Avaya

User's Guide

M-ACCF/SF Module

Avaya M770 Multifunction Switch

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AVAYA

Introduction

This guide provides the information that you need to install and configure the M-ACCF/SF OC12 ATM Access Modules. These modules fit into the Avaya M770 Modular switch chassis.

This guide is intended for use by network administrators who are responsible for installing and setting up networking equipment. It assumes a basic working knowledge of Local Area Networks.

This guide also explains basic *Asynchronous Transfer Mode (ATM)* and *LAN Emulation (LANE)* concepts.

Note: See the accompanying Release Notes for last minute product updates.

User Guide, Embedded Software, Release Notes and CajunView SNMP management updates are available at Avaya Network's World Wide Web site when they are released: http://www.avayanetwork.com/

ATM Terminology

This user guide uses the term *Network-To-Network Interface (NNI)*. You may know this protocol by its alternative name, *Network-to-Node Interface (NNI)*.

Finding Information in This Guide

The following Table shows you where to find specific information within this guide.

Table P.1 Finding Information

Use	Location
Learning concepts	*Chapter 1, Overview* Features and Benefits Avaya M770 Frame Switching Domains Network Layer Concepts — LAN Emulation Network Layer Concepts — ATM & ATM Adaptation
Planning your network	*Chapter 2, Applications* Putting Your ATM Network Together ATM Configuration Rules Extending VLANs Through the ATM Network Network Configuration Examples
Installing the M-ACC ATM Access module	*Chapter 3, Installation* Installing the M-ACC Module Domain Usage Considerations Configuring the M-ACC Module Setting up the M-ACC Module
Using TELNET, Accessing screens, Logging on/off, Configuring parameters, Upgrading Software	*Chapter 4, X-Switch CLI and ATM Terminal Interface* X-Switch Command Line Interface (CLI) ATM Access Module Terminal Interface for Configuring ATM Parameters Managing and Monitoring the M-ACC Module
Network Management and Monitoring (NMS)	*Chapter 5, Network Management and Monitoring* Management of the ATM module using the CajunView M770 Device Manager and LaneMaster applications
Specifications	M-ACC Module Module Technical Specifications
Troubleshooting	Troubleshooting common problems
Subjects & concepts lookup	Contents, Index

Conventions

The following Tables list conventions that are used throughout this guide.

Table P.2 Notice Icons

Icon	Notice Type	Description
	Note	Information that describes important features or instructions
	Caution	Information that alerts you to potential loss of data or potential damage to an application, system, or device
	Warning	Information that alerts you to potential personal injury

Table P.3 Text Conventions

Convention	Description
Screen displays	This typeface represents information as it appears on the screen.
Syntax	The word “syntax” means that you must evaluate the syntax provided and then supply the appropriate values for the placeholders that appear in angle brackets.
Commands	The word “command” means that you must enter the command exactly as shown and then press Return or Enter. Commands appear in bold.
The words “enter” and “type”	When you see the word “enter” in this guide, you must type something, and then press Return or Enter. Do not press Return or Enter when an instruction simply says “type.”
Keyboard key names	If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example: Press Ctrl+Alt+Del
Words in *italics*	Italics are used to: Emphasize a point. Denote a new term at the place where it is defined in the text. Identify menu names, menu commands, and software button names. Examples: From the *Help* menu, select *Contents*. Click *OK*.

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Chapter 1

Overview

ATM Access Modules

There are two M-ACC OC-12 ATM Access modules for the Avaya M770 Multifunction switch:

- M-ACCF: 500m, Multimode fiber, can also be OC-3 reduced range
- M-ACCSF: 15 km, Single-mode fiber, can also be OC-3

The M-ACC ATM Access modules need the following S/W Versions:

- M-ACCF/SF ATM Entity S/W Version 1.8
- M-ACCF/SF X-Switch Module S/W Ver. 4.0.7
- M-SPX/M-SPS Embedded S/W 3.2.1 and higher.

Features and Benefits

This Section describes the main features of the M-ACC OC-12 module and the benefits of ATM within your network. The following topics are described:

- ATM Benefits
- ATM Access Module Features

The ATM module provides a high-speed ATM connection between your Avaya M770 X-Switch domain and the ATM network.

Positioned within a workgroup or departmental LAN, the ATM access module provides a fast ATM uplink to the building or ATM campus.

Redundant links protect your Switch from network and equipment failure, while the software upgrade feature future-proofs your Switch by allowing you to add new features as they become available.

ATM Benefits

ATM is the only technology specifically designed to carry voice, video and data traffic simultaneously and to provide the required level of service that these different applications need in order to run effectively across a network. ATM provides the following benefits:

- It is easy and of low cost to add additional services to the ATM network.
- Services can be added as and when they are needed. It is easier to scale ATM networks compared to other network technologies.
- ATM devices interoperate with your existing network. *LAN Emulation (LANE)* is a standards-based technology specifically designed to provide interoperability between existing Ethernet/Fast Ethernet networks and ATM

networks. LANE allows users to interoperate with ATM or traditional LAN based servers over ATM for higher performance and functionality.

ATM Access Module Features

The following list summarizes the ATM access module features. These features are described in more detail in this guide.

- Conforms to ATM Forum Standards
- OC-12c 622Mbps Interface
  - SONET (STS 3c/STS 12c) compliant (SDH STM-1/STM-4)
  - Multimode fiber, SC/SM connectors
  - Single-mode fiber.
- *LAN Emulation (LANE)* version 1.0
  - 16 Emulated LAN Clients
  - 3,740 Virtual Circuits
  - 8,000 remote MAC Addresses
- *User-To-Network Interface (UNI)* version 3.0 and 3.1
- *Interim Local Management Interface (ILMI)*
- AAL5 ATM Adaptation Layer
- 16 ELAN/VLAN associations (in the range from VLAN 1 to 254)
- Data buffer to store 16,000 ATM cells
- High performance with fast data transfer
  - *Wire Rate Transmission* on ATM port
- Redundant Links from two different modules protect your network against cable and equipment failure
- For Management you can use:
  - Avaya's CajunView™ SNMP Manager
  - TELNET

Avaya M770 Frame Switch Domains

The Avaya M770 supports two Frame Switches, named DomainXs: DomainXL (Left DomainX) spans slots 1-7, and DomainXR (Right DomainX) spans slots 8-14. Each DomainX supports up to 6 Gbytes of bandwidth. You can insert the M32-100T into either DomainX, provided you don't exceed the maximum of 100 Domain Resource Units (DRUs) per DomainX. Each module uses a certain number of DRUs; the M32-100T uses 12 DRUs.

