device under test.

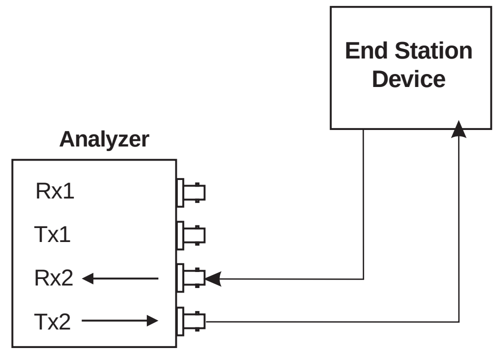


Figure 12-2. Connecting for Emulation for an ATM Network Device (loopback not shown)

Note:

All transmitted data on Tx2 can be internally looped back to Rx1 if the loopback option is selected in the Analyzer Setup Wizard within the application.

12.2.2. Connecting for Monitoring

There are two basic monitoring topologies:

- **Monitoring between ATM devices**. This topology allows you to monitor and decode full-duplex data exchanges at the Network Layer (and higher) of the OSI reference model. See Figure 12-3. It is ideal for analyzing both sides of the conversation between two devices.
- **Monitoring across ATM interconnect devices**. This topology allows you to monitor data exchanges going through an interconnect device. It is ideal for analyzing part of the conversation between two ATM devices. See Figure 12-4.

In both topologies, the analyzer can be connected in an in-service or out-of-service mode.

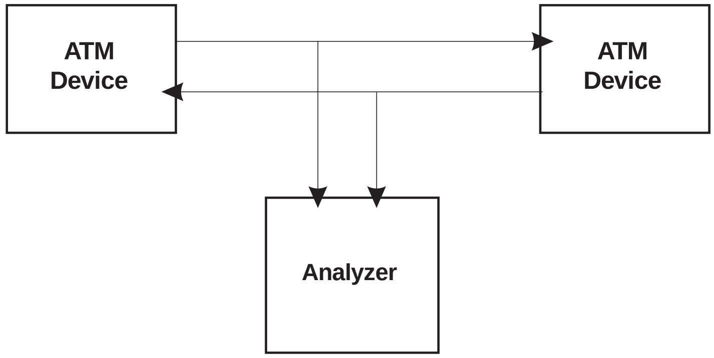


Figure 12-3. Monitoring Between ATM Devices.

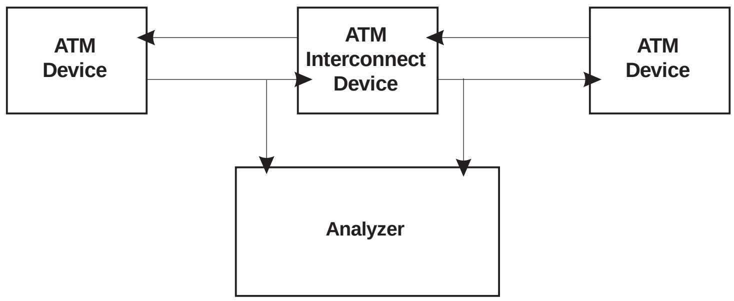


Figure 12-4. Monitoring Across ATM Interconnect Devices.

12.2.2.1.In-Service and Out-of-Service Monitoring

When monitoring, note the distinction between in-service and out-of-service monitoring:

- "In-service" refers to the monitoring of ATM equipment in a live network, where the network is not brought down when making test connections. In such situations, the monitor points and connection method should be carefully planned. These connections are generally made using the monitor jacks provided by most network terminating equipment.
- "Out-of-service" refers to the monitoring of ATM equipment where the connections are broken to insert the analyzer in a through mode. See Figure 12-5. When the DS3 ATM interface module is configured for passive high impedance monitoring, both receivers are enabled and the data from each is internally connected to transmitter connectors through copper paths (Rx1 connected to Tx2; Rx2 connected to Tx1).

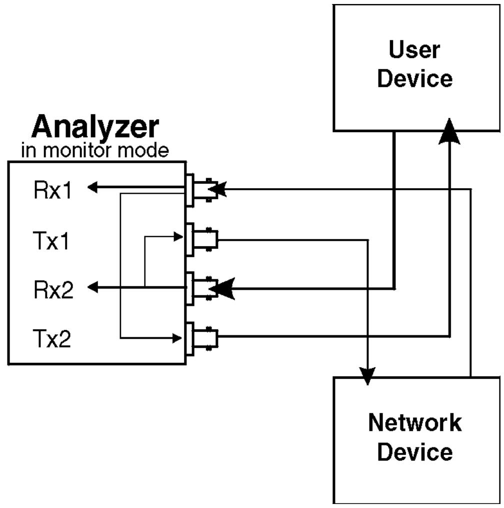


Figure 12-5. DS3 ATM Interface Module Monitoring Connections

12.2.2.2.Connecting for Out-of-service Monitoring Between ATM Devices

The following procedure shows you how to make a basic out-of-service connection for monitoring traffic between two ATM devices.

To monitor between two DS3 ATM interconnect devices (out-of-service):

1. Disconnect both links between the two devices.
2. Connect a suitable cable from the Rx1 port on the DS3 ATM interface module to the Tx port on the first interconnect device.
3. Connect a suitable cable from the Tx1 port on the DS3 ATM interface module to the Rx port on the first interconnect device.
4. Connect a suitable cable from the Rx2 port on the DS3 ATM interface module to the Tx port on the second interconnect device.
5. Connect a suitable cable from the Tx2 port on the DS3 ATM interface module to the Rx port on the second interconnect device.

12.3. Using the Light Emitting Diode (LED) Indicators

The front panel LED indicators report signal and synchronization status. They are directly controlled by the DS3 interface module. The indicators are divided into two groups: one for each receiver (Rx1 and Rx2) as seen on the LED overlay.

The LEDs report status through one of three colors. Green indicates that no signal or synchronization defects are occurring or have occurred since testing began. The orange color represents a history status. It indicates that a defect occurred. Red indicates that such a defect is occurring.

This history data is cleared whenever testing is restarted or network statistics are reset.

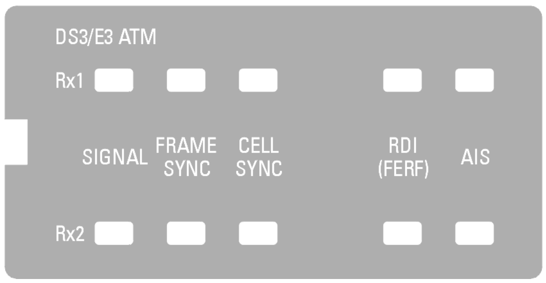


Figure 12-6. LED Overlay

12.3.1. Signal

The Signal LED indicates the status of the signal. There is a loss of signal whenever 175 consecutive zeros are received.

Green	Signal is present.
Red	There is currently no signal present: loss of signal (LOS).
Orange	One or more loss of signal errors have occurred since testing began or since the last time that network statistics were reset.

12.3.2. Frame Sync

The Frame Sync LED indicates whether frame alignment signal framing has been achieved.

Green	DS3 framing has been achieved.
Red	There is currently an out of frame (OOF) condition; three F-bit errors out of eight consecutive F-bits are present.
Orange	One or more frame alignment framing errors have occurred since testing began or since the last time that network statistics were reset.

12.3.3. Cell Sync

The Cell Sync LED indicates cell synchronization or delineation. An error is indicated when six consecutive cells containing HEC errors are encountered.

Green	Delineated (both PLCP and HEC).
Red	Out of cell synchronization. There is currently a loss of cell synchronization condition (PLCP) or a loss of cell synchronization with seven or more consecutive HEC errors (for non-PLCP modes).
Orange	One or more cell sync errors have occurred since testing began or since the last time that network statistics were reset.

12.3.4. RDI (FERF)

The RDI (FERF) LED reports Remote Defect Indicator for Far End Receive Failures. These occur when an M frame with the X1 and X2 bits both set to zero is detected.

Green	No Remote Defect Indicator for Far End Receive Failure errors.
Red	There is currently a Far End Receive Failure indicated by the Remote Defect Indicator.
Orange	One or more Far End Receive Failures indicated by the Remote Defect Indicator have occurred since testing began or since the last time that network statistics were reset.

12.3.5. AIS

The AIS/Alarms LED indicates whether or not an alarm indication signal is detected. The AIS is indicated when less than eight zeros in a frame are detected while in the OOF OOF state.

Off	No alarm signal has been detected since testing began or since the last time that network statistics were reset.
Red	An alarm signal currently exists.
Orange	One or more alarm indication signal errors have occurred since testing began or since the last time that network statistics were reset.

12.4. Specifying the DS3 ATM Interface Module in the Application

To use the module with the ATM Analysis Application, you must specify the physical layer hardware settings for the interface module from within the ATM Analysis Application. The last page of the Analyzer Setup Wizard allows you to:

- Select line build-out.
- Filter out unassigned and idle cells being received on the selected port.
- Select a receiver termination.
- Select the type of cell delineation.
- Select the frame alignment.

To access the Analyzer Setup Wizard:

- Click Setup\Setup Analyzer from the command menu of the application.

More information about the DS3 Settings page of the Analyzer Setup Wizard can be found by clicking Help on that page. Other details related to the DS3 ATM interface module can be accessed in the online Help.

13. The ATM 25 Mbps Interface Module

This chapter provides information regarding the characteristics of the ATM 25 Mbps Interface module, including hardware installation and LED descriptions. This chapter also explains how to specify the ATM 25 Mbps interface module physical layer hardware settings within the ATM Analysis Application.

13.1. Overview of the ATM 25 Mbps interface module

The ATM 25 Mbps interface module and the ATM Analysis Application enable your analyzer to perform network analysis of ATM traffic carried over ATM 25 Mbps (25.6) transmission facilities. The interface makes your analyzer suitable for monitoring, troubleshooting, and simulating ATM networks. You can verify the functionality of any LAN traffic running on an ATM link, such as Ethernet or FDDI, or you can measure the performance of any ATM networking device.

13.1.1. Installation

To perform testing, the ATM 25 Mbps interface module must be paired with a Broadband Analyzer Module (BAM). See Chapter 2 and see the hardware guide that came with your ATM analyzer for further information.

13.1.2. Interface Module Specifications

ATM 25 Mbps interface module	Part Number: 9305/90.64
Requires: 155 Mbps Broadband Analyzer Module	Part Number: 9305/90.69
Interface connectors	RJ-48/C (two) and DB-9 (two)
Cabling Reach Specification	100 m Cat. 5 UTP ATM Forum

13.1.3. Safety Information

The ATM 25 Mbps interface module meets these safety specifications:

- CAN No. C22.2 1010-1
- UL 3111-1
- EN-61010-1
- IEC-1010-1.

Warning: The external terminals of this interface module are not intended for direct connection to outside plant leads and TNV circuits.

13.1.4. Equipment Necessary to Ensure Compliance with EMC Directive

- DominoATM analyzer, BN 9316/02 with a ATM 25 Mbps BN 9305/90.64
- Broadband Analyzer Module 155, C0029, P/N 9305/90.69
- Laptop: IBM Thinkpad, Type 2620-20F with associated power supply P/N 84G2098, S/N 9408103047; FCC ID of ANO2620CS.

The following accessories were used for CE Mark compliance testing.

BN Number	Part Number	Equipment Description
K9139	9314-8537.002	110v power cable for North America
K9140	9314-8538.001	220v power cable for Europe
K9123	9314-8520.006	0.45 m PC-to-Domino cable
K9127	9314-8523.003	Domino-to-Domino cable (now K9194)
K9125	9314-8521.005	1 m Domino-to-printer cable
Black box	1-5580472	1 m UTP patch cable
None	None	Generic loopback box

Note:

The DominoATM analyzer is CE compliant from Series A.

13.1.5. Rear Panel Connectors

The rear panel of the ATM 25 Mbps interface module provides two RJ-48C connections. Use these for connections to the network or device under test:

- Tx1 (Transmitter #1, user port to network)
- Rx1 (Receiver #1, user port to network)
- Tx2 (Transmitter #2, network port, to user)
- Rx2 (Receiver #2, network port, to user).

Card Ejector

The card ejector button is located at the bottom of the rear panel. Use it to remove the interface module. See Chapter 2, “Installing ATM on a PC for Domino” for more information.

13.2. Connecting to the Network

Connectors located on the rear panel of the ATM 25 Mbps interface module allow for connection to the network for ATM monitoring or emulation.

The following sections describe some of the options for how to connect the interface module to the network.

13.2.1. Connecting for Emulation of an ATM End Station

Use the following procedure to emulate an ATM 25 Mbps interconnect device:

1. Connect the user UTP port on the ATM 25 Mbps interface module to the UTP network port of the ATM device under test.
2. Connect the user STP port on the ATM 25 Mbps interface module to the STP network port of the ATM device under test.

Note:

All transmitted data on Tx1 can be internally looped back to Rx2 if the loopback option is selected in the Analyzer Setup Wizard within the application.

13.2.2. Connecting for Emulation of an ATM Network Device

Use the following procedures to emulate a ATM 25 Mbps device if you are using DB-9 connections:

1. Connect the network UTP through an STP cable to the ATM device under test.

   or

2. Connect the Network STP port on the ATM 25 Mbps interface module to the user STP port of the ATM device under test.

Use the following procedure to emulate a ATM 25 Mbps device is you are using RJ-48C connections with UTP cable:

- Connect the Rx2/Tx2 port on the interface module to the receive port of the ATM device under test.

Note:

Transmitted data on Tx2 can be looped back to Rx1 if the loopback option is selected in the Analyzer Setup Wizard within the application.

13.2.3. Connecting for Monitoring

There are two basic monitoring topologies:

- **Monitoring between ATM devices**. This topology allows you to monitor and decode full-duplex data exchanges at the Network Layer (and higher) of the OSI reference model. See Figure 11-3. It is ideal for analyzing both sides of the conversation between two devices.
- **Monitoring across ATM interconnect devices**. This topology allows you to monitor data exchanges going through an interconnect device. It is ideal for analyzing part of the conversation between two ATM devices. See Figure 11-4.

In both topologies, the analyzer can be connected in an in-service or out-of-service mode.