M-ACC Module Architecture

The M-ACC module consists of separate X-Switch and ATM entities. The X-switch CPU connects the M-ACC module to the Avaya M770 X-Domain. The ATM CPU performs all ATM signalling. Each entity has it's own embedded software.

Network Layer Concepts — LAN Emulation

The following Sections describe the LAN emulation and ATM adaptation concepts behind the network layer architecture of a typical ATM network.
Chapter 2 describes how to plan your ATM network and provides some examples of where to use the ATM access module within an ATM network.

LAN Emulation Overview

LAN Emulation (LANE) is a method of connecting LAN users over an ATM network which enables them to communicate with each other as if they were operating over traditional LANs. LANE can be configured in an ATM network in several ways:

- To connect legacy end stations directly to other legacy systems, as well as to servers, routers, switches and other networking devices attached to the ATM network.
- To connect bridged-LAN environments to each other over ATM. In this case the Emulated LAN acts as a bridge on the ATM network.
- To connect ATM end stations to each other, enabling communication between them.

More than one emulated LAN can operate on the same ATM network. However, each of the emulated LANs is independent of the others and users cannot communicate directly across emulated LAN boundaries.

Emulated LAN Components

LAN Emulation is implemented as a set of connection services collectively called an *emulated LAN* (ELAN). Each ELAN is composed of a set of *LAN Emulation Clients* (LEC) and a single LAN Emulation Service. The latter consists of a *LAN Emulation Configuration Server* (LECS), a *LAN Emulation Server* (LES), and a *Broadcast and Unknown Server* (BUS).

LAN Emulation Client (LEC)

Each LEC is incorporated in an ATM edge device, such as the M-ACC module and represents a set of the device's LAN users to the ATM network. A LEC has a unique *LEC ID* as well as an *ATM address* by which it is known in the emulated LAN. It handles the forwarding of its LAN users' data frames over the ATM network to their destination, a task which also includes ascertaining the destination LEC address and setting up the connection between them.

Also provided is a MAC-level emulated Ethernet service interface to higher level software which implements the *LAN Emulation User to Network Interface* (LUNI).

An ELAN is assigned a name (*ELAN name*). A LEC joining an ELAN may use the ELAN name in the configuration or join phase.

LAN Emulation Server (LES)

The LES coordinates and controls an Emulated LAN. It provides the central "directory" service of an emulated LAN to which a LEC can turn to look up the ATM address of another LEC. The LES directory contains a table of LAN destinations (*LAN destination* refers to either a MAC address or a Route Descriptor) together with the ATM addresses of the LECs that represent them. In order to transmit a data frame to a particular LAN destination, the LEC sends the data frame to the LEC that represents that LAN destination. If the LEC does not already know the destination LEC's address, it can send the LAN destination to the LES to look it up (*resolve)*. To populate the LES directory, the LECs may *register* the LAN destination of LAN stations they represent with the LES. Every Route Descriptor must be registered with the LES.

The LANE Service normally resides on a central ATM switch, such as the M770 ATM Switch, but may reside on an ATM end station instead.

Broadcast and Unknown Server (BUS)

The BUS is the LANE connection service which handles ATM traffic other than direct transmissions between LECs. It handles the following:

- Data sent by a LEC to the broadcast MAC address
- All multicast traffic
- Initial unicast frames which are sent by a LEC before the data direct virtual connection to the ATM address has been resolved
- Unknown traffic
- All broadcast, multicast and unknown traffic to and from a LEC passes through a single BUS.

The BUS also handles ATM connections and manages its distribution group.

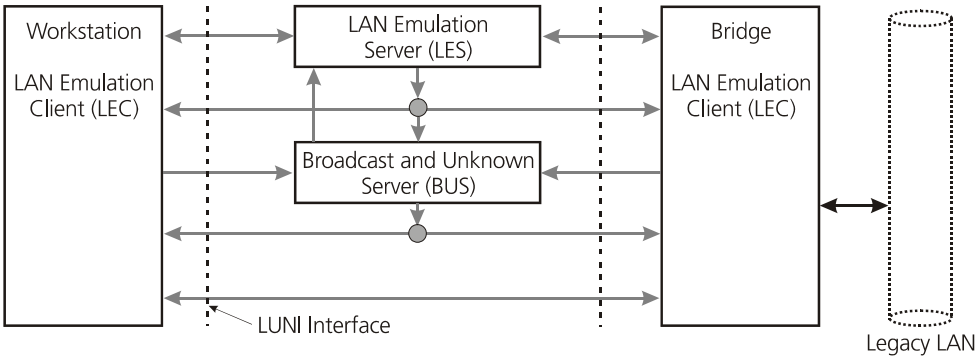
LAN Emulation Configuration Server (LECS)

The LECS assigns individual LAN Emulation Clients to different emulated LANs. Based on its own programming, configuration database and information provided by clients, it assigns any client which requests configuration information to a particular emulated LAN service by giving the client the LES's ATM address. This method supports the ability to assign a client to an emulated LAN based on either the physical location (ATM address) or the identity of a LAN destination which it is representing (ELAN name). LECs obtain information from a LECS using the configuration protocol.

Emulated LAN Connections

LECs and LESs communicate with each other by means of ATM virtual channel connections (VCCs). Control signals and data transmissions are handled by separate VCCs: Control VCCs and Data VCCs.

Figure 1.1 Basic LAN Emulation Client Connections



Control VCCs

The control VCCs carry control traffic such as LE_ARP requests and responses. On initialization, control VCCs are established between LEC and LES (bi-directional *control-direct* VCC and *control-distribute* VCC) as well as a bi-directional *configuration* VCC between LEC and LECS. Characteristics of the control VCCs are summarized in Table 1.1.

Table 1.1 Control VCCs

VCC Name	From/To	Information carried	Initialized by	Duration
Configuration	LEC<==>LECS	LEC requests and receives configuration information from LECS, including LES address	LEC	While needed
Control-direct	LEC<==>LES	LEC sends and receives controls from LES, including LE_ARP information	LEC	Membership of LEC in ELAN

Table 1.1 Control VCCs (Continued)

VCC Name	From/To	Information carried	Initialized by	Duration
Control-distribute	LES==>LEC	LES distributes control traffic to LECs, including LE_ARP information	LES	Membership of LEC in ELAN

Data VCCs

Data VCCs carry data frames between LECs and between a LEC and the BUS. Unicast data is normally sent from one LEC to another LEC by *data-direct* VCCs. Data direct VCCs are set up dynamically in a SVC environment by a transmitting LEC after ascertaining the ATM LEC destination address for the packet to be transmitted. Once established, a data-direct VCC remains in place for transmission of subsequent traffic between the two LECs. However, a data direct VCC that remains unused for *VCC-Timeout-period* is released by the LEC.