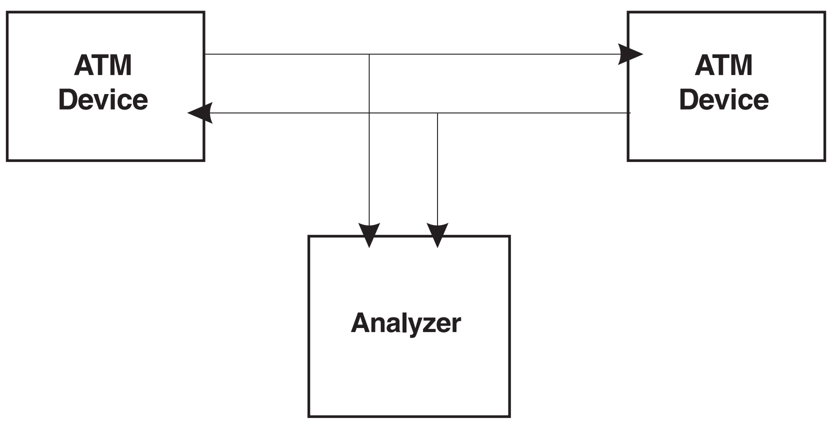


Figure 13-1. Monitoring Between ATM Devices.

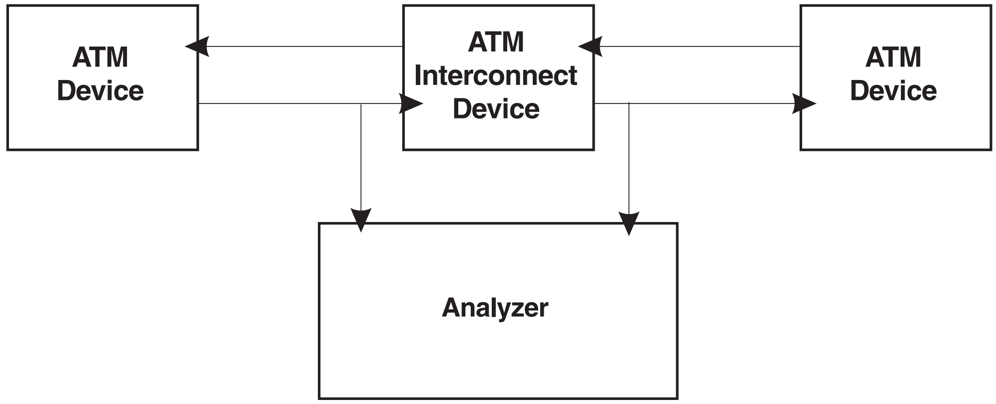


Figure 13-2. Monitoring Across ATM Interconnect Devices.

13.2.3.1.In-Service and Out-of-Service Monitoring

When monitoring, note the distinction between in-service and out-of-service monitoring:

- "In-service" refers to the monitoring of ATM equipment in a live network, where the network is not brought down when making test connections. In such situations, the monitor points and connection method should be carefully planned. These connections are generally made using the monitor jacks provided by most network terminating equipment.
- "Out-of-service" refers to the monitoring of ATM equipment where the connections are broken to insert the analyzer in a through mode. When the ATM 25 Mbps interface module is configured for passive high impedance monitoring, both receivers are enabled and the data from each is internally connected to transmitter connectors through copper paths (Rx1 connected to Tx2; Rx2 connected to Tx1).

13.2.3.2.Connecting for Out-of-service Monitoring Between ATM Devices

The following procedure shows you how to make a basic out-of-service connection for monitoring traffic between two ATM devices.

To monitor between two ATM 25 Mbps interconnect devices (out-of-service):

1. Disconnect both links between the two devices.
2. Connect a suitable cable from the Rx1/TX1 port on the ATM 25 Mbps interface module to the Tx port on the first interconnect device.
3. Connect a suitable cable from the Tx1 port on the ATM 25 Mbps interface module to the Rx port on the first interconnect device.
4. Connect a suitable cable from the Rx2/TX2 port on the ATM 25 Mbps interface module to the Tx port on the second interconnect device.
5. Connect a suitable cable from the Tx2 port on the ATM 25 Mbps interface module to the Rx port on the second interconnect device.

13.2.3.3.Monitoring with RJ-48C Connections

Monitoring a network with RJ-48C connections can be complicated. Study the figures below and on the next page carefully before connecting the analyzer to the network for monitoring with RJ-48C connections.

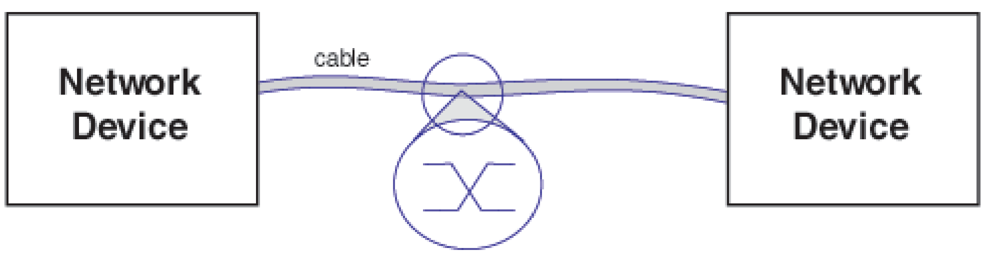


Figure 13-3. Example of a network using a crossover cable (network to network).

If you are using the analyzer to monitor such a network, use one RJ-48C cross-over cable and one RJ-48C straight-through cable.

If you are using the analyzer to monitor such a network, use two RJ-48C straight-through cables.

13.3. Using the Light Emitting Diode (LED) Indicators

The front panel LED indicators report signal and synchronization status. They are directly controlled by the DS1 interface module. The indicators are divided into two groups: one for each receiver (Rx1 and Rx2) as seen on the LED overlay.

The LEDs report status through one of three colors. Green indicates that no signal or synchronization defects are occurring or have occurred since testing began. The orange color represents a history status. It indicates that a defect occurred. Red indicates that such a defect is occurring.

This history data is cleared whenever testing is restarted or network statistics are reset.

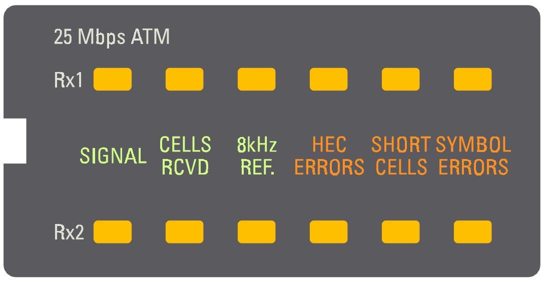


Figure 13-4. LED Overlay

13.3.1. Signal

The Signal LED indicates whether a signal is detected.

Off	No signal has been detected.
Green	The first cell has been detected and 204.8 symbols have been counted.
Red	Errors are currently being received.
Orange	One or more errors have occurred since testing began or since the last time that network statistics were reset.

13.3.2. Cells RCVD

The Cells RCVD LED indicates whether cells or being received.

Off	Cells are not being received.
Green	Cells are being received.

13.3.3. 8kHz REF

The reference clock counts the 8kHz.

Off	The 8kHz reference clock has not counted.
Green	There is a 8kHz reference signal detected.

13.3.4. HEC Errors

There is a loss of cell synchronization from HEC errors.

Off	There are no HEC errors.
Red	One or more HEC errors are being detected.
Orange	One or more HEC errors have occurred since testing began or since the last time that network statistics were reset.

13.3.5. Short Cells

Short cells are cells that are less than 53 bytes in length.

Off	No short cells are being detected.
Red	A short cell is being detected.
Orange	One or more short cells have been detected since testing began or since the last time that network statistics were reset.

13.3.6. Symbol Errors

A symbol error is an unrecognized symbol.

Off	No symbol errors are being detected.
Red	A symbol error is being detected.
Orange	One or more symbol errors has been detected since testing began or since the last time that network statistics were reset.

13.4. Specifying the ATM 25 Mbps Interface Module in the Application

To use the ATM 25 Mbps interface module with the application, you must specify the physical layer hardware settings for the interface module from within the ATM Analysis Application. The last page of the Analyzer Setup Wizard allows you to:

- Set the 8KHz reference.
- Select a receiver termination: terminated or high impedance (depending on other selections).
- Filter out unassigned and idle cells being received on the selected port.

To access the Analyzer Setup Wizard:

- Click Setup\Setup Analyzer from the command menu of the application.

More information about the ATM 25 Mbps Settings page of the Analyzer Setup Wizard can be found by clicking Help on that page. Other details related to the ATM 25 Mbps interface module can be accessed in the online Help.

Glossary

Numerics

16-CAP Carrierless Amplitude/Phase Modulation with 16 constellation points: The modulation technique used in the 51.84 Mb Mid-Range Physical Layer Specification for Category 3 Unshielded Twisted-Pair (UTP-3).

64-CAP Carrierless Amplitude/Phase Modulation with 64 constellation points.

A

AAL ATM Adaptation Layer: The standards layer that allows multiple applications to have data converted to and from the ATM cell. A protocol used that translates higher layer services into the size and format of an ATM cell.

AAL Connection Association established by the AAL between two or more next higher layer entities.

AAL-1 ATM Adaptation Layer Type 1: AAL functions in support of constant bit rate, time-dependent traffic such as voice and video.

AAL-2 ATM Adaptation Layer Type 2: This AAL is still undefined by the International Standards bodies. It is a placeholder for variable bit rate video transmission.

AAL-3/4 ATM Adaptation Layer Type 3/4: AAL functions in support of variable bit rate, delay-tolerant data traffic requiring some sequencing and/or error detection support. Originally two AAL types, i.e. connection-oriented and connectionless, which have been combined.

AAL-5 ATM Adaptation Layer Type 5: AAL functions in support of variable bit rate, delay-tolerant connection-oriented data traffic requiring minimal sequencing or error detection support.

ABR Available Bit Rate: ABR is an ATM layer service category for which the limiting ATM layer transfer characteristics provided by the network may change subsequent to connection establishment. A flow control mechanism is specified which supports several types of feedback to control the source rate in response to changing ATM layer transfer characteristics. It is expected that an end-system that adapts its traffic in accordance with the feedback will experience a low cell loss ratio and obtain a fair share of the available bandwidth according to a network specific allocation policy. Cell delay variation is not controlled in this service, although admitted cells are not delayed unnecessarily.

ACM Address Complete Message: A BISUP call control message from the receiving exchange to sending exchange indicating the completion of address information.

ACR Attenuation to Crosstalk Ratio: One of the factors that limits the distance a signal may be sent through a given media. ACR is the ratio of the power of the received signal, attenuated by the media, over the power of the NEXT crosstalk from the local transmitter, usually expressed in decibels (db). To achieve a desired bit error rate, the received signal power must usually be several times larger than the NEXT power or plus several db. Increasing a marginal ACR may decrease the bit error rate.
ACR Allowed Cell Rate: An ABR service parameter, ACR is the current rate in cells/sec at which a source is allowed to send.

Address Prefix A string of 0 or more bits up to a maximum of 152 bits that is the lead portion of one or more ATM addresses.

Address Resolution Address Resolution is the procedure by which a client associates a LAN destination with the ATM address of another client or the BUS.

Adjacency The relationship between two communicating neighboring peer nodes.

Administrative Domain
A collection of managed entities grouped for administrative reasons.

ADPCM Adaptive Differential Pulse Code Modulation: A reduced bit rate variant of PCM audio encoding (see also PCM). This algorithm encodes the difference between an actual audio sample amplitude and a predicted amplitude and adapts the resolution based on recent differential values.

ADTF ACR Decrease Time Factor: This is the time permitted between sending RM-cells before the rate is decreased to ICR (Initial Cell Rate). The ADTF range is .01 to 10.23 sec. with granularity of 10 ms.

AFI Authority and Format Identifier: This identifier is part of the network level address header.

Aggregation Token A number assigned to an outside link by the border nodes at the ends of the outside link. The same number is associated with all uplinks and induced uplinks associated with the outside link. In the parent and all higher-level peer group, all uplinks with the same aggregation token are aggregated.

AHFG ATM-attached Host Functional Group: The group of functions performed by an ATM-attached host that is participating in the MPOA service.

Ai Signaling ID assigned by Exchange A.

AIM ATM Inverse Multiplexer: A term discontinued because of conflict with an established product. Refer to AIMUX.

AIMUX ATM Inverse Multiplexing: A device that allows multiple T1 or E1 communications facilities to be combined into a single broadband facility for the transmission of ATM cells.

AIR Additive Increase Rate: An ABR service parameter, AIR controls the rate at which the cell transmission rate increases. It is signaled as AIRF, where AIRF = AIR*Nrm/PCR.

AIRF Additive Increase Rate Factor: Refer to AIR.

AIS Alarm Indication Signal: An all ones signal sent down or up stream by a device when it detects an error condition or receives an error condition or receives an error notification from another unit in the transmission path.

Alternate Routing A mechanism that supports the use of a new path after an attempt to set up a connection along a previously selected path fails.

AMI Alternate Mark Inversion: A line coding format used on T1 facilities that transmits ones by alternate positive and negative pulses.

Ancestor Node A logical group node that has a direct parent relationship to a given node (i.e., it is the parent of that node, or the parent's parent, ...).

ANI Automatic Number Identification: A charge number parameter that is normally included in the Initial Address Message to the succeeding carrier for billing purposes.

ANM Answer Message: A BISUP call control message from the receiving exchange to the sending exchange indicating answer and that a through connection should be completed in both directions.

ANSI American National Standards Institute: A U.S. standards body.

API Application Program Interface: API is a programmatic interface used for interprogram communications or for interfacing between protocol layers.

API_connection Native ATM Application Program Interface Connection: API_connection is a relationship between an API_endpoint and other ATM devices that has the following characteristics:

- Data communication may occur between the API_endpoint and the other ATM devices comprising the API_connection
- Each API_connection may occur over a duration of time only once; the same set of communicating ATM devices may form a new connection after a prior connection is released
- The API_connection may be presently active (able to transfer data), or merely anticipated for the future

APPN Advanced Peer to Peer Network: IBM network architecture for building dynamic routing across arbitrary network topologies. Intended as an eventual replacement for SNA, IBM's static routed, hierarchical network architecture.

ARE All Routes Explorer: A specific frame initiated by a source which is sent on all possible routes in Source Route Bridging.

ARP Address Resolution Protocol: The procedures and messages in a communications protocol which determines which physical network address (MAC) corresponds to the IP address in the packet.

ASP Abstract Service Primitive: An implementation-independent description of an interaction between a service-user and a service-provider at a particular service boundary, as defined by Open Systems Interconnection (OSI).

Assigned Cell Cell that provides a service to an upper layer entity or ATM Layer Management entity (ATMM-entity).

Asynchronous Time Division Multiplexing A multiplexing technique in which a transmission capability is organized in a priori unassigned time slots. The time slots are assigned to cells upon request of each application's instantaneous real need.

ATM Asynchronous Transfer Mode: A transfer mode in which the information is organized into cells. It is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic.

ATM Address Defined in the UNI Specification as 3 formats, each having 20 bytes in length including country, area and end-system identifiers.

ATM Layer Link A section of an ATM Layer connection between two adjacent active ATM Layer entities (ATM-entities).

ATM Link A virtual path link (VPL) or a virtual channel link (VCL).

ATM Peer-to-Peer Connection A virtual channel connection (VCC) or a virtual path connection (VPC).

ATM Traffic Descriptor A generic list of traffic parameters that can be used to capture the intrinsic traffic characteristics of a requested ATM connection.

ATM User-User Connection An association established by the ATM Layer to support communication between two or more ATM service users (i.e., between two or more next higher entities or between two or more ATM-entities). The communications over an ATM Layer connection may be either bidirectional or unidirectional. The same Virtual Channel Identifier (VCI) issued for both directions of a connection at an interface.

ATS Abstract Test Suite: A set of abstract test cases for testing a particular protocol. An "executable" test suite may be derived from an abstract test suite.

Attenuation
The process of the reduction of the power of a signal as it passes through most media. Usually proportional to distance, attenuation is sometimes the factor that limits the distance a signal may be transmitted through a media before it can nolonger be received.

B

B-ICI B-ISDN Inter-Carrier Interface: An ATM Forum defined specification for the interface between public ATM networks to support user services across multiple public carriers.

B-ICI SAAL B-ICI Signaling ATM Adaptation Layer: A signaling layer that permits the transfer of connection control signaling and ensures reliable delivery of the protocol message. The SAAL is divided into a Service Specific part and a Common part (AAL5).

B-ISDN Broadband ISDN: A high-speed network standard (above 1.544 Mbps) that evolved Narrowband ISDN with existing and new services with voice, data and video in the same network.

B-LLI Broadband Low Layer Information: This is a Q.2931 information element that identifies a layer 2 and a layer 3 protocol used by the application.

B-TE Broadband Terminal Equipment: An equipment category for B-ISDN which includes terminal adapters and terminals.

BBC Broadband Bearer Capability: A bearer class field that is part of the initial address message.

BCD Binary Coded Decimal: A form of coding of each octet within a cell where each bit has one of two allowable states, 1 or 0.

BCOB Broadband Connection Oriented Bearer: Information in the SETUP message that indicates the type of service requested by the calling user.

BCOB-A Bearer Class A: Indicated by ATM end user in SETUP message for connection-oriented, constant bit rate service. The network may perform internetworking based on AAL information element (IE).

BCOB-C Bearer Class C: Indicated by ATM end user in SETUP message for connection-oriented, variable bit rate service. The network may perform internetworking based on AAL information element (IE).

BCOB-X Bearer Class X: Indicated by ATM end user in SETUP message for ATM transport service where AAL, traffic type and timing requirements are transparent to the network.

BECN Backward Explicit Congestion Notification: A Resource Management (RM) cell type generated by the network or the destination, indicating congestion or approaching congestion for traffic flowing in the direction opposite that of the BECN cell.

BER Bit Error Rate: A measure of transmission quality. It is generally shown as a negative exponent, (e.g., 10-7 which means 1 out of 107 bits are in error or 1 out of 10,000,000 bits are in error).

BHLI Broadband High Layer Information: This is a Q.2931 information element that identifies an application (or session layer protocol of an application).

Bi Signaling ID assigned by Exchange B.

BIP Bit Interleaved Parity: A method used at the PHY layer to monitor the error performance of the link. A check bit or word is sent in the link overhead covering the previous block or frame. Bit errors in the payload will be detected and may be reported as maintenance information.

BIS Border Intermediate System.

BISUP Broadband ISDN User's Part: A SS7 protocol which defines the signaling messages to control connections and services.

BN Bridge Number: A locally administered bridge ID used in Source Route Bridging to uniquely identify a route between two LANs.

BN
BECN Cell: A Resource Management (RM) cell type indicator. A Backwards Explicit Congestion Notification (BECN) RM-cell may be generated by the network or the destination. To do so, BN=1 is set, to indicate the cell is not source-generated, and DIR=1 to indicate the backward flow. Source generated RM-cells are initialized with BN=0.

BOM Beginning of Message: An indicator contained in the first cell of an ATM segmented packet.

Border Node A logical node that is in a specified peer group, and has at least one link that crosses the peer group boundary.

BPDU Bridge Protocol Data Unit: A message type used by bridges to exchange management and control information.

BPP Bridge Port Pair (Source Routing Descriptor): Frame header information identifying a bridge/LAN pair of a Source route segment.

Broadband A service or system requiring transmission channels capable of supporting rates greater than the Integrated Services Digital Network (ISDN) primary rate.

Broadband Access An ISDN access capable of supporting one or more broadband services.

Broadcast Data transmission to all addresses or functions.

BT Burst Tolerance: BT applies to ATM connections supporting VBR services and is the limit parameter of the GCRA.

Btag Beginning Tag: A one octet field of the CPCS_PDU used in conjunction with the Etag octet to form an association between the beginning of message and end of message.

BUS Broadcast and Unknown Server: This server handles data sent by an LE Client to the broadcast MAC address ('FFFFFFFFFFFF'), all multicast traffic, and initial unicast frames which are sent by a LAN Emulation Client.

BW Bandwidth: A numerical measurement of throughput of a system or network.

C

CAC Connection Admission Control: Connection Admission Control is defined as the set of actions taken by the network during the call set- up phase (or during call re-negotiation phase) in order to determine whether a connection request can be accepted or should be rejected (or whether a request for re-allocation can be accommodated).

Call A call is an association between two or more users or between a user and a network entity that is established by the use of network capabilities. This association may have zero or more connections.

CAS Channel Associated Signaling: A form of circuit state signaling in which the circuit state is indicated by one or more bits of signaling status sent repetitively and associated with that specific circuit.

CBDS Connectionless Broadband Data Service: A connectionless service similar to Bellcore's SMDS defined by European Telecommunications Standards Institute (ETSI).

CBR Constant Bit Rate: An ATM service category which supports a constant or guaranteed rate to transport services such as video or voice as well as circuit emulation which requires rigorous timing control and performance parameters.

CCR Current Cell Rate: The Current Cell Rate is an RM-cell field set by the source to its current ACR when it generates a forward RM-cell. This field may be used to facilitate the calculation of ER, and may not be changed by network elements. CCR is formatted as a rate.

CCS Common Channel Signaling: A form signaling in which a group of circuits share a signaling channel. Refer to SS7.

CD-ROM Compact Disk-Read Only Memory: Used by a computer to store large amounts of data. Commonly used for interactive video games.

CDF Cutoff Decrease Factor: CDF controls the decrease in ACR (Allowed Cell Rate) associated with CRM.

CDV Cell Delay Variation: CDV is a component of cell transfer delay, induced by buffering and cell scheduling. Peak-to-peak CDV is a QoS delay parameter associated with CBR and VBR services. The peak-to- peak CDV is the ((1-a) quantile of the CTD) minus the fixed CTD that could be experienced by any delivered cell on a connection during the entire connection holding time. The parameter "a" is the probability of a cell arriving late. See CDVT.

CDVT Cell Delay Variation Tolerance-ATM layer functions may alter the traffic characteristics of ATM connections by introducing Cell Delay Variation. When cells from two or more ATM connections are multiplexed, cells of a given ATM connection may be delayed while cells of another ATM connection are being inserted at the output of the multiplexer. Similarly, some cells may be delayed while physical layer overhead or OAM cells are inserted. Consequently, some ran domness may affect the inter-arrival time between consecutive cells of a connection as monitored at the UNI. The upper bound on the "clumping" measure is the CDVT.

CE Connection Endpoint: A terminator at one end of a layer connection within a SAP.

CEI Connection Endpoint Identifier: Identifier of a CE that can be used to identify the connection at a SAP.

Cell A unit of transmission in ATM. A fixed-size frame consisting of a 5-octet header and a 48-octet payload.

Cell Header ATM Layer protocol control information.

Cells in Frames Cells In Frames is a protocol established by the CIF Alliance which specifies how to transport ATM protocol over Ethernet, Token Ring and other frame protocols. CIF uses software at the workstation instead of a new hardware Network Interface Card to do QOS scheduling and ABR flow control.

CER Cell Error Ratio: The ratio of errored cells in a transmission in relation to the total cells sent in a transmission. The measurement is taken over a time interval and is desirable to be measured on an in-service circuit.

CES Circuit Emulation Service: The ATM Forum circuit emulation service interoperability specification specifies interoperability agreements for supporting Constant Bit Rate (CBR) traffic over ATM networks that comply with the other ATM Forum interoperability agreements. Specifically, this specification supports emulation of existing TDM circuits over ATM networks.

Child Node A node at the next lower level of the hierarchy which is contained in the peer group represented by the logical group node currently referenced. This could be a logical group node, or a physical node.

Child Peer Group A child peer group of a peer group is any one containing a child node of a logical group node in that peer group. A child peer group of a logical group node is the one containing the child node of that logical group node.

CI Congestion Indicator: This is a field in a RM-cell, and is used to cause the source to decrease its ACR. The source sets CI=0 when it sends an RM-cell. Setting CI=1 is typically how destinations indicate that EFCI has been received on a previous data cell.

CIP Carrier Identification Parameter: A 3 or 4 digit code in the initial address message identifying the carrier to be used for the connection.

CIR Committed Information Rate: CIR is the information transfer rate which a network offering Frame Relay Services (FRS) is committed to transfer under normal conditions. The rate is averaged over a minimum increment of time.

CL Connectionless Service: A service which allows the transfer of information among service subscribers without the need for end-to- end establishment procedures.

CLP Cell Loss Priority: This bit in the ATM cell header indicates two levels of priority for ATM cells. CLP=0 cells are higher priority than CLP=1 cells. CLP=1 cells may be discarded during periods of congestion to preserve the CLR of CLP=0 cells.

CLR Cell Loss Ratio: CLR is a negotiated QoS parameter and acceptable values are network specific. The objective is to minimize CLR provided the end-system adapts the traffic to the changing ATM layer transfer characteristics. The Cell Loss Ratio is defined for a connection as: Lost Cells/Total Transmitted Cells. The CLR parameter is the value of CLR that the network agrees to offer as an objective over the lifetime of the connection. It is expressed as an order of magnitude, having a range of 10-1 to 10-15 and unspecified.

CMIP Common Management Interface Protocol: An ITU-TSS standard for the message formats and procedures used to exchange management information in order to operate, administer maintain and provision a network.

CMR Cell Misinsertion Rate: The ratio of cells received at an endpoint that were not originally transmitted by the source end in relation to the total number of cells properly transmitted.

CNR Complex Node Representation: A collection of nodal state parameters that provide detailed state information associated with a logical node.

COD Connection Oriented Data: Data requiring sequential delivery of its component PDUs to assure correct functioning of its supported application, (e.g., voice or video).

COM Continuation of Message: An indicator used by the ATM Adaptation Layer to indicate that a particular ATM cell is a continuation of a higher layer information packet which has been segmented.

Common Peer Group The lowest level peer group in which a set of nodes is represented. A node is represented in a peer group either directly or through one of its ancestors.

Communication endpoint An object associated with a set of attributes which are specified at the communication creation time.

Configuration The phase in which the LE Client discovers the LE Service.

Connection An ATM connection consists of concatenation of ATM Layer links in order to provide an end-to-end information transfer capability to access points.

Connection In switched virtual connection (SVC) environments the LAN Emulation Management entities set up connections between each other using UNI signaling.

Connectionless Refers to ability of existing LANs to send data without previously establishing connections.

Control Connections A Control VCC links the LEC to the LECS. Control VCCs also link the LEC to the LES and carry LE_ARP traffic and control frames. The control VCCs never carry data frames.

Corresponding Entities Peer entities with a lower layer connection among them.

CPCS Common Part Convergence Sublayer: The portion of the convergence sublayer of an AAL that remains the same regardless of the traffic type.

CPCS-SDU Common Part Convergence Sublayer-Service Data Unit: Protocol data unit to be delivered to the receiving AAL layer by the destination CP convergence sublayer.

CPE Customer Premises Equipment: End user equipment that resides on the customer's premise which may not be owned by the local exchange carrier.

CPN Calling Party Number: A parameter of the initial address message that identifies the calling number and is sent to the destination carrier.

Crankback
A mechanism for partially releasing a connection setup in progress which has encountered a failure. This mechanism allows PNNI to perform alternate routing.

CRC Cyclic Redundancy Check: A mathematical algorithm that computes a numerical value based on the bits in a block of data. This number is transmitted with the data and the receiver uses this information and the same algorithm to insure the accurate delivery of data by comparing the results of algorithm and the number received. If a mismatch occurs, an error in transmission is presumed.

CRF Cell Relay Function: This is the basic function that an ATM network performs in order to provide a cell relay service to ATM end-stations.

CRF Connection Related Function: A term used by Traffic Management to reference a point in a network or a network element where per connection functions are occurring. This is the point where policing at the VCC or VPC level may occur.

CRM Missing RM-Cell Count: CRM limits the number of forward RM-cells which may be sent in the absence of received backward RM-cells.

CRM Cell Rate Margin: This is a measure of the difference between the effective bandwidth allocation and the allocation for sustainable rate in cells per second.