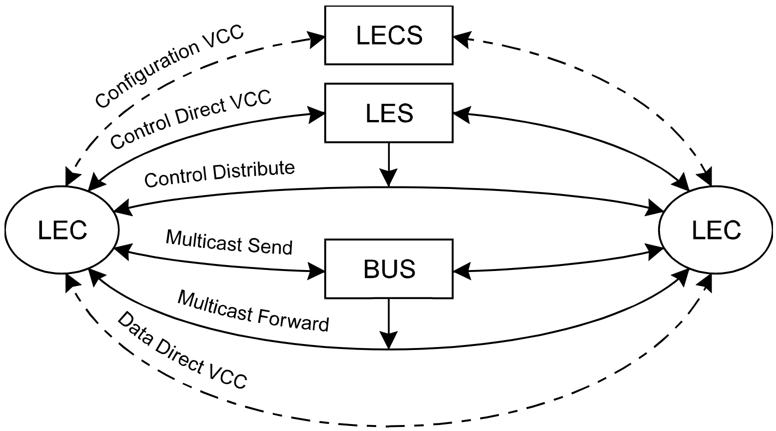
A multicast data VCC pair (*multicast-send* and *multicast-forward*) are established between a LEC and the BUS in order to allow the LEC to send and receive multicast data. In addition, *initial* unicast data (data whose LEC destination has not yet been ascertained by the transmitting LEC) is sent on the multicast-send VCC to the BUS which forwards it to all other LECs in the same ELAN. Characteristics of the data VCCs are summarized in the following table:

Table 1.2 Data VCCs

VCC Name	From/To	Information carried	Initialized by	Duration
Data-direct	LEC<==>LEC	Point-to-point Unicast data between LECs	LEC	Established by need and released when unused for VCC-Timeout-period.
Multicast-send	LEC<==>BUS	LEC sends multicast and initial unicast data to BUS	LEC	Membership of LEC in ELAN.
Multicast-forward	BUS==>LEC	BUS distributes data traffic to LECs	BUS	Membership of LEC in ELAN.

Figure 1.2 illustrates the VCCs active among LAN Emulation Components.

Figure 1.2 VCCs in LAN Emulation Components



LECS - LAN Emulation Configuration Server
LES - LAN Emulation Server
LEC - LAN Emulation Client
BUS - Broadcast and Unknown Server

Frame Ordering

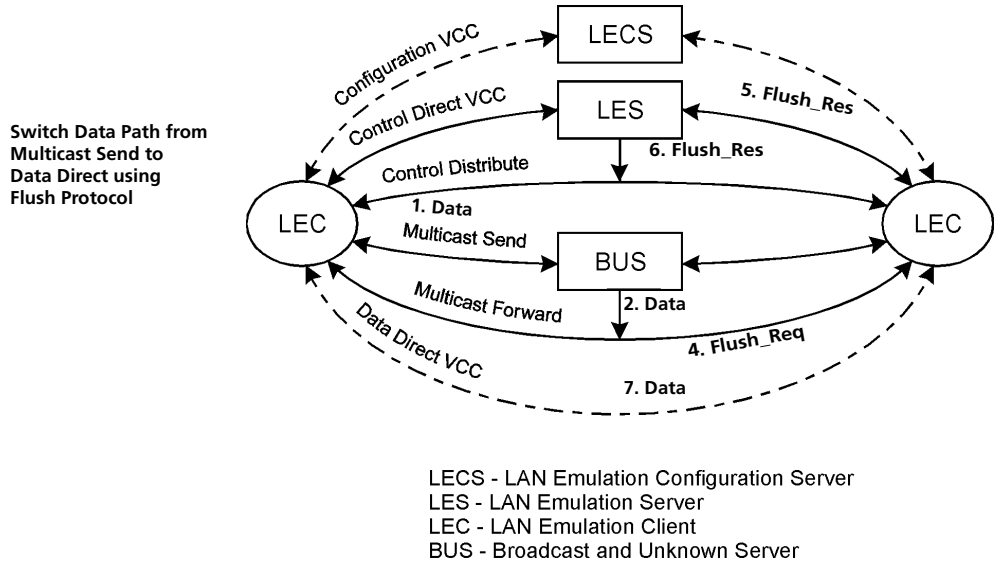
There are two paths for unicast frames between a sending LAN Emulation Client and a receiving client: one via the BUS and one via a data direct VCC between them. For a given LAN destination, a sending client is expected to use only one path at a time, but the choice of paths may change over time. Switching between those paths introduces the possibility that frames may be delivered to the receiving client out of order. Delivery of out-of-order frames between two LAN endpoints is uncharacteristic of LANs, and undesirable in an ATM emulated LAN. The flush protocol ensures the correct order of delivery of unicast data frames.

Flush Protocol

When switching between paths, the sender first transmits a flush message down the old path and suspends further transmission to that LAN destination. When the flush message is returned by the receiving client (via control VCCs), the sender knows that all previous messages for that LAN destination have been processed and it can start using the new path.

Figure 1.3 shows the various stages of the flush protocol:

Figure 1.3 The Flush Protocol.



Operation of the LAN Emulation

The following functions are performed by the LAN Emulation. The LAN Emulation Clients (LEC) and the LAN Emulation Servers interact by way of a well-defined interface (LUNI).

- Connecting a LEC to an ELAN
- Address Registration
- Address Resolution
- Data Transfer

Connecting a LEC to an ELAN

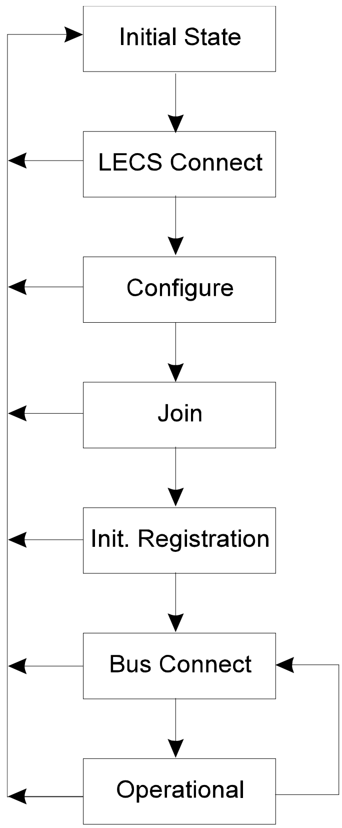
The connection function of the LEC with the LAN Emulation Server (LES) includes the following:

- LECS connect phase in which a LEC establishes a configuration data-direct VCC to the LECS (optional).
- The configuration phase in which the LEC discovers the LES.
- The join phase in which the LEC establishes its control connections to the LES. The LEC may also implicitly register one MAC address with the LES.
- The registering by the LAN Emulation Client of any number of MAC addresses and/or route descriptors.
- The establishment of a connection to the BUS by the LAN Emulation Client.