CRS Cell Relay Service: A carrier service which supports the receipt and transmission of ATM cells between end users in compliance with ATM standards and implementation specifications.

CS Convergence Sublayer; The general procedures and functions that convert between ATM and non-ATM formats. This describes the functions of the upper half of the AAL layer. This is also used to describe the conversion functions between non-ATM protocols such as frame relay or SMDS and ATM protocols above the AAL layer.

CSU Channel Service Unit: An interface for digital leased lines which performs loopback testing and line conditioning.

CT Conformance Test: Testing to determine whether an implementation complies with the specifications of a standard and exhibits the behaviors mandated by that standard.

CTD Cell Transfer Delay: This is defined as the elapsed time between a cell exit event at the measurement point 1 (e.g., at the source UNI) and the corresponding cell entry event at measurement point 2 (e.g., the destination UNI) for a particular connection. The cell transfer delay between two measurement points is the sum of the total inter-ATM node transmission delay and the total ATM node processing delay.

D

DA Destination Address: Information sent in the forward direction indicating the address of the called station or customer.

DA Destination MAC Address: A six octet value uniquely identifying an endpoint and which is sent in IEEE LAN frame headers to indicate frame destination.

Data Connections Data VCCs connect the LECs to each other and to the Broadcast and Unknown Server. These carry Ethernet/IEEE 802.3 or IEEE 802.5 data frames as well as flush messages.

DCC Data Country Code: This specifies the country in which an address is registered. The codes are given in ISO 3166. The length of this field is two octets. The digits of the data country code are encoded in Binary Coded Decimal (BCD) syntax. The codes will be left justified and padded on the right with the hexadecimal value "F" to fill the two octets.

DCE Data Communication Equipment: A generic definition of computing equipment that attaches to a network via a DTE.

Default Node Representation A single value for each nodal state parameter giving the presumed value between any entry or exit to the logical node and the nucleus.

Demultiplexing A function performed by a layer entity that identifies and separates SDUs from a single connection to more than one connection.

DES Destination End Station: An ATM termination point which is the destination for ATM messages of a connection and is used as a reference point for ABR services. See SES.

Dijkstra's Algorithm An algorithm that is sometimes used to calculate routes given a link and nodal state topology database.

DIR This is a field in an RM-cell which indicates the direction of the RM- cell with respect to the data flow with which it is associated. The source sets DIR=0 and the destination sets DIR=1.

Direct Set A set of host interfaces which can establish direct layer two communications for unicast (not needed in MPOA).

DLPI UNIX International, Data Link Provider Interface (DLPI) Specification: Revision 2.0.0, OSI Work Group, August 1991.

Domain Refer to Administrative Domain.

DS Distributed Single Layer Test Method: An abstract test method in which the upper tester is located within the system under test and the point of control and observation (PCO) is located at the upper service boundary of the Implementation Under Test (IUT) - for testing one protocol layer. Test events are specified in terms of the abstract service primitives (ASP) at the upper tester above the IUT and ASPs and/or protocol data units (PDU) at the lower tester PCO.

DS-0 Digital Signal, Level 0: The 64 kbps rate that is the basic building block for both the North American and European digital hierarchies.

DS-1 Digital Signal, Level 1: The North American Digital Hierarchy signaling standard for transmission at 1.544 Mbps. This standard supports 24 simultaneous DS-0 signals. The term is often used interchangeably with T1 carrier although DS-1 signals may be exchanged over other transmission systems.

DS-2 Digital Signal, Level 2: The North American Digital Hierarchy signaling standard for transmission of 6.312 Mbps that is used by T2 carrier which supports 96 calls.

DS-3 Digital Signal, Level 3: The North American Digital Hierarchy signaling standard for transmission at 44.736 Mbps that is used by T3 carrier. DS-3 supports 28 DS-1s plus overhead.

DS3 PLCP Physical Layer Convergence Protocol: An alternate method used by older T carrier equipment to locate ATM cell boundaries. This method has recently been moved to an informative appendix of the ATM DS3 specification and has been replaced by the HEC method.

DSE Distributed Single-Layer Embedded (Test Method): An abstract test method in which the upper tester is located within the system under test and there is a point of control and observation at the upper service boundary of the Implementation Under Test (IUT) for testing a protocol layer, or sublayer, which is part of a multi-protocol IUT.

DSS1 Digital Subscriber Signalling System #1: N-ISDN UNI Signalling

DSS2 Setup DSS2 Digital Subscriber Signalling System #2: B-ISDN UNI Signalling

DSU Data Service Unit: Equipment used to attach users' computing equipment to a public network.

DTE Data Terminal Equipment: A generic definition of external networking interface equipment such as a modem.

DTL Designated Transit List: A list of nodes and optional link IDs that completely specify a path across a single PNNI peer group.

DTL Originator The first switching system within the entire PNNI routing domain to build the initial DTL stack for a given connection.

DTL Terminator The last switching system within the entire PNNI routing domain to process the connection and thus the connection's DTL.

DXI Data Exchange Interface: A variable length frame-based ATM interface between a DTE and a special ATM CSU/DSU. The ATM CSU/DSU converts between the variable-length DXI frames and the fixed-length ATM cells.

E

E.164 A public network addressing standard utilizing up to a maximum of 15 digits. ATM uses E.164 addressing for public network addressing.

E1 Also known as CEPT1, the 2.048 Mbps rate used by European CEPT carrier to transmit 30 64 kbps digital channels for voice or data calls, plus a 64 kbps signaling channel and a 64 kbps channel for framing and maintenance.

E3 Also known as CEPT3, the 34.368 Mbps rate used by European CEPT carrier to transmit 16 CEPT1s plus overhead.

Edge Device A physical device which is capable of forwarding packets between legacy interworking interfaces (e.g., Ethernet, Token Ring, etc.) and ATM interfaces based on data-link and network layer information but which does not participate in the running of any network layer routing protocol. An Edge Device obtains forwarding descriptions using the route distribution protocol.

EFCI Explicit Forward Congestion Indication: EFCI is an indication in the ATM cell header. A network element in an impending-congested state or a congested state may set EFCI so that this indication may be examined by the destination end-system. For example, the end- system may use this indication to implement a protocol that adaptively lowers the cell rate of the connection during congestion or impending congestion. A network element that is not in a congestion state or an impending congestion state will not modify the value of this indication. Impending congestion is the state when a network equipment is operating around its engineered capacity level.

EFS Error Free Seconds: A unit used to specify the error performance of T carrier systems, usually expressed as EFS per hour, day, or week. This method gives a better indication of the distribution of bit errors than a simple bit error rate (BER). Also refer to SES.

ELAN Emulated Local Area Network: A logical network initiated by using the mechanisms defined by LAN Emulation. This could include ATM and legacy attached end stations.

EMI Electromagnetic Interference: Equipment used in high speed data systems, including ATM, that generate and transmit many signals in the radio frequency portion of the electromagnetic spectrum. Interference to other equipment or radio services may result if sufficient power from these signals escape the equipment enclosures or transmission media. National and international regulatory agencies (FCC, CISPR, etc.) set limits for these emissions. Class A is for industrial use and Class B is for residential use.

EML Element Management Layer: An abstraction of the functions provided by systems that manage each network element on an individual basis.

EMS Element Management System: A management system that provides functions at the element Management Layer.

End Station These devices (e.g., hosts or PCs) enable the communication between ATM end stations and end stations on "legacy" LAN or among ATM end stations.

Entry Border Node The node which receives a call over an outside link. This is the first node within a peer group to see this call.

EOM End of Message: An indicator used in the AAL that identifies the last ATM cell containing information from a data packet that has been segmented.

ER Explicit Rate: The Explicit Rate is an RM-cell field used to limit the source ACR to a specific value. It is initially set by the source to a requested rate (such as PCR). It may be subsequently reduced by any network element in the path to a value that the element can sustain. ER is formatted as a rate.

ES End System: A system where an ATM connection is terminated or initiated. An originating end system initiates the ATM connection, and terminating end system terminates the ATM connection. OAM cells may be generated and received.

ESF Extended Superframe: A DS1 framing format in which 24 DS0 times lots plus a coded framing bit are organized into a frame which is repeated 24 times to form a superframe.

ESI End System Identifier: This identifier distinguishes multiple nodes at the same level in case the lower level peer group is partitioned.

ETSI European Telecommunications Standards Institute: The primary telecommunications standards organization.

Exception A connectivity advertisement in a PNNI complex node representation that represents something other than the default node representation.

Exit Border Node The node that will progress a call over an outside link. This is the last node within a peer group to see this call.

Exterior Denotes that an item (e.g., link, node, or reachable address) is outside of a PNNI routing domain.

Exterior Link A link which crosses the boundary of the PNNI routing domain. The PNNI protocol does not run over an exterior link.

Exterior Reachable Address An address that can be reached through a PNNI routing domain, but which is not located in that PNNI routing domain.

Exterior Route A route which traverses an exterior link.

F

Fairness As related to Generic Flow Control (GFC), fairness is defined as meeting all the agreed quality of service (QOS) requirements, by controlling the order of service for all active connections.

FC Feedback Control: Feedback controls are defined as the set of actions taken by the network and by the end-systems to regulate the traffic submitted on ATM connections according to the state of network elements.

FCS Frame Check Sequence: Any mathematical formula which derives a numeric value based on the bit pattern of a transmitted block of information and uses that value at the receiving end to determine the existence of any transmission errors.

FDDI Fiber Distributed Data Interface: A 100 Mbps Local Area Network standard that was developed by ANSI that is designed to work on fiber-optic cables, using techniques similar to token-ring.

FEBE Far End Block Error: A maintenance signal transmitted in the PHY overhead that a bit error(s) has been detected at the PHY layer at the far end of the link. This is used to monitor bit error performance of the link.

FEC Forward Error Correction: A technique for detection and correction of errors in a digital data stream.

FG Functional Group: A collection of functions related in such a way that they will be provided by a single logical component. Examples include the Route Server Functional Group (RSFG), the IASG (Internetwork Address Sub-Group), Coordination Functional Group (ICFG), the Edge Device Functional Group (EDFG) and the ATM attached host Behavior Functional Group (AHFG).

Flush Protocol The flush protocol is provided to ensure the correct order of delivery of unicast data frames.

Foreign Address An address that does not match any of a given node's summary addresses.

Forwarding Description The resolved mapping of an MPOA Target to a set of parameters used to set up an ATM connection on which to forward packets.

FRS Frame-Relay Service: A connection oriented service that is capable of carrying up to 4096 bytes per frame.

FRTT Fixed Round-Trip Time: This is the sum of the fixed and propagation delays from the source to the furthest destination and back.

G

G.703 ITU-T Recommendation G.703, "Physical/Electrical Characteristics of Hierarchical Digital Interfaces".

G.704 ITU-T Recommendation G.704, "Synchronous Frame Structures Used at Primary and Secondary Hierarchy Levels".

G.804 ITU-T Recommendation G.804, "ATM Cell Mapping into Plesiochronous Digital Hierarchy (PDH)".

GCAC Generic Connection Admission Control: This is a process to determine if a link has potentially enough resources to support a connection.

GCRA Generic Cell Rate Algorithm: The GCRA is used to define conformance with respect to the traffic contract of the connection. For each cell arrival the GCRA determines whether the cell conforms to the traffic contract. The UPC function may implement the GCRA, or one or more equivalent algorithms to enforce conformance. The GCRA is defined with two parameters: the Increment (I) and the Limit (L).

GFC Generic Flow Control: GFC is a field in the ATM header which can be used to provide local functions (e.g., flow control). It has local significance only and the value encoded in the field is not carried end-to-end.

H

H-Channel H-Channels are ISDN bearer services that have pre-defined speeds, starting and stopping locations on a PRI and are contiguously transported from one PRI site through networks to another PRI site.

H0 Channel A 384 kbps channel that consists of six contiguous DS0s (64 kbps) of a T1 line.

H10 Channel The North American 1472 kbps channel from a T1 or primary rate carrier. This is equivalent to twenty-three (23) 64 kbps channels.

H11 Channel The North American primary rate used as a single 1536 kbps channel. This channel uses 24 contiguous DS0s or the entire T1 line except for the 8 kbps framing pattern.

H12 The European primary rate used as a single 1920 kbps channel (30 64 kbps channels or the entire E1 line except for the 64 kbps framing and maintenance channel.

HBFG Host Behavior Functional Group: The group of functions performed by an ATM-attached host that is participating in the MPOA service.

HDLC High Level Data Link Control: An ITU-TSS link layer protocol standard for point-to-point and multi-point
communications.

Header Protocol control information located at the beginning of a protocol data unit.

HEC Header Error Control: Using the fifth octet in the ATM cell header, ATM equipment may check for an error and corrects the contents of the header. The check character is calculated using a CRC algorithm allowing a single bit error in the header to be corrected or multiple errors to be detected.

Hello Packet A type of PNNI Routing packet that is exchanged between neighboring logical nodes.

Hierarchically Complete Source Route A stack of DTLs representing a route across a PNNI routing domain such that a DTL is included for each hierarchical level between and including the current level and the lowest visible level in which the source and destination are reachable.

Hop-by-Hop Route A route that is created by having each switch along the path use its own routing knowledge to determine the next hop of the route, with the expectation that all switches will choose consistent hops such that the call will reach the desired destination. PNNI does not use hop-by-hop routing.

Horizontal Link A link between two logical nodes that belong to the same peer group.

Host Apparent Address A set of internetwork layer addresses which a host will directly resolve to lower layer addresses.

I

I.356 ITU-T Specifications for Traffic Measurement.

I.361 B-ISDN ATM Layer Specification.

I.362 B-ISDN ATM Layer (AAL) Functional Description.

I.363 B-ISDN ATM Layer (AAL) Specification.

I.432 ITU-T Recommendation for B-ISDN User-network Interface.

IASG Internetwork Address Sub-Group: A range of internetwork layer addresses summarized in an internetwork layer routing protocol.

ICD International Code Designator: This identifies an international organization. The registration authority for the International Code Designator is maintained by the British Standards Institute. The length of this field is two octets.
ICR Initial Cell Rate: An ABR service parameter, in cells/sec, that is the rate at which a source should send initially and after an idle period.