The LECS Connect and Configuration phases may be bypassed for certain applications. The Registration phase may also be bypassed if the LEC performs required address registration during the Join phase.

The Processes connecting the LEC to the ELAN are shown in Figure 1.4.

Figure 1.4 Connection Processes of the LEC to LANE Server



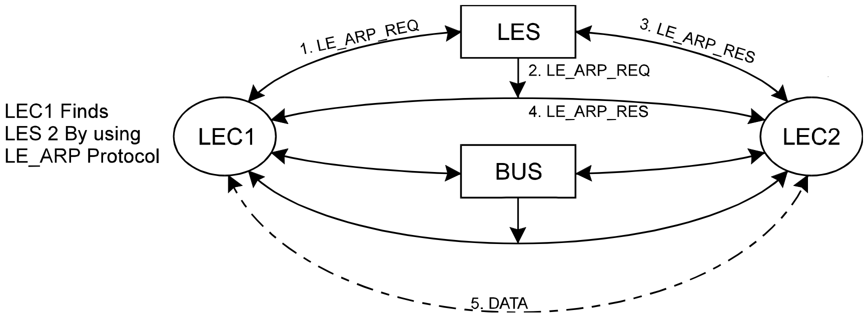
Registration

The address registration function is the mechanism by which LECs provide address information to the LAN Emulation Server. The LAN destinations may also be unregistered as the state of the client changes. A client must either register all LAN destinations for which it is responsible or join as a proxy to other MAC addresses.

Address Resolution

Address resolution is the procedure by which a LEC associates a LAN destination with the ATM address of another LEC or the BUS. Address resolution allows clients to set up data direct VCCs to carry frames (refer to Figure 1.5).

Figure 1.5 Address Resolution



Connection Management

In Switched Virtual Connection (SVC) environments, the LAN Emulation entities (LEC, LES and BUS) set up connections between each other using UNI signaling.

LAN Emulation Components in Your Network

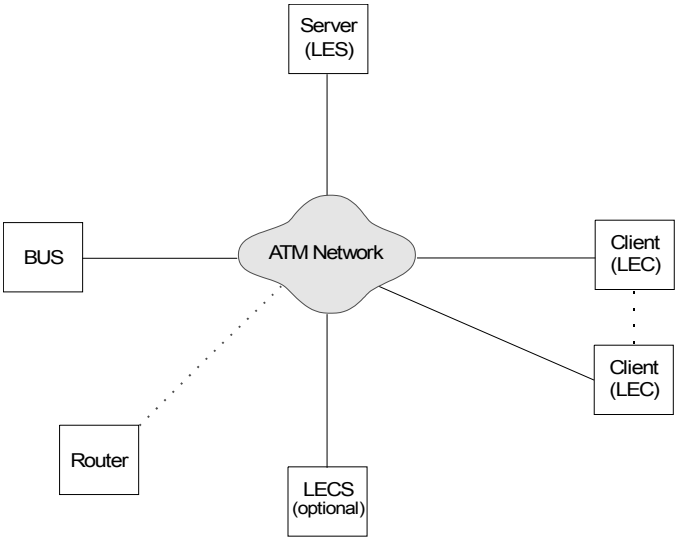
Each Emulated LAN consists of a single *LANE Service*, and a number of LAN Emulation clients.

A LANE Service consists of:

- A *LAN Emulation Server (LES)*
- A *Broadcast and Unknown Server (BUS)*
- Optional *LAN Emulation Configuration Server (LECS)*.

Figure 1.6 shows a logical view of a typical ELAN.

Figure 1.6 LAN Emulation Components



Note: The router shown in Figure 1.6 is not a LAN Emulation component, but would be required should a device on one Emulated LAN need to communicate with a device on another Emulated LAN.

LAN Emulation and Avaya Devices

LAN Emulation components are implemented in ATM devices. The LAN Emulation standards do not specify how each vendor implements each of these components.

Avaya provides a wide range of ATM equipment, and the following example is just one way in which you can implement an Emulated LAN using Avaya devices.

An Example:

- The Avaya M770 ATM switch incorporates the BUS, LES and LECS components. These components are known collectively as *LANE Services*.
- The M-ACC module has 16 LAN Emulation Clients (LECs); one for each of the *Virtual LANs (VLANs)* supported by the module.

Joining the ELAN

Before a LAN Emulation Client (LEC) can transmit any Ethernet frames onto the ATM network it must first join an ELAN. To join the ELAN:

1 **The LEC must know the name of the ELAN it is to join.**
The ELAN name is specified through the management software on the Switch.

2 **The LEC must communicate with the LAN Emulation Server (LES) that is serving that ELAN.**
To communicate with the LES, the LEC must first locate the LES. The LEC can find the ATM address of the LES in one of the following ways:
— If there is a LAN Emulation Configuration Server (LECS) on the network, the LEC gets the address of the LES from the LECS.
— The way in which the LECS determines which LES the LEC needs to communicate with, depends on the *policy* that the LECS is running. Refer to the user guide that accompanies your LECS for more details of the policies your LECS uses.
— If the network does not have a LECS, the LEC gets the LES address from the management software on the ATM device.

3 **The LEC must have a connection to the Broadcast and Unknown Server (BUS).**
When the LEC has joined the LES, the LES helps the LEC locate the *Broadcast and Unknown Server* (BUS) associated with that ELAN.

Locating the LECS

Before the LEC can ask the LECS for the address of the LES, the LEC must first locate the LECS as follows:

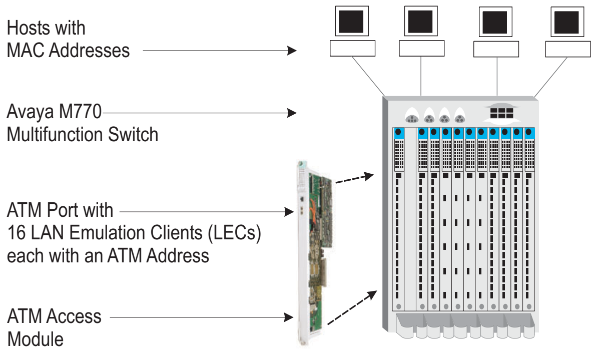
- The LEC can use a well known ATM address that is reserved for the LECS. The well known address is pre-programmed into most LECS devices. The well known address is: 47.00.79.00.00.00.00.00.00.00.00.00.00.A0.3E.00.00.01.00

Mapping Ethernet and ATM Addresses

Each device connected to an Ethernet port has one or more MAC addresses.

Each ATM device has a number of LAN Emulation clients, and each *LAN Emulation Client (LEC)* has an ATM address. An example of this is shown in Figure 1.7.

Figure 1.7 LAN Emulation Clients and Ethernet Hosts



These clients represent (act as a proxy for) devices connected to the Ethernet ports.

Whenever an Ethernet device wants to communicate with another device over the ATM network, the LEC must first discover the ATM address of the LEC that is acting as a proxy for the destination MAC address. The LEC must do this for each unicast Ethernet frame sent. The process is known as *Address Resolution.*

Address Resolution

The process by which a LEC associates a LAN destination address with the ATM address of another LEC (or the BUS) is known as *Address Resolution*.

Each LEC keeps a LAN Emulation *ARP Table* (which should not to be confused with the IP ARP Table). The ARP Table lists the remote destination MAC addresses and the ATM address of the LEC through which each destination MAC address can be reached.

Prior to sending a frame with a known destination, the LEC checks the ARP Table to see if the destination MAC address of the frame is listed in the ARP Table. The action the LEC then takes depends on whether the MAC address is listed in the ARP Table:

- **If the destination MAC address is listed in the ARP Table:**
  - — and there is an ATM connection to that LEC, the frame is sent directly to that LEC.
  - — and an ATM connection has not already been set up, the LEC sets up an ATM connection.
- **If the destination MAC address is not listed in the ARP Table:** the LEC sends the frame to the BUS. The BUS then sends the frame to all LECs on the Emulated LAN.

Sending a frame to every LEC is an inefficient use of resources, so the LEC also tries to locate the MAC address for future use.

To discover the correct address, the LEC uses a process called *LAN Emulation Address Resolution Protocol (LE_ARP)*.

LAN Emulation Address Resolution Protocol (LE_ARP)

An LE_ARP request is sent to the LES to locate the destination MAC address. The LES in turn sends the LE_ARP request to all of the LECs in the Emulated LAN.

LECs represent (act as a proxy for) MAC address devices connected to the Ethernet ports. When a LEC receives an LE_ARP request it checks whether the MAC address is on its Switch. It does this by checking the entries in the Switch database.

If the MAC address belongs to one of the devices connected to an Ethernet port, the LEC sends an LE_ARP response to the LEC that sent the original LE_ARP request.

The LEC that sent the LE_ARP request adds this information to its ARP Table. The LEC then sets up a direct connection through the ATM network to the appropriate LEC, so that subsequent frames are forwarded more efficiently.

What Happens to Unicast Frames?

The path a unicast frame takes through the ATM network depends on whether the location of the destination address is known to the sending LEC.

- **If the location of the destination address is known**, the LEC sets up a direct connection to the LEC serving the destination address.
- **If the location of the destination address is unknown**, a unicast frame is sent to the *Broadcast and Unknown Server (BUS)*; where it is treated in the same way as a broadcast or multicast frame.

In addition the sending LEC attempts to locate the LEC serving the destination address. It does this using the LE_ARP process, described in "LAN Emulation Address Resolution Protocol (LE_ARP)".

What Happens to Broadcast and Multicast Frames?

Each *Emulated LAN (ELAN)* acts as a broadcast domain. When a broadcast or multicast frame is passed to the LEC for transmission, the frame is sent to the *Broadcast and Unknown Server (BUS)*.

When the LEC receives a broadcast, multicast, or unicast frame it checks to see if it originally sent the frame, and then does the following:

- If the LEC sent the frame, it discards the frame.
- If the LEC did not send the frame, the LEC passes the frame to the Ethernet device so that it can be forwarded to the appropriate port(s)

Note: Unlike broadcast and multicast frames, the number of unicast frames that can be sent to the BUS every second is limited so as not to overload the BUS and LECs with too much traffic.

Network Layer Concepts — ATM & ATM Adaptation

This Section describes the following concepts behind the network layer architecture of a typical ATM network:

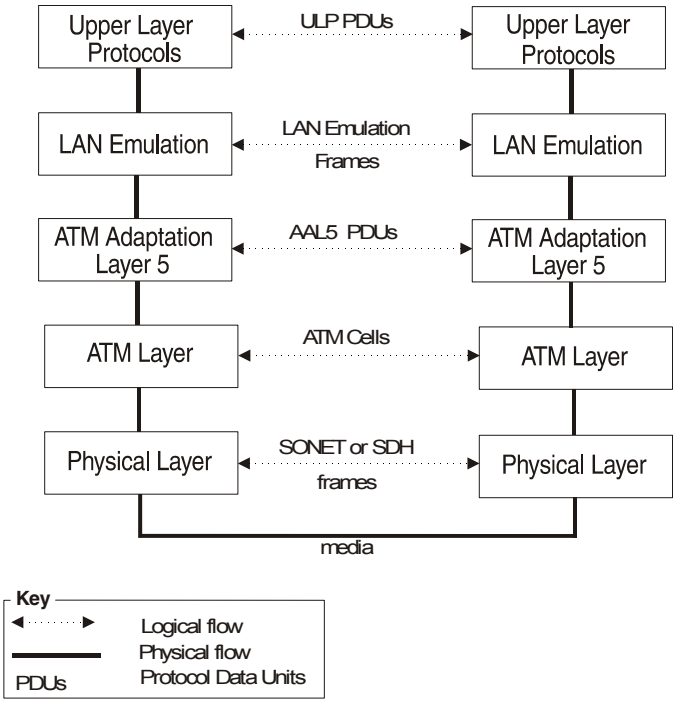
- The Layered Network Architecture
- ATM Adaptation Layer (AAL)
- Asynchronous Transfer Mode (ATM) Layer
- Physical Layer

The Layered Network Architecture

Asynchronous Transfer Mode (ATM) is one part of the layered network architecture. This architecture is shown in Figure 1.8.

Each of the layers is discussed in turn; starting with the Upper Layer and working down to the Physical Layer.

Figure 1.8 Network Layer Architecture



ATM Adaptation Layer (AAL)

Ethernet frames can be between 64 and 1514 bytes in length. ATM transmits data in fixed length *cells*. Each cell contains 48 bytes of user data. The *ATM Adaptation Layer (AAL)* converts data between the Ethernet and ATM formats.

The AAL has a *Segmentation and Reassembly (SAR)* sub-layer that does the conversion.

In the sending device the LEC passes the Ethernet frames to the SAR. The SAR converts the user data into fixed length cells, and passes these cells to the ATM Layer for transmission across the ATM network.

In the receiving device, the SAR converts the ATM cells back into the appropriate user data again, and passes this data to the LEC.

As ATM can carry different traffic types (for example, voice, video, and other data), several Adaptation Layer protocols have been defined. These protocols operate simultaneously within the Adaptation Layer, and allow the ATM Layer to support different applications and traffic types.