IDU Interface Data Unit: The unit of information transferred to/from the upper layer in a single interaction across the SAP. Each IDU contains interface control information and may also contain the whole or part of the SDU.

IEC Inter-exchange Carrier: A long distance telephone company.

IEEE Institute of Electrical and Electronics Engineers: A worldwide engineering publishing and standards-making body for the electronics industry.

IEEE 802.3 A Local Area Network protocol suite commonly known as Ethernet. Ethernet has either a 10 Mbps or 100 Mbps throughput and uses Carrier Sense Multiple Access bus with Collision Detection CSMA/CD. This method allows users to share the network cable. However, only one station can use the cable at a time. A variety of physical medium dependent protocols are supported.

IEEE 802.5 A Local Area Network protocol suite commonly known as Token Ring. A standard originated by IBM for a token passing ring network that can be configured in a star topology. Versions supported are 4 Mbps and 16 Mbps.

IETF Internet Engineering Task Force: The organization that provides the coordination of standards and specification development for TCP/IP networking.

ILMI Integrated Local Managment Interface: An ATM Forum defined interim specification for network management function between an end user and a public or private network and between a public network and a private network. This is based on a limited subset of SNMP capabilities.

Induced Uplink An uplink "A" that is created due to the existence of an uplink "B" in the child peer group represented by the node that created uplink "A". Both "A" and "B" share the same upnode, which is higher in the PNNI hierarchy than the peer group in which uplink "A" is seen.

Inside Link Synonymous with horizontal link.

Instance ID A subset of an object's attributes which serve to uniquely identify a MIB instance.

Interior Denotes that an item (e.g., link, node, or reachable address) is inside of a PNNI routing domain.

Internal Reachable Address An address of a destination that is directly attached to the logical node advertising the address.

IOP Interoperability: The ability of equipment from different manufacturers (or different implementations) to operate together.

IP Internet Protocol: Originally developed by the Department of Defense to support interworking of dissimilar computers across a network. This protocol works in conjunction with TCP and is usually identified as TCP/IP. A connectionless protocol that operates at the network layer (layer 3) of the OSI model.

IPX Novell Internetwork Packet Exchange: A built-in networking protocol for Novell Netware. It was derived from the Xerox Network System protocol and operates at the network layer of the OSI protocol model.

IS Intermediate System: A system that provides forwarding functions or relaying functions or both for a specific ATM connection. OAM cells may be generated and received.

ISO International Organization for Standardization: An international organization for standardization, based in Geneva, Switzerland, that establishes voluntary standards and promotes global trade of 90 member countries.

ITU-T International Telecommunications Union Telecommunications: ITU-T is an international body of member countries whose task is to define recommendations and standards relating to the international telecommunications industry. The fundamental standards for ATM have been defined and published by the ITU-T (Previously CCITT).

ITU H.222 An ITU-T Study Group 15 standard that addresses the multiplexing of multimedia data on an ATM network.

ITU Q.2100 B-ISDN Signaling ATM Adapation Layer Overview.

ITU Q.2110 B-ISDN Adapation Layer -- Service Specific Connection Oriented Protocol.

ITU Q.2130 B-ISDN Adapation Layer -- Service Specific Connection Oriented Function for Support of Signaling at the UNI.

ITU Q.2931 The signaling standard for ATM to support Switched Virtual Connections. This is based on the signaling standard for ISDN.

ITU Q.931 The signaling standard for ISDN to support SVCs. The basis for the signaling standard developed for Frame Relay and ATM.

ITU Q.933 The signaling standard for Frame Relay to support SVCs. This is based on the signaling standard for ISDN.

IUT Implementation Under Test: The particular portion of equipment which is to be studied for testing. The implementation may include one or more protocols.

IWF Interworking Function

J

Joining The phase in which the LE Client establishes its control connections to the LE Server.

JPEG Joint Photographic Experts Group: An ISO Standards group that defines how to compress still pictures.

L

LAN Local Area Network: A network designed to move data between stations within a campus.

LANE LAN Emulation: The set of services, functional groups and protocols which provide for the emulation of LANS utilizing ATM as a backbone to allow connectivity among LAN and ATM attached end stations.

LAPD Link Access Procedure D: A layer 2 protocol defined by CCITT (original name of ITU-T). This protocol reliably transfers blocks of information across a single Layer 1 link and supports multiplexing of different connections at Layer 2.

Layer Entity An active element within a layer.

Layer Function A part of the activity of the layer entities.

Layer Service A capability of a layer and the layers beneath it that is provided to the upper layer entities at the boundary between that layer and the next higher layer.

Layer User Data Data transferred between corresponding entities on behalf of the upper layer or layer management entities for which they are providing services.

LB Leaky Bucket: Leaky Bucket is the term used as an analogous description of the algorithm used for conformance checking of cell flows from a user or network. See GCRA, UPC and NPC. The "leaking hole in the bucket" applies to the sustained rate at which cells can be accommodated, while the "bucket depth" applies to the tolerance to cell bursting over a given time period.

LE LAN Emulation. Refer to LANE.

LE_ARP LAN Emulation Address Resolution Protocol: A message issued by a LE client to solicit the ATM address of another function.

Leadership Priority The priority with which a logical node wishes to be elected peer group leader of its peer group. Generally, of all nodes in a peer group, the one with the highest leadership priority will be elected as peer group leader.

Leaky Bucket An informal term for the Generic Cell Rate Algorithm.

LEC Local Exchange Carrier: A telephone company affiliate of a Regional Bell Operating Company or an Independent Telephone Company.

LEC LAN Emulation Client: The entity in end systems which performs data forwarding, address resolution, and other control functions.

LECID LAN Emulation Client Identifier: This identifier, contained in the LAN Emulation header, indicates the ID of the ATM host or ATM-LAN bridge. It is unique for every ATM Client.

LECS LAN Emulation Configuration Server: This implements the policy controlled assignment of individual LE clients to different emulated LANs by providing the LES ATM addresses.

LES LAN Emulation Server: This implements the control coordination function for the Emulated LAN, examples are enabling a LEC to join an ELAN, resolving MAC to ATM addresses.

LGN Logical Group Node: LGN is a single node that represents the lowest level peer groups in the respective higher level peer group.

LIJP Leaf Initiated Joint Parameter: Root screening options and Information Element (IE) instructions carried in SETUP message.

Link An entity that defines a topological relationship (including available transport capacity) between two nodes in different subnetworks. Multiple links may exist between a pair of subnetworks. Synonymous with logical link.

Link Aggregation Token Refer to Aggregation Token.

Link Attribute A link state parameter that is considered individually to determine whether a given link is acceptable and/or desirable for carrying a given connection.

Link Connection A link connection (e.g., at the VP-level) is a connection capable of transferring information transparently across a link without adding any overhead, such as cells for purposes for monitoring. It is delineated by connection points at the boundary of the subnetwork.

Link Constraint A restriction on the use of links for path selection for a specific connection.

Link Metric A link parameter that requires the values of the parameter for all links along a given path to be combined to determine whether the path is acceptable and/or desirable for carrying a given connection.

Link State Parameter Information that captures an aspect or property of a link.

LNNI LANE NNI: The standardized interface between two LAN servers (LES-LES, BUS-BUS, LECS-LECS and
LECS-LES).

LOC Loss of Cell Delineation: A condition at the receiver or a maintenance signal transmitted in the PHY overhead indicating hat the receiving equipment has lost cell delineation. Used to monitor the performance of the PHY layer.

LOF Loss of Frame: A condition at the receiver or a maintenance signal transmitted in the PHY overhead indicating that the receiving equipment has lost frame delineation. This is used to monitor the performance of the PHY layer.

Logical Group Node A logical node that represents a lower level peer group as a single point for purposes of operating at one level of the PNNI routing hierarchy.

Logical Link An abstract representation of the connectivity between two logical nodes. This includes individual physical links, individual virtual path connections, and parallel physical links and/or virtual path connections.

Logical Node An abstract representation of a peer group or a switching system as a single point.

Logical Node ID A string of bits that unambiguously identifies a logical node within a routing domain.

LOP Loss of Pointer: A condition at the receiver or a maintenance signal transmitted in the PHY overhead indicating that the receiving equipment has lost the pointer to the start of cell in the payload. This is used to monitor the performance of the PHY layer.

LOS Loss of Signal: A condition at the receiver or a maintenance signal transmitted in the PHY overhead indicating that the receiving equipment has lost the received signal. This is used to monitor the performance of the PHY layer.

LPF Low Pass Filter: In an MPEG-2 clock recovery circuit, it is a technique for smoothing or averaging changes to the system clock.

LSAP Link Service Access Point: Logical address of boundary between layer 3 and LLC sublayer 2.

LSB Least Significant Bit: The lowest order bit in the binary representation of a numerical value.

LSR Leaf Setup Request: A setup message type used when a leaf node requests connection to existing point-to-multipoint connection or requests creation of a new multipoint connection.

LT Lower Tester: The representation in ISO/IEC 9646 of the means of providing, during test execution, indirect control and observation of the lower service boundary of the IUT using the underlying service provider.

LTE SONET Lite Terminating Equipment: ATM equipment terminating a communications facility using a SONET Lite Transmission Convergence (TC) layer. This is usually reserved for end user or LAN equipment. The SONET Lite TC does not implement some of the maintenance functions used in long haul networks such as termination of path, line and section overhead.

LUNI LANE UNI: The standardized interface between a LE client and a LE Server (LES,LECS and BUS).

M

M1 Management Interface 1: The management of ATM end devices.

M2 Management Interface 2: The management of Private ATM networks or switches.

M3 Management Interface 3: The management of links between public and private networks.

M4 Management Interface 4: The management of public ATM networks.

M5 Management Interface 5: The management of links between two public networks.

MAC Media Access Control: IEEE specifications for the lower half of the data link layer (layer 2) that defines topology dependent access control protocols for IEEE LAN specifications.

MAN Metropolitan Area Network: A network designed to carry data over an area larger than a campus such as an entire city and its outlying area.

Managed System An entity that is managed by one or more management systems, which can be either Element Management Systems, Subnetwork or Network Management Systems, or any other management systems.

Management Domain An entity used here to define the scope of naming.

Management System An entity that manages a set of managed systems, which can be either NEs, subnetworks or other management systems.

MaxCR Maximum Cell Rate: This is the maximum capacity usable by connections belonging to the specified service category.

MBS Maximum Burst Size: In the signaling message, the Burst Tolerance (BT) is conveyed through the MBS which is coded as a number of cells. The BT together with the SCR and the GCRA determine the MBS that may be transmitted at the peak rate and still be in conformance with the GCRA.

MCDV Maximum Cell Delay Variance: This is the maximum two-point CDV objective across a link or node for the specified service category.

MCLR Maximum Cell Loss Ratio: This is the maximum ratio of the number of cells that do not make it across the link or node to the total number of cells arriving at the link or node.

MCR Minimum Cell Rate: An ABR service traffic descriptor, in cells/sec, that is the rate at which the source is always allowed to send.

MCTD Maximum Cell Transfer Delay: This is the sum of the fixed delay component across the link or node and MCDV.

Metasignaling ATM Layer Management (LM) process that manages different types of signaling and possibly semipermanent virtual channels (VCs), including the assignment, removal and checking of VCs.

Metasignaling VCs The standardized VCs that convey metasignaling information across a User-Network Interface (UNI).

MIB Management Information Base: A definition of management items for some network component that can be accessed by a network manager. A MIB includes the names of objects it contains and the type of information retained.

MIB Attribute A single piece of configuration, management, or statistical information which pertains to a specific part of the PNNI protocol operation.

MIB Instance An incarnation of a MIB object that applies to a specific part, piece, or aspect of the PNNI protocol's operation.

MIB Object A collection of attributes that can be used to configure, manage, or analyze an aspect of the PNNI protocol's operation.

MID Message Identifier: The message identifier is used to associate ATM cells that carry segments from the same higher layer packet.

MIR Maximum Information Rate: Refer to PCR.

MMF Multimode Fiberoptic Cable: Fiberoptic cable in which the signal or light propagates in multiple modes or paths. Since these paths may have varying lengths, a transmitted pulse of light may be received at different times and smeared to the point that pulses may interfere with surrounding pulses. This may cause the signal to be difficult or impossible to receive. This pulse dispersion sometimes limits the distance over which a MMF link can operate.

MPEG Motion Picture Experts Group: An ISO Standards group dealing with video and audio compression techniques and mechanisms for multiplexing and synchronizing various media streams.

MPOA Multiprotocol over ATM: An effort taking place in the ATM Forum to standardize protocols for the purpose of running multiple network layer protocols over ATM.

MPOA Client A device which implements the client side of one or more of the MPOA protocols, (i.e., is a SCP client and/or an RDP client. An MPOA Client is either an Edge Device Functional Group (EDFG) or a Host Behavior Functional Group (HBFG).

MPOA Server An MPOA Server is any one of an ICFG or RSFG.

MPOA Service Area The collection of server functions and their clients. A collection of physical devices consisting of an MPOA server plus the set of clients served by that server.

MPOA Target A set of protocol address, path attributes, (e.g., internetwork layer QoS, other information derivable from received packet) describing the intended destination and its path attributes that MPOA devices may use as lookup keys.

Mrm An ABR service parameter that controls allocation of bandwidth between forward RM-cells, backward RM-cells, and data cells.

MSB Most Significant Bit: The highest order bit in the binary representation of a numerical value.

MT Message Type: Message type is the field containing the bit flags of a RM-cell. These flags are as follows: DIR = 0 for forward RM-cells = 1 for backward; RM-cells BN = 1 for Non-Source Generated (BECN), RM-cells = 0 for Source Generated RM-cells CI = 1 to indicate congestion = 0 otherwise NI = 1 to indicate no additive increase allowed = 0 otherwise RA -- Not used for ATM Forum ABR.

MTP Message Transfer Part: Level 1 through 3 protocols of the SS7 protocol stack. MTP 3 (Level 3) is used to support BISUP.

Multicasting The transmit operation of a single PDU by a source interface where the PDU reaches a group of one or more destinations.

Multiplexing A function within a layer that interleaves the information from multiple connections into one connection.