Note: The M-ACC module uses the AAL5 ATM Adaptation Layer protocol, which is a data-oriented protocol. The ATM access module will only work with other devices using the AAL5 ATM adaptation layer protocol.

Asynchronous Transfer Mode (ATM) Layer

Asynchronous Transfer Mode (ATM) is a connection-oriented transmission protocol that has the following features:

- ATM uses the *Signalling Protocol (Q.2931)* to dynamically create, maintain and clear ATM connections between end-systems.
- ATM uses fixed length packets known as *cells*, and each cell identifies the connection to be used.
- ATM is transparent to the multiple services it supports and can carry cells from different applications over the same physical connection.
- ATM has well-defined user and network interfaces.

ATM Basics

Asynchronous Transfer Mode (ATM) technology transfers network traffic, including voice, video, and data, at high speed. Using this connection-oriented networking technology, centered by a switch, you can set up a great number of virtual connections to support multiple applications through the same physical connection. The switching technology enables dedicated bandwidth for each application, overcoming the problems that exist in a shared-media networking technology, like Ethernet, Token Ring, and FDDI. ATM allows different types of

physical layer technology to share the same higher layer — the ATM layer.

ATM uses fixed length packets called *cells*. The ATM cell is defined as 48 bytes of payload and 5 bytes of header information totaling 53 bytes. The header contains enough information to allow the network to forward each cell to its proper destination. The cell header also provides the network with the ability to implement congestion control and traffic management mechanisms.

ATM advantages include the fact that:

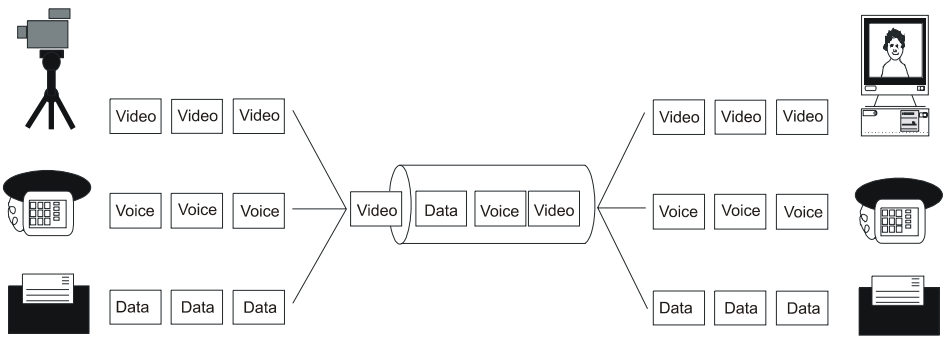
- Fixed-length cells offer smaller and more predictable switching delays, because cell switching is less complex than variable-length packet switching.
- Having all the data in the same cell format also dramatically increases the speed of transmission, by eliminating the need for protocol recognition and decoding. A good analogy is containerized shipping, where uniform shape and weight containers with standardized labelling, ease and speed up processing.
- Cell switching is less complex and more reliable. ATM hardware can be implemented more efficiently because control structures, buffers, and buffer management schemes can be designed to known size criteria.
- Cell-relay switches can process cells in parallel, achieving speeds that far exceed the limitations of packet switch architectures.
- The cell format also allows for multi-protocol transmissions. Since ATM is protocol transparent, the various protocols can be transferred at the same time. With ATM, one line can carry phone, fax, video, data and other information simultaneously. This multiprotocol advantage also offers scalability, greatly reducing the configuration changes necessary for adding a new traffic type to your network.

ATM is Service Transparent

ATM allows for the high speed transfer of a wide range of user traffic, including voice, video and other data.

The cell format means that more than one service (traffic type) can be *multiplexed* over the same physical line, see Figure 1.9.

Figure 1.9 Service Processing



Cells are *de-multiplexed* at the other end of the connection and forwarded to the correct service destination.

Multi-service processing promotes scalability by significantly reducing the number of changes needed to add new service traffic types to your network.

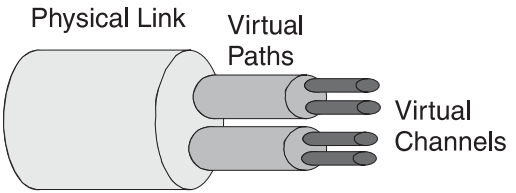
ATM is Connection-Oriented

ATM is a *connection-oriented* transport service that requires a communication channel to be set up between the ATM source and destination end-systems before ATM cells can pass between them.

Note: Before a direct data connection can be set up between two end-systems, a number of control connections are set up. These control connections are beyond the scope of this guide. If you require further information about control connections, refer to the ATM Forum's "LAN Emulation Over ATM" document.

Figure 1.10 shows the logical structure of a communication channel.

Figure 1.10 Communication Channels

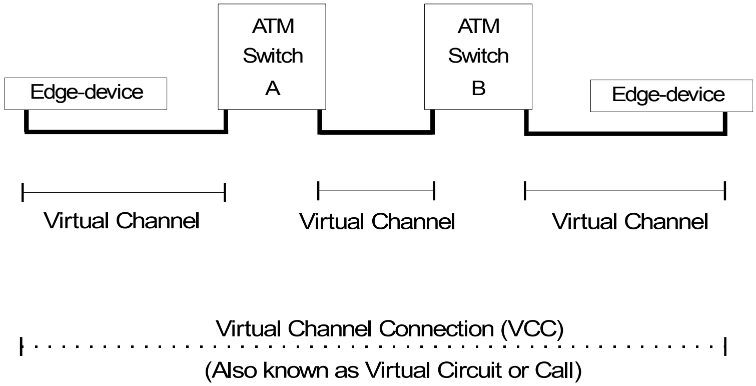


Several communication channels can operate over the same physical link. Each *Virtual Path Connection (VPC)* contains several communication channels known as *Virtual Channel Connections (VCCs)*.

Note: The ATM access module only manages Virtual Channel Connections (VCC).

A VCC is defined as spanning end-to-end, whereas a *Virtual Channel (VC)* is the name given to a section of the VCC, refer to Figure 1.11.

Figure 1.11 Connection Terminology



Many virtual channels can exist on the same physical link. Each virtual channel is identified by a pair of numbers:

- The *Virtual Path Identifier (VPI)* and
- The *Virtual Channel Identifier (VCI)*.

Any end-system that wishes to communicate with another end-system must first use the *Signalling* protocol to set up the VCC.

The *Signalling* protocol negotiates with each ATM device between the end-systems to set up a series of virtual channels. Each of these virtual channels is identified using the VPI and VCI values.

Figure 1.12 shows how ATM cells are switched through an ATM network with Legacy Avaya Edge Devices.