Multipoint Access User access in which more than one terminal equipment (TE) is supported by a single network termination.

Multipoint-to-Multipoint Connection A Multipoint-to-Multipoint Connection is a collection of associated ATM VC or VP links, and their associated nodes, with the following properties:

1. All Nodes in the connection, called endpoints, serve as a Root Node in a Point-to-Multipoint connection to all of the (N-1) remaining endpoints.
2. Each of the endpoints on the connection can send information directly to any other endpoint, but the receiving endpoint cannot distinguish which of the endpoints is sending information without additional (e.g., higher layer) information.

Multipoint-to-Point Connection A Point-to-Multipoint Connection may have zero bandwidth from the Root node to the Leaf Nodes, and non-zero return bandwidth from the Leaf Nodes to the Root Node. Such a connection is also known as a Multipoint-to-Point Connection. Note that UNI 4.0 does not support this connection type.

N

N-ISDN Narrowband Integrated Services Digital Network: Services include basic rate interface (2B+D or BRI) and primary rate interface (30B+D - Europe and 23B+D - North America or PRI). Supports narrowband speeds at/or below 1.5 Mbps.

Native Address An address that matches one of a given node's summary addresses.

NDIS Network Driver Interface Specification: Refer to 3COM/Microsoft, LAN Manager: Network Driver Interface Specification, October 8, 1990.

NE Network Element: A system that supports at least NEFs and may also support Operation System Functions/Mediation Functions. An ATM NE may be realized as either a standalone device or a geographically distributed system. It cannot be further decomposed into managed elements in the context of a given management function.

NEF Network Element Function: A function within an ATM entity that supports the ATM based network transport services, (e.g., multiplexing, cross-connection).

Neighbor Node A node that is directly connected to a particular node via a logical link.

NEL Network Element Layer: An abstraction of functions related specifically to the technology, vendor, and the network resources or network elements that provide basic communications services.

NEXT Near End Crosstalk: Equipment that must concurrently receive on one wire pair and transmit on another wire pair in the same cable bundle must accommodate NEXT interference. NEXT is the portion of the transmitted signal that leaks into the receive pair. Since at this point on the link the transmitted signal is at maximum and the receive signal has been attenuated, it may be difficult to maintain an acceptable ACR with the received signal if the cable media allows large amounts of crosstalk leakage to occur. Foiled or shielded cables generally have less crosstalk than unshielded varieties.

NM Network Management Entity: The body of software in a switching system that provides the ability to manage the PNNI protocol. NM interacts with the PNNI protocol through the MIB.

NML Network Management Layer: An abstraction of the functions provided by systems which manage network elements on a collective basis, so as to monitor and control the network end-to-end.

NMS Network Management System: An entity that implements functions at the Network Management Layer. It may also include Element Management Layer functions. A Network Management System may manage one or more other Network Management Systems.

NMS Environment A set of NMS which cooperate to manage one or more subnetworks.

NNI Network Node Interface: An interface between ATM switches defined as the interface between two network nodes.

Nodal Attribute A nodal state parameter that is considered individually to determine whether a given node is acceptable and/or desirable for carrying a given connection.

Nodal Constraint A restriction on the use of nodes for path selection for a specific connection.

Nodal Metric A nodal parameter that requires the values of the parameter for all nodes along a given path to be combined to determine whether the path is acceptable and/or desirable for carrying a given connection.

Nodal State Parameter Information that captures an aspect or property of a node.

Node Synonymous with logical node.

NPC Network Parameter Control: Network Parameter Control is defined as the set of actions taken by the network to monitor and control traffic from the NNI. Its main purpose is to protect network resources from malicious as well as unintentional misbehavior which can affect the QoS of other already established connections by detecting violations of negotiated parameters and taking appropriate actions. Refer to UPC.

Nrm An ABR service parameter, Nrm is the maximum number of cells a source may send for each forward RM-cell.

NSAP Network Service Access Point: OSI generic standard for a network address consisting of 20 octets. ATM has specified E.164 for public network addressing and the NSAP address structure for private network addresses.

NSR Non-Source Routed: Frame forwarding through a mechanism other than Source Route Bridging.

NT Network Termination: Network Termination represents the termination point of a Virtual Channel, Virtual Path, or Virtual Path/Virtual Channel at the UNI.

NTSC National Television System Committee: An industry group that defines how television signals are encoded and transmitted in the US.

Nucleus The interior reference point of a logical node in the PNNI complex node representation.

nx64K This refers to a circuit bandwidth or speed provided by the aggregation of nx64 kbps channels (where n= integer > 1). The 64K or DS0 channel is the basic rate provided by the T Carrier systems.

O

OAM Operations Administration and Maintenance: A group of network management functions that provide network fault indication, performance information, and data and diagnosis functions.

Octet A term for eight (8) bits that is sometimes used interchangeably with "byte" to mean the same thing.

ODI Open Data-Link Interface: This refers to Novell Incorporated, Open Data-Link Interface Developer's Guide, March 20, 1992.

One Hop Set A set of hosts which are one hop apart in terms of internetwork protocols TTLs (TTL=0 - on the wire+).

OOF Out of Frame. Refer to LOF.

OSI Open Systems Interconnection: A seven (7) layer architecture model for communications systems developed by the ISO for the interconnection of data communications systems. Each layer uses and builds on the services provided by those below it.

OSPF Open Shortest Path First: A link-state routing algorithm that is used to calculate routes based on the number of routers, transmission speed, delays and route cost.

OUI Organizationally Unique Identifier: The OUI is a three-octet field in the IEEE 802.1a defined SubNetwork Attachment Point (SNAP) header, identifying an organization which administers the meaning of the following two octet Protocol Identifier (PID) field in the SNAP header. Together they identify a distinct routed or bridged protocol.

Outlier A node whose exclusion from its containing peer group would significantly improve the accuracy and simplicity of the aggregation of the remainder of the peer group topology.

Outside Link A link to an outside node.

Outside Node A node which is participating in PNNI routing, but which is not a member of a particular peer group.

P

PAD Packet Assembler and Disassembler: A PAD assembles packets of asynchronous data and emits these buffers in a burst to a packet switch network. The PAD also disassembles packets from the network and emits the data to the non-packet device.

Parent Node The logical group node that represents the containing peer group of a specific node at the next higher level of the hierarchy.

Parent Peer Group The parent peer group of a peer group is the one containing the logical group node representing that peer group. The parent peer group of a node is the one containing the parent node of that node.

Path Constraint A bound on the combined value of a topology metric along a path for a specific connection.

PBX Private Branch eXchange: PBX is the term given to a device which provides private local voice switching and voice-related services within the private network. A PBX could have an ATM API to utilize ATM services, for example Circuit Emulation Service.

PC Protocol Control: Protocol Control is a mechanism which a given application protocol may employ to determine or control the performance and health of the application. Example, protocol liveness may require that protocol control information be sent at some minimum rate; some applications may become intolerable to users if they are unable to send at least at some minimum rate. For such applications, the concept of MCR is defined. Refer to MCR.

PCM Pulse Code Modulation: An audio encoding algorithm which encodes the amplitude of a repetitive series of audio samples. This encoding algorithm converts analog voice samples into a digital bit stream.

PCO Point of Control and Observation: A place (point) within a testing environment where the occurrence of test events is to be controlled and observed as defined by the particular abstract test method used.

PCR Program Clock Reference: A timestamp that is inserted by the MPEG-2 encoder into the Transport Stream to aid the decoder in the recovering and tracking the encoder clock.

PCR Peak Cell Rate: The Peak Cell Rate, in cells/sec, is the cell rate which the source may never exceed.

PDH Plesiochronous Digital Hierarchy: PDH (plesiochronous means nearly synchronous), was developed to carry digitized voice over twisted pair cabling more efficiently. This evolved into the North American, European, and Japanese Digital Hierarchies where only a discrete set of fixed rates is available, namely, nxDS0 (DS0 is a 64 kbps rate) and then the next levels in the respective multiplex hierarchies.

PDU Protocol Data Unit: A PDU is a message of a given protocol comprising payload and protocol-specific control information, typically contained in a header. PDUs pass over the protocol interfaces which exist between the layers of protocols (per OSI model).

Peer Entities Entities within the same layer.

Peer Group A set of logical nodes which are grouped for purposes of creating a routing hierarchy. PTSEs are exchanged among all members of the group.

Peer Group Identifier A string of bits that is used to unambiguously identify a peer group.

Peer Group Leader A node which has been elected to perform some of the functions associated with a logical group node.

Peer Group Level The number of significant bits in the peer group identifier of a particular peer group.

Peer Node A node that is a member of the same peer group as a given node.

PES Packetized Elementary Stream: In MPEG-2, after the media stream has been digitized and compressed, it is formatted into packets before it is multiplexed into either a Program Stream or Transport Stream.

PG Peer Group: A set of logical nodes which are grouped for purposes of creating a routing hierarchy. PTSEs are
exchanged among all members of the group.

PGL Peer Group Leader: A single real physical system which has been elected to perform some of the functions associated with a logical group node.

PHY OSI Physical Layer: The physical layer provides for transmission of cells over a physical medium connecting two ATM devices. This physical layer is comprised of two sublayers: the PMD Physical Medium Dependent sublayer, and the TC Transmission Convergence sublayer. Refer PMD and TC.

Physical Layer (PHY) Connection An association established by the PHY between two or more ATM entities. A PHY connection consists of the concatenation of PHY links in order to provide an end-to-end transfer capability to PHY SAPs.

Physical Link A real link which attaches two switching systems.

PICS Protocol Implementation Conformance Statement: A statement made by the supplier of an implementation or system stating which capabilities have been implemented for a given protocol.

PID Protocol Identification. Refer to OUI.

PIXIT Protocol Implementation eXtra Information for Testing: A statement made by a supplier or implementor of an IUT which contains information about the IUT and its testing environment which will enable a test laboratory to run an appropriate test suite against the IUT.

Plastic Fiber Optics An optical fiber where the core transmission media is plastic in contrast to glass or silica cores. Proposed plastic fibers generally have larger attenuation and dispersion than glass fiber but may have applications where the distance is limited. Plastic systems may also offer lower cost connectors that may be installed with simple tools and a limited amount of training.

PLCP Physical Layer Convergence Protocol: The PLCP is defined by the IEEE 802.6. It is used for DS3 transmission of ATM. ATM cells are encapsulated in a 125microsecond frame defined by the PLCP which is defined inside the DS3 M-frame.

PLL Phase Lock Loop: Phase Lock Loop is a mechanism whereby timing information is transferred within a data stream and the receiver derives the signal element timing by locking its local clock source to the received timing information.

PM Physical Medium: Physical Medium refers to the actual physical interfaces. Several interfaces are defined including STS-1, STS-3c, STS-12c, STM-1, STM-4, DS1, E1, DS2, E3, DS3, E4, FDDI-based, Fiber Channel-based, and STP. These range in speeds from 1.544Mbps through 622.08 Mbps.

PMD Physical Media Dependent: This sublayer defines the parameters at the lowest level, such as speed of the bits on the media.

PNI Permit Next Increase: An ABR service parameter, PNI is a flag controlling the increase of ACR upon reception of the next backward RM-cell. PNI=0 inhibits increase. The range is 0 or 1.

PNNI Private Network-Network Interface: A routing information protocol that enables extremely scalable, full function, dynamic multi-vendor ATM switches to be integrated in the same network.

PNNI Protocol Entity The body of software in a switching system that executes the PNNI protocol and provides the routing service.

PNNI Routing Control Channel VCCs used for the exchange of PNNI routing protocol messages.

PNNI Routing Domain A group of topologically contiguous systems which are running one instance of PNNI routing.

PNNI Routing Hierarchy The hierarchy of peer groups used for PNNI routing.

PNNI Topology State Element A collection of PNNI information that is flooded among all logical nodes within a peer group.

PNNI Topology State Packet A type of PNNI Routing packet that is used for flooding PTSEs among logical nodes within a peer group.

POH Path Overhead: A maintenance channel transmitted in the SONET overhead following the path from the beginning multiplexer to the ending demultiplexer. This is not implemented in SONET Lite.

Point-to-Multipoint Connection A Point-to-Multipoint Connection is a collection of associated ATM VC or VP links, with associated endpoint nodes, with the following properties:

1. One ATM link, called the Root Link, serves as the root in a simple tree topology. When the Root Node sends information, all of the remaining nodes on the connection, called Leaf Nodes, receive copies of the information.
2. Each of the Leaf Nodes on the connection can send information directly to the Root Node. The Root Node cannot distinguish which Leaf is sending information without additional (higher layer) information. (See note below for UNI 4.0 support.)
3. The Leaf Nodes cannot communicate directly to each other with this connection type.

Note: UNI 4.0 does not support traffic sent from a Leaf to the Root.

Point-to-Point Connection A connection with only two endpoints.

Port Identifier The identifier assigned by a logical node to represent the point of attachment of a link to that node.

PRI Primary Rate Interface: An ISDN standard for provisioning of 1.544 Mbit/s (DS1 - North America, Japan, et al) or 2.048 Mbit/s (E1 - Europe) ISDN services. DS1 is 23 "B" channels of 64 kbit/s each and one signalling "D" channel of 64 kbit/s/ E1 is 30 "B" channels of 64 kbit/s each and one signalling "D" channel of 64 kbit/s.

PRS Primary Reference Source

Primitive An abstract, implementation independent, interaction between a layer service user and a layer service provider.

Private ATM Address A twenty-byte address used to identify an ATM connection termination point.

Protocol A set of rules and formats (semantic and syntactic) that determines the communication behavior of layer entities in the performance of the layer functions.

Protocol Control Information Information exchanged between corresponding entities, using a lower layer connection, to coordinate their joint operation.

PT Payload Type: Payload Type is a 3-bit field in the ATM cell header that discriminates between a cell carrying management information or one which is carrying user information.

PTI Payload Type Indicator: Payload Type Indicator is the Payload Type field value distinguishing the various management cells and user cells. Example: Resource Management cell has PTI=110, end-to-end OAM F5 Flow cell has PTI=101.

PTMPT Point-To-Multipoint: A main source to many destination connections.

PTS Presentation Time Stamp: A timestamp that is inserted by the MPEG-2 encoder into the packetized elementary stream to allow the decoder to synchronize different elementary streams (i.e. lip sync).

PTSE PNNI Topology State Element: A collection of PNNI information that is flooded among all logical nodes within a peer group.

PTSP PNNI Topology State Packet: A type of PNNI Routing packet that is used for flooding PTSEs among logical nodes within a peer group.

PVC Permanent Virtual Circuit: This is a link with static route defined in advance, usually by manual setup.

PVCC Permanent Virtual Channel Connection: A Virtual Channel Connection (VCC) is an ATM connection where switching is performed on the VPI/VCI fields of each cell. A Permanent VCC is one which is provisioned through some network management function and left up indefinitely.

PVPC Permanent Virtual Path Connection: A Virtual Path Connection (VPC) is an ATM connection where switching is performed on the VPI field only of each cell. A Permanent VPC is one which is provisioned through some network management function and left up indefinitely.

Q

QD Queuing Delay: Queuing Delay refers to the delay imposed on a cell by its having to be buffered because of unavailability of resources to pass the cell onto the next network function or element. This buffering could be a result of oversubscription of a physical link, or due to a connection of higher priority or tighter service constraints getting the resource of the physical link.

QoS Quality of Service: Quality of Service is defined on an end-to-end basis in terms of the following attributes of the end-to-end ATM connection:
- Cell Loss Ratio
- Cell Transfer Delay
- Cell Delay Variation.

Q.SIG A symmetrical adaptatation of N-ISDN signalling (DSS1) for inter-PBX signalling.

R

RBOC Regional Bell Operating Company: Seven companies formed to manage the local exchanges originally owned by AT&T. These companies were created as a result of an agreement between AT&T and the United States Department of Justice.

RD Routing Domain: A group of topologically contiguous systems which are running one instance of routing.

RDF Rate Decrease Factor: An ABR service parameter, RDF controls the decrease in the cell transmission rate. RDF is a power of 2 from 1/32,768 to 1.

RO Read-Only: Attributes which are read-only can not be written by Network Management. Only the PNNI Protocol entity may change the value of a read-only attribute. Network Management entities are restricted to only reading such read-only attributes. Read-only attributes are typically for statistical information, including reporting result of actions taken by auto-configuration.

RW Read-Write : Attributes which are read-write can not be written by the PNNI protocol entity. Only the Network Management Entity may change the value of a read-write attribute. The PNNI Protocol Entity is restricted to only reading such read-write attributes. Read-write attributes are typically used to provide the ability for Network Management to configure, control, and manage a PNNI Protocol Entity's behavior.

Registration The address registration function is the mechanism by which Clients provide address information to the LAN Emulation Server.

Relaying A function of a layer by means of which a layer entity receives data from a corresponding entity and transmits it to another corresponding entity.

RFC Request For Comment: The development of TCP/IP standards, procedures and specifications is done via this
mechanism. RFCs are documents that progress through several development stages, under the control of IETF, until they are finalized or discarded.

RFC1695 Definitions of Managed Objects for ATM Management or AToM MIB.

RFI Radio Frequency Interface: Refer to EMI.

RIF Rate Increase Factor: This controls the amount by which the cell transmission rate may increase upon receipt of an RM-cell. The additive increase rate AIR=PCR*RIF. RIF is a power of 2, ranging from 1/32768 to 1.

RISC Reduced Instruction Set Computing: A computer processing technology in which a microprocessor understands a few simple instructions thereby providing fast, predictable instruction flow.

RM Resource Management: Resource Management is the management of critical resources in an ATM network. Two critical resources are buffer space and trunk bandwidth. Provisioning may be used to allocate network resources in order to separate traffic flows according to service characteristics. VPCs play a key role in resource management. By reserving capacity on VPCs, the processing required to establish individual VCCs is reduced. Refer to RM-cell.

RM-Cell Resource Management Cell: Information about the state of the net work like bandwidth availability, state of congestion, and impending congestion, is conveyed to the source through special control cells called Resource Management Cells (RM-cells).

Route Server A physical device that runs one or more network layer routing protocols, and which uses a route query protocol in order to provide network layer routing forwarding descriptions to clients.

Router A physical device that is capable of forwarding packets based on network layer information and that also participates in running one or more network layer routing protocols.

Routing Computation The process of applying a mathematical algorithm to a topology database to compute routes. There are many types of routing computations that may be used. The Djikstra algorithm is one particular example of a possible routing computation.

Routing Constraint A generic term that refers to either a topology constraint or a path constraint.

Routing Protocol A general term indicating a protocol run between routers and/or route servers in order to exchange information used to allow computation of routes. The result of the routing computation will be one or more forwarding descriptions.

RS Remote single-layer (Test Method): An abstract test method in which the upper tester is within the system under test and there is a point of control and observation at the upper service boundary of the Implementation Under Test (IUT) for testing one protocol layer. Test events are specified in terms of the abstract service primitives (ASP) and/or protocol data units at the lower tester PCO.

RSE Remote Single-layer Embedded (Test Method): An abstract test method in which the upper tester is within the system under test and there is a point of control and observation at the upper service boundary of the Implementation Under Test (IUT) for testing a protocol layer or sublayer which is part of a multi-protocol IUT.

RSFG Route Server Functional Group: The group of functions performed to provide internetworking level functions in an MPOA System. This includes running conventional interworking Routing Protocols and providing inter-IASG destination resolution.

S

SA Source Address: The address from which the message or data originated.

SA Source MAC Address: A six octet value uniquely identifying an end point and which is sent in an IEEE LAN frame header to indicate source of frame.

SAAL Signaling ATM Adaptation Layer: This resides between the ATM layer and the Q.2931 function. The SAAL provides reliable transport of Q.2931 messages between Q.2931 entities (e.g., ATM switch and host) over the ATM layer; two sublayers: common part and service specific part.

SAP Service Access Point: A SAP is used for the following purposes:

1. When the application initiates an outgoing call to a remote ATM device, a destination_SAP specifies the ATM address of the remote device, plus further addressing that identifies the target software entity within the remote device.
2. When the application prepares to respond to incoming calls from remote ATM devices, a local_SAP specifies the ATM address of the device housing the application, plus further addressing that identifies the application within the local device.

There are several groups of SAPs that are specified as valid for Native ATM Services.

SAR Segmentation and Reassembly: Method of breaking up arbitrarily sized packets.

Scope A scope defines the level of advertisement for an address. The level is a level of a peer group in the PNNI routing hierarchy.

SCCP Signaling Connection and Control Part: A SS7 protocol that provides additional functions to the Message Transfer Part (MTP). It typically supports Transaction Capabilities Application Part (TCAP).

SCP Service Control Point: A computer and database system which executes service logic programs to provide customer services through a switching system. Messages are exchanged with the SSP through the SS7 network.

SCR Sustainable Cell Rate: The SCR is an upper bound on the conforming average rate of an ATM connection over time scales which are long relative to those for which the PCR is defined. Enforcement of this bound by the UPC could allow the network to allocate sufficient resources, but less than those based on the PCR, and still ensure that the performance objectives (e.g., for Cell Loss Ratio) can be achieved.

SDH Synchronous Digital Hierarchy: The ITU-TSS International standard for transmitting information over optical fiber.

SDT Structured Data Transfer: An AAL1 data transfer mode in which data is structured into blocks which are then segmented into cells for transfer.

SDU Service Data Unit: A unit of interface information whose identity is preserved from one end of a layer connection to the other.

SE Switching Element: Switching Element refers to the device or network node which performs ATM switching functions based on the VPI or VPI/VCI pair.

SEAL Simple and Efficient Adapation Layer: An earlier name for AAL5.

Segment A single ATM link or group of interconnected ATM links of an ATM connection.

SEL Selector: A subfield carried in SETUP message part of ATM endpoint address Domain specific Part (DSP) defined by ISO 10589, not used for ATM network routing, used by ATM end systems only.

Semipermanent Connection A connection established via a service order or via network management.

SES Severely Errored Seconds: A unit used to specify the error performance of T carrier systems. This indicates a second containing ten or more errors, usually expressed as SES per hour, day, or week. This method gives a better indication of the distribution of bit errors than a simple Bit Error Rate (BER). Refer also to EFS.

SES Source End Station: An ATM termination point, which is the source of ATM messages of a connection, and is used as a reference point for ABR services. Refer to DES.

SF SuperFrame: A DS1 framing format in which 24 DS0 timeslots plus a coded framing bit are organized into a frame which is repeated 12 times to form the superframe.

Shaping Descriptor N ordered pairs of GCRA parameters (I,L) used to define the negotiated traffic shape of a connection.

SIPP SMDS Interface Protocol: Protocol where layer 2 is based on ATM, AAL and DQDB. Layer 1 is DS1 and DS3.

SMDS Switched Multi-Megabit Data Services: A connectionless service used to connect LANs, MANs and WANs to exchange data.

SMF Single Mode Fiber: Fiber optic cable in which the signal or light propagates in a single mode or path. Since all light follows the same path or travels the same distance, a transmitted pulse is not dispersed and does not interfere with adjacent pulses. SMF fibers can support longer distances and are limited mainly by the amount of attenuation. Refer to MMF.

SN Sequence Number: SN is a 4 octet field in a Resource Management cell defined by the ITU-T in recommendation I.371 to sequence such cells. It is not used for ATM Forum ABR. An ATM switch will either preserve this field or set it in accordance with I.371.

SN cell Sequence Number Cell: A cell sent periodically on each link of an AIMUX to indicate how many cells have been transmitted since the previous SN cell. These cells are used to verify the sequence of payload cells reassembled at the receiver.

SNA Systems Network Architecture: IBM's seven layer, vendor specific architecture for data communications

SNC Subnetwork Connection: In the context of ATM, an entity that passes ATM cells transparently, (i.e., without adding any overhead). A SNC may be either a stand-alone SNC, or a concatenation of SNCs and link connections.

SNMP Simple Network Management Protocol: Originally designed for the Department of Defense network to support TCP/IP network management. It has been widely implemented to support the management of a broad range of network products and functions. SNMP is the IETF standard management protocol for TCP/IP networks.

SONET Synchronous Optical Network: An ANSI standard for transmitting information over optical fiber. This standard is used or accepted in the United States and Canada and is a variation of the SDH International standard.

Source Route As used in this document, a hierarchically complete source route.

Source Traffic A set of traffic parameters belonging to the ATM Traffic Descriptor Descriptor used during the connection set-up to capture the intrinsic traffic characteristics of the connection requested by the source.

SPE SONET Synchronous Payload Envelope.

Split System A switching system which implements the functions of more than one logical node.

SPTS Single Program Transport Stream: An MPEG-2 Transport Stream that consists of only one program.

SR Source Routing: A bridged method whereby the source at a data exchange determines the route that subsequent frames will use.

SRF Specifically Routed Frame: A Source Routing Bridging Frame which uses a specific route between the source and destination.

SRT Source Routing Transparent: An IETF Bridging Standard combining Transparent Bridging and Source Route Bridging.

SRTS Synchronous residual Time Stamp: A clock recovery technique in which difference signals between source timing and a network reference timing signal are transmitted to allow reconstruction of the source timing at the destination.

SSCF Service Specific Coordination Function: SSCF is a function defined in Q.2130, B-ISDN Signaling ATM Adaptation Layer-Service Specific Coordination Function for Support of Signaling at the User-to-Network Interface.

SSCOP Service Specific Connection Oriented Protocol: An adaptation layer protocol defined in ITU-T Specification: Q.2110.

SSCS Service Specific Convergence Sublayer: The portion of the convergence sublayer that is dependent upon the type of traffic that is being converted.

SS7 Signal System Number 7: A family of signaling protocols originating from narrowband telephony. They are used to set-up, manage and tear down connections as well as to exchange non-connection associated information. Refer to BISUP, MTP, SCCP and TCAP.

STC System Time Clock: The master clock in an MPEG-2 encoder or decoder system.
STE Spanning Tree Explorer: A Source Route Bridging frame which uses the Spanning Tree algorithm in determining a route.

STE SONET Section Terminating Equipment: SONET equipment that terminates a section of a link between a transmitter and repeater, repeater and repeater, or repeater and receiver. This is usually implemented in wide area facilities and not implemented by SONET Lite.

STM Synchronous Transfer Module: STM is a basic building block used for a synchronous multiplexing hierarchy defined by the CCITT/ITU-T. STM-1 operates at a rate of 155.52 Mbps (same as STS-3).

STM-1 Synchronous Transport Module 1: SDH standard for transmission over OC-3 optical fiber at 155.52 Mbps.

STM-n Synchronous Transport Module "n" : (where n is an integer) SDH standards for transmission over optical fiber (OC-'n x3) by multiplexing "n" STM-1 frames, (e.g., STM-4 at 622.08 Mbps and STM-16 at 2.488 Gbps).

STM-nc Synchronous Transport Module "n" concatenated: (where n is an integer) SDH standards for transmission over optical fiber (OC-'n x 3) by multiplexing "n" STM-1 frames, (e.g., STM-4 at 622.08 Mbps and STM-16 at 2.488 Gbps, but treating the information fields as a single concatenated payload).

STP Signaling Transfer Point: A high speed, reliable, special purpose packet switch for signaling messages in the SS7 network.

STP Shielded Twisted Pair: A cable containing one or more twisted pair wires with each pair having a shield of foil wrap.

STS-1 Synchronous Transport Signal 1: SONET standard for transmission over OC-1 optical fiber at 51.84 Mbps.

STS-n Synchronous Transport Signal "n" : (where n is an integer) SONET standards for transmission over OC-n optical fiber by multiplexing "n" STS-1 frames, (e.g., STS-3 at 155.52 Mbps STS-12 at 622.08 Mbps and STS-48 at 2.488 Gbps).

STS-nc Synchronous Transport Signal "n" concatenated: (where n is an integer) SONET standards for transmission over OC-n optical fiber by multiplexing "n" STS-1 frames, (e.g., STS-3 at 155.52 Mbps STS-12 at 622.08 Mbps and STS-48 at 2.488 Gbps but treating the information fields as a single concatenated payload).

Sublayer A logical sub-division of a layer.