Instead of containing the ATM address of the final destination device, each cell header contains the VPI/VCI values associated with the virtual channel it is going to take to get to the next ATM Switch in the connection.

Each ATM switch knows that when it receives a cell with a particular VPI/VCI value on one port that it must transmit the cell on another port with another VPI/VCI.

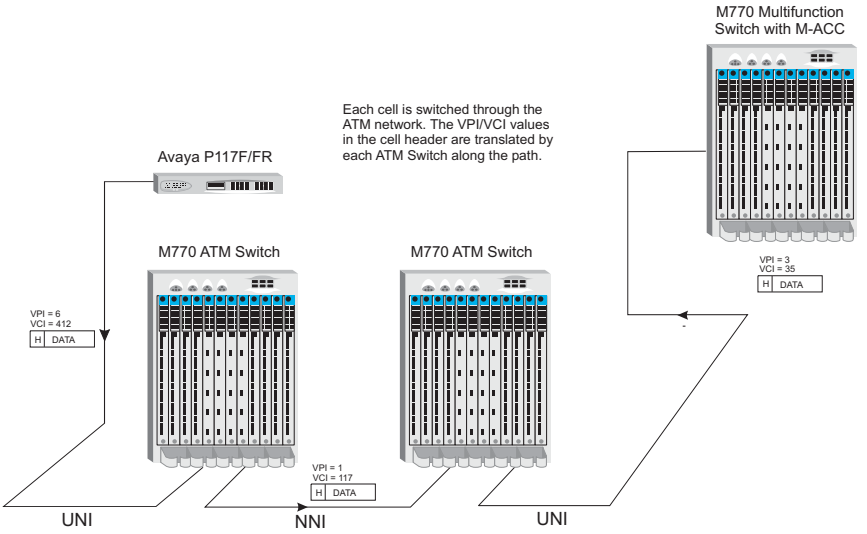
Cells are switched through the network based on these VPI/VCI values, and switching is performed independently for every cell. Each cell can be thought of as taking a virtual channel connection.

Note: The VPI/VCI values are only meaningful in the context of that user-to-switch, or switch-to-switch, interface. Identical VPI/VCI values can exist on different interfaces within the network.

Connections that are established dynamically using the Signalling protocol are known as *Switched Virtual Circuits (SVCs)*. *Switched Virtual Circuits* are described on Page 20.

ATM connections can also be established via management, and these type of connections are known as *Permanent Virtual Circuits (PVCs)*.

Figure 1.12 Switching Cells Using VPI and VCI Values



Switched Virtual Circuits (SVCs)

SVCs use the signalling protocol to dynamically define connections as they are needed and to release them when they are no longer needed.

SVCs use signalling for:

- Connections initiated by the user/application.
- Connections established and dropped dynamically.
- Varied connection time.
- Connections not automatically re-established after network failure.

Note: The ATM access module does not support PVCs.

ATM Interfaces

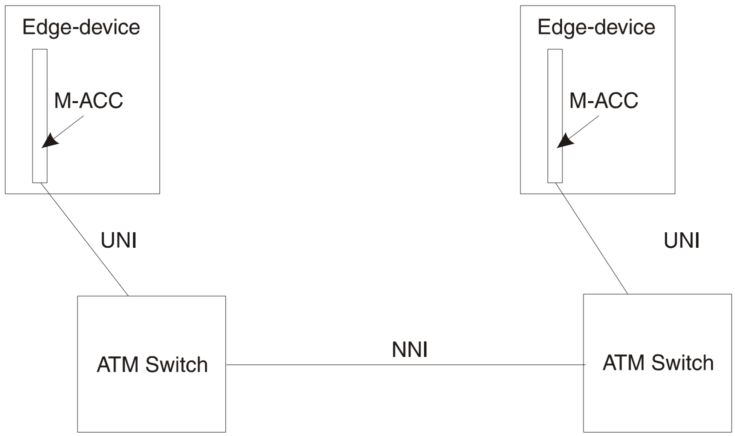
ATM technology is implemented in ATM edge-devices and ATM Switches.

ATM provides a *User-to-Network Interface* (UNI). The User-to-Network Interface (UNI) is used to connect an ATM edge device to an ATM switch that is managed as part of the same network.

ATM also provides a *Network-to-Network Interface (NNI)* that is typically used to interconnect two ATM switches managed as part of the same network.

The ATM Interfaces are shown in Figure 1.13.

Figure 1.13 ATM Interfaces



The User-to-Network Interface (UNI) is managed by the *Interim Local Management Interface (ILMI)* protocol.

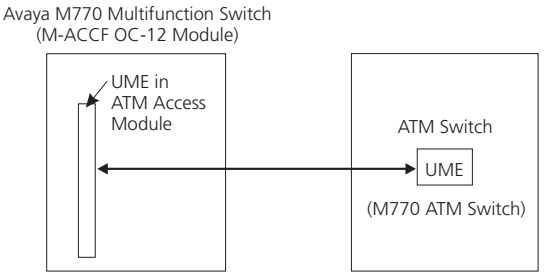
Interim Local Management Interface (ILMI)

The ATM Forum produced the *Interim Local Management Interface (ILMI)* to increase monitoring and diagnostic facilities, and to provide ATM address registration at the *User-to-Network Interface (UNI)*.

ILMI uses a *Management Information Base (MIB)* and the *SNMP* protocol.

Each device that provides ILMI support contains a *UNI Management Entity (UME)*, which uses SNMP to access management information stored in the ILMI MIB of the adjacent switch, see Figure 1.14.

Figure 1.14 UNI Management Entities



ATM Address Registration

In order to establish an ATM connection, both the user and the network must know the ATM addresses used at that *User-to-Network Interface (UNI).* An example of an ATM address is shown below.

47.00.79.00.00.00.00.00.00.00.00.00.00.A0.3E.00.00.01.00

An ATM address consists of three sections of information and is 20 bytes in length:

network:host:identifier

Where **network** is a network prefix assigned to the device by the ATM Switch, and is 13 bytes long.

Where **host** is the edge-device identifier, and is 6 bytes long.

Where **identifier** identifies the client within the edge-device, and is 1 byte long.

ILMI provides a mechanism for the edge-device (in this case the ATM access module) to inform the ATM Switch of the addresses it represents.

When the ATM access module initializes, the ATM Switch sends a network prefix to the module. The module then tries to register itself with the ATM Switch by attaching the prefix to the front of its MAC address, and an identifier to the end of the address. It then sends this back to the ATM switch. If acceptable, the ATM Switch registers the address as the ATM Module's ATM address.

The ATM Layer and Cell Structure

This section describes the cell structure, and how the ATM Layer uses the information stored in the cell header to perform each of its tasks.

The ATM Layer's primary responsibility is to manage the sending and receiving of cells between the user and the network.

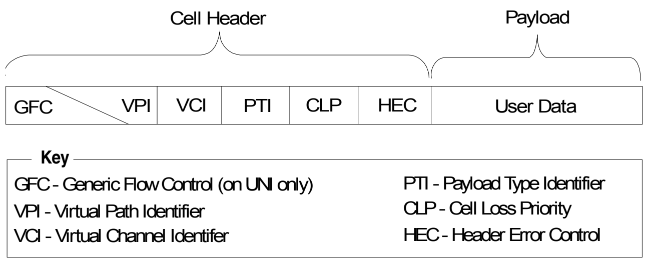
The ATM Layer accepts the user data and control information from the ATM Adaptation Layer, adds the cell header, and passes the resulting 53 byte cell to the physical layer.

In addition, it also receives cells from the physical layer, strips off the cell header and passes the remaining 48 bytes to the higher layer protocols.

The ATM cell has 48 bytes of payload (information to be carried) and five bytes of header information, making the cell 53 bytes in length.

The cell header contains the information used by the network to forward each cell to its destination. The ATM cell structure is shown in Figure 1.15.

Figure 1.15 ATM Cell Structure



The ATM cell header consists of the following fields:

Generic Flow Control (GFC) — Provides local functions, such as flow control over the *User-to Network Interface (UNI)*. The value encoded in the GFC is not carried end-to-end and can be overwritten by the ATM Switch.

Virtual Path Identifier (VPI) and **Virtual Channel Identifier (VCI) —** The VPI/ VCI values allow the network to associate a cell with a given connection, so that the cell can be switched to its destination.

Payload Type Identifier (PTI) — The PTI is used to indicate whether the cell contains user information, or management information. The management information is used for resource and network congestion management.

Cell Loss Priority (CLP) — The purpose of the *Cell Loss Priority (CLP)* bit in the ATM cell is to indicate that cells with this bit set should be discarded before cells which do not have the CLP bit set. Cells can be discarded based on CLP condition and according to the network load. When the network overloads, a discard mechanism, based on the value of the CLP bit in the cell header, may come into operation.

Header Error Check (HEC) — The HEC field is used for detecting bit errors in the cell header. It is also used for cell delineation, defining where the cell begins in a SONET frame.

Physical Layer

The physical layer is responsible for transmitting and receiving ATM cells over a physical medium. It is also responsible for checking the integrity of the bits being transferred over a physical media, and for making sure that they are error-free.

The ATM access module is compliant with both *SONET STS-3c* and *SDH STM-1* physical layer standards.

These standards are similar, and most devices allow you to use either framing standard on each link in the ATM network.The same framing standard must be used at each end of the link.

Many users prefer to use the same framing standard throughout their network (for example SONET STS-3c).

The physical layer is sub-divided into:

- **Path** — SONET and SDH are capable of carrying traffic for a number of upper layers, and ATM is only one of those layers. Each upper layer uses its own *Path* through the SONET/SDH layer.
- **Line** — A *line* is the whole path between one ATM device and the adjacent ATM switch or ATM end-station.

Extending VLANs into the ATM Network

You can use LAN Emulation to define and extend VLANs seamlessly through the ATM network, as shown in the example in Figure 1.17.

Traffic from one *Emulated LAN (ELAN)* is not seen on another ELAN as they are logically separate domains. For this reason, when you plan your network, you should consider what ELANs you require, and how the VLANs will map to these ELANs.

The ATM access module has a LEC for each of the Switch's 16 VLANS, and each VLAN/LEC can be mapped onto an *ELAN*. In this way, Ethernet traffic is mapped to an ELAN by a VLAN-to-LEC association. The mapping of VLANs to ELANs is shown in Figure 1.16.

When an Ethernet device attached to a Switch generates traffic, the Switch forwards the frames to the appropriate port.

A unicast frame is only forwarded to a port if the address of the destination device is known to be on that port and the destination port is in the same VLAN as the source port. If a unicast frame is forwarded to the ATM port, the ATM port uses the destination MAC address to identify the ATM connection to use.

A broadcast or multicast frame is forwarded to all ports in the same VLAN as the source port. If a frame is received by the ATM port, the ATM port forwards it to the BUS for the associated VLAN.

Note: ELAN-to-VLAN and VLAN-to-ELAN mapping is only one-to-one. Unassociated packets/cells are discarded.

Figure 1.16 VLAN to ELAN Mapping

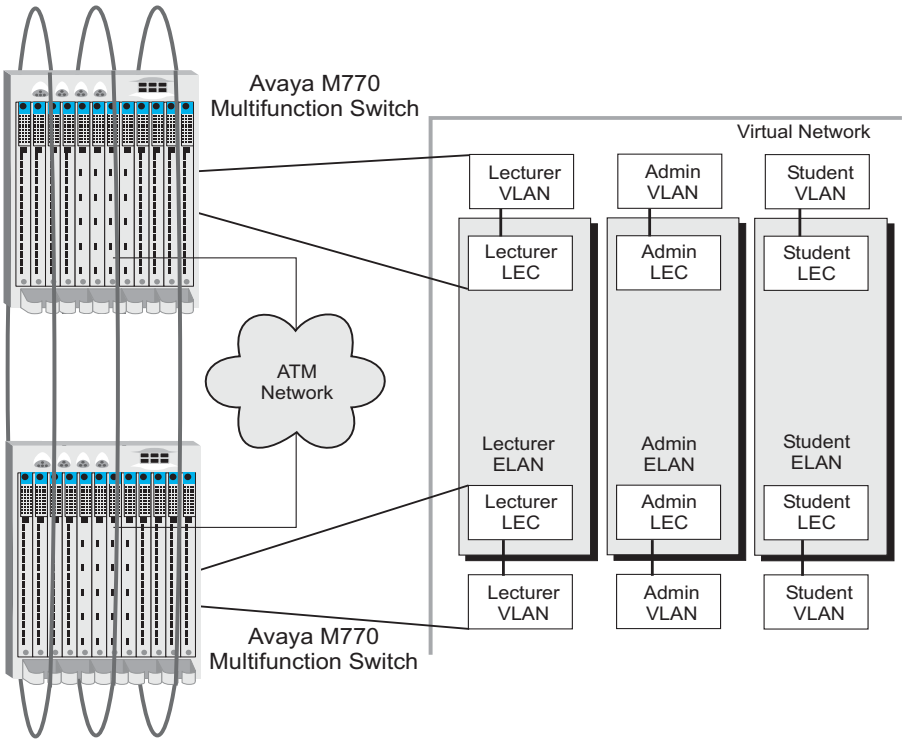