Subnet The use of the term subnet to mean a LAN technology is a historical use and is not specific enough in the MPOA work. Refer to Internetwork Address Sub-Group, Direct Set, Host Apparent Address Sub-Group and One Hop Set for more specific definitions.

Subnetwork A collection of managed entities grouped together from a connectivity perspective, according to their ability to transport ATM cells.

subNMS Subnetwork Management System: A Network Management System that is managing one or more subnetworks and that is managed by one or more Network Management Systems.

Summary Address An address prefix that tells a node how to summarize reachability information.

SUT System Under Test: The real open system in which the Implementation Under Test (IUT) resides.

SVC Switched Virtual Circuit: A connection established via signaling. The user defines the endpoints when the call is initiated.

SVCC Switched Virtual Channel Connection: A Switched VCC is one which is established and taken down dynamically through control signaling. A Virtual Channel Connection (VCC) is an ATM connection where switching is performed on the VPI/VCI fields of each cell.

SVE SAP Vector Element: The SAP address may be expressed as a vector, (ATM_addr, ATM_selector, BLLI_id2, BLLI_id3, BHLI_id), where:

- ATM_addr corresponds to the 19 most significant octets of a device's 20-octet ATM address (private ATM address structure) or the entire E.164 address (E.164 address structure)
- ATM_selector corresponds to the least significant octet of a device's 20-octet ATM address (private ATM address structure only)
- BLLI_id2 corresponds to an octet in the Q.2931 BLLI information element that identifies a layer 2 protocol
- BLLI_id3 corresponds to a set of octets in the Q.2931 BLLI information element that identify a layer 3 protocol
- BHLI_id corresponds to a set of octets in the Q.2931 BHLI information element that identify an application (or session layer protocol of an application)

Each element of the SAP vector is called a SAP Vector Element, or SVE. Each SVE consists of a tag, length, and value field.

SVPC Switched Virtual Path Connection: A Switched Virtual Path Connection is one which is established and taken down dynamically through control signaling. A Virtual Path Connection (VPC) is an ATM connection where switching is performed on the VPI field only of each cell.

Switched Connection A connection established via signaling.

Switching System A set of one or more systems that act together and appear as a single switch for the purposes of PNNI routing.

Symmetric Connection A connection with the same bandwidth value specified for both directions.

T

T1E1 An ANSI standards sub-committee dealing with Network Interfaces.

T1M1 An ANSI standards sub-committee dealing with Inter-Network Operations, Administration and Maintenance.

T1Q1 An ANSI standards sub-committee dealing with performance.

T1S1 An ANSI standards sub-committee dealing with services, architecture and signaling.

T1X1 An ANSI standards sub-committee dealing with digital hierarchy and synchronization.

TB Transparent Bridging: An IETF bridging standard where bridge behavior is transparent to the data traffic. To avoid ambiguous routes or loops, a Spanning Tree algorithm is utilized.

TBE Transient Buffer Exposure: This is a negotiated number of cells that the network would like to limit the source to sending during startup periods, before the first RM-cell returns.

TC Transaction Capabilities: TCAP (see below) plus supporting Presentation, Session and Transport protocol layers.

TC Transmission Convergence: The TC sublayer transforms the flow of cells into a steady flow of bits and bytes for transmission over the physical medium. On transmit, the TC sublayer maps the cells to the frame format, generates the Header Error Check (HEC), sends idle cells when the ATM layer has none to send. On reception, the TC sublayer delineates individual cells in the received bit stream, and uses the HEC to detect and correct received errors.

TCAP Transaction Capabilities Applications Part: A connectionless SS7 protocol for the exchange of information outside the context of a call or connection. It typically runs over SCCP and MTP 3.

TCP Transmission Control Protocol: Originally developed by the Department of Defense to support interworking of dissimilar computers across a network. A protocol which provides end-to-end, connection-oriented, reliable transport layer (layer 4) functions over IP controlled networks. TCP performs the following functions: flow control between two systems, acknowledgements of packets received and end-to-end sequencing of packets.

TCP Test Coordination Procedure: A set of rules to coordinate the test process between the lower tester and the upper tester. The purpose is to enable the lower tester to control the operation of the upper tester. These procedures may, or may not, be specified in an abstract test suite.

TCR Tagged Cell Rate: An ABR service parameter, TCR limits the rate at which a source may send out-of-rate forward RM-cells. TCR is a constant fixed at 10 cells/second.

TCS Transmission Convergence Sublayer: This is part of the ATM physical layer that defines how cells will be transmitted by the actual physical layer.

TDF An ABR service parameter, TDF controls the decrease in ACR associated with TOF. TDF is signaled as TDFF, where TDF = TDFF/RDF times the smallest power of 2 greater or equal to PCR. TDF is in units of 1/seconds.

TDFF Refer to TDF. TDFF is either zero or a power of two in the range 1/64 to 1 in units of 1/cells.

TDM Time Division Multiplexing: A method in which a transmission facility is multiplexed among a number of channels by allocating the facility to the channels on the basis of time slots.

TE Terminal Equipment: Terminal equipment represents the endpoint of ATM connection(s) and termination of the various protocols within the connection(s).

TLV Type / Length / Value: A coding methodology which provides a flexible and extensible means of coding parameters within a frame. Type indicates parameter type. Length indicates parameter's value length. Value indicates the actual parameter value.

TM Traffic Management: Traffic Management is the aspect of the traffic control and congestion control procedures for ATM. ATM layer traffic control refers to the set of actions taken by the network to avoid congestion conditions. ATM layer congestion control refers to the set of actions taken by the network to minimize the intensity, spread and duration of congestion. The following functions form a framework for managing and controlling traffic and congestion in ATM networks and may be used in appropriate combinations:

- Connection Admission Control
- Feedback Control
- Usage Parameter Control
- Priority Control
- Traffic Shaping
- Network Resource Management
- Frame Discard
- ABR Flow Control.

TMP Test Management Protocol: A protocol which is used in the test coordination procedures for a particular test suite.

TNS Transit Network Selection: A signaling element that identifies a public carrier to which a connection setup should be routed.

TOF Time Out Factor: An ABR service parameter, TOF controls the maximum time permitted between sending forward RM-cells before a rate decrease is required. It is signaled as TOFF where TOF=TOFF+1. TOFF is a power of 2 in the range: 1/8 to 4,096.

TOFF Time Out Factor: Refer to TOF.

Topology Aggregation The process of summarizing and compressing topology information at a hierarchical level to be advertised at the level above.

Topology Attribute A generic term that refers to either a link attribute or a nodal attribute.

Topology Constraint A topology constraint is a generic term that refers to either a link constraint or a nodal constraint.

Topology Database The database that describes the topology of the entire PNNI routing domain as seen by a node.

Topology Metric A generic term that refers to either a link metric or a nodal metric.

Topology State Parameter A generic term that refers to either a link parameter or a nodal parameter.

TP-MIC Twisted-Pair Media Interface Connector: This refers to the connector jack at the end user or network equipment that receives the twisted pair plug.

TPCC Third Party Call Control: A connection setup and management function that is executed from a third party that is not involved in the data flow.

Trail An entity that transfers information provided by a client layer network between access points in a server layer network. The transported information is monitored at the termination points.

Trailer Protocol control information located at the end of a PDU.

Transit Delay The time difference between the instant at which the first bit of a PDU crosses one designated boundary and the instant at which the last bit of the same PDU crosses a second designated boundary.

Trm An ABR service parameter that provides an upper bound on the time between forward RM-cells for an active source. It is 100 times a power of two with a range of 100*2-7 to 100*20.

TS Transport Stream: One of two types of streams produced by the MPEG-2 Systems layer. The Transport Stream consists of 188 byte packets and can contain multiple programs.

TS Traffic Shaping: Traffic Shaping is a mechanism that alters the traffic characteristics of a stream of cells on a connection to achieve better network efficiency, while meeting the QoS objectives, or to ensure conformance at a subsequent interface. Traffic shaping must maintain cell sequence integrity on a connection. Shaping modifies traffic characteristics of a cell flow with the consequence of increasing the mean Cell Transfer Delay.

TS Time Stamp: Time Stamping is used on OAM cells to compare time of entry of cell to time of exit of cell to be used to determine the cell transfer delay of the connection.

TTCN Tree and Tabular Combined Notation: The internationally standardized test script notation for specifying abstract test suites. TTCN provides a notation which is independent of test methods, layers and protocol.

U

UBR Unspecified Bit Rate: UBR is an ATM service category which does not specify traffic related service guarantees. Specifically, UBR does not include the notion of a per-connection negotiated bandwidth. No numerical commitments are made with respect to the cell loss ratio experienced by a UBR connection, or as to the cell transfer delay experienced by cells on the connection.

UDP User Datagram Protocol: This protocol is part of the TCP/IP protocol suite and provides a means for applications to access the connectionless features of IP. UDP operates at layer 4 of the OSI reference model and provides for the exchange of datagrams without acknowledgements or guaranteed delivery.

UME UNI Management Entity: The software residing in the ATM devices at each end of the UNI circuit that implements the management interface to the ATM network.

Unassigned Cells A cell identified by a standardized virtual path identifier (VPI) and virtual channel identifier (VCI) value, which has been generated and does not carry information from an application using the ATM Layer service.

UNI User-Network Interface: An interface point between ATM end users and a private ATM switch, or between a private ATM switch and the public carrier ATM network; defined by physical and protocol specifications per ATM Forum UNI documents. The standard adopted by the ATM Forum to define connections between users or end stations and a local switch.

Unicasting The transmit operation of a single PDU by a source interface where the PDU reaches a single destination.

UPC Usage Parameter Control: Usage Parameter Control is defined as the set of actions taken by the network to monitor and control traffic, in terms of traffic offered and validity of the ATM connection, at the end-system access. Its main purpose is to protect network resources from malicious as well as unintentional misbehavior, which can affect the QoS of other already established connections, by detecting violations of negotiated parameters and taking appropriate actions.

Uplink Represents the connectivity from a border node to an upnode.

Upnode The node that represents a border node's outside neighbor in the common peer group. The upnode must be a neighboring peer of one of the border node's ancestors.

UT Upper Tester: The representation in ISO/IEC 9646 of the means of providing, during test execution, control and observation of the upper service boundary of the IUT, as defined by the chosen Abstract Test Method.

UTOPIA Universal Test & Operations Interface for ATM: Refers to an electrical interface between the TC and PMD sublayers of the PHY layer.

UTP Unshielded Twisted Pair: A cable having one or more twisted pairs, but with no shield per pair.

V

VBR Variable Bit Rate: An ATM Forum defined service category which supports variable bit rate data traffic with average and peak traffic parameters.

VC A communications channel that provides for the sequential unidirectional transport of ATM cells.

VCC Virtual Channel Connection: A concatenation of VCLs that extends between the points where the ATM service users access the ATM layer. The points at which the ATM cell payload is passed to, or received from, the users of the ATM Layer (i.e., a higher layer or ATM-entity) for processing signify the endpoints of a VCC. VCCs are unidirectional.

VCI Virtual Channel Identifier: A unique numerical tag as defined by a 16 bit field in the ATM cell header that identifies a virtual channel, over which the cell is to travel.

VCL Virtual Channel Link: A means of unidirectional transport of ATM cells between the point where a VCI value is assigned and the point where that value is translated or removed.

VCO Voltage Controlled Oscillator: An oscillator whose clock frequency is determined by the magnitude of the voltage presented at its input. The frequency changes when the voltage changes.

VD Virtual Destination. Refer to VS/VD.

VF Variance Factor: VF is a relative measure of cell rate margin normalized by the variance of the aggregate cell rate on the link.

Virtual Channel Switch A network element that connects VCLs. It terminates VPCs and translates VCI values. It is directed by Control Plane functions and relays the cells of a VC.

Virtual Path Switch A network element that connects VPLs. It translates VPI (not VCI) values and is directed by Control Plane functions. It relays the cell of the VP.

VLAN Virtual Local Area Network: Work stations connected to an intelligent device which provides the capabilities to define LAN membership.

VP Virtual Path: A unidirectional logical association or bundle of VCs.

VPC Virtual Path Connection: A concatenation of VPLs between Virtual Path Terminators (VPTs). VPCs are unidirectional.

VPI Virtual Path Identifier: An eight bit field in the ATM cell header which indicates the virtual path over which the cell should be routed.

VPL Virtual Path Link: A means of unidirectional transport of ATM cells between the point where a VPI value is assigned and the point where that value is translated or removed.

VPT Virtual Path Terminator: A system that unbundles the Vcs of a VP for independent processing of each VC.

VS Virtual Scheduling: Virtual Scheduling is a method to determine the conformance of an arriving cell. The virtual scheduling algorithm updates a Theoretical Arrival Time (TAT), which is the "nominal" arrival time of the cell assuming that the active source sends equally spaced cells. If the actual arrival time of a cell is not "too" early relative to the TAT, then the cell is conforming. Otherwise the cell is non-conforming.

VS Virtual Source. Refer to VS/VD.

VS/VD Virtual Source/Virtual Destination: An ABR connection may be divided into two or more separately controlled ABR segments. Each ABR control segment, except the first, is sourced by a virtual source. A virtual source implements the behavior of an ABR source endpoint. Backwards RM-cells received by a virtual source are removed from the connection. Each ABR control segment, except the last, is terminated by a virtual destination. A virtual destination assumes the behavior of an ABR

destination endpoint. Forward RM-cells received by a virtual destination are turned around and not forwarded to the next segment of the connection.
VTOA Voice and Telephony Over ATM: The ATM Forum voice and telephony over ATM service interoperability specifications address three applications for carrying voice over ATM networks; desktop (or LAN services), trunking (or WAN services), and mobile services.

W

WAN Wide Area Network: This is a network which spans a large geographic area relative to office and campus environment of LAN (Local Area Network). WAN is characterized by having much greater transfer delays due to laws of physics.

X, Y, Z

XDF Xrm Decrease Factor: An ABR service parameter, XDF controls the decrease in ACR associated with Xrm. It is a power of two in range: [0, 1].

Xrm An ABR service parameter, Xrm limits the number of forward RM-cells which may be sent in the absence of received backward RM-cells. The range is 0-255.

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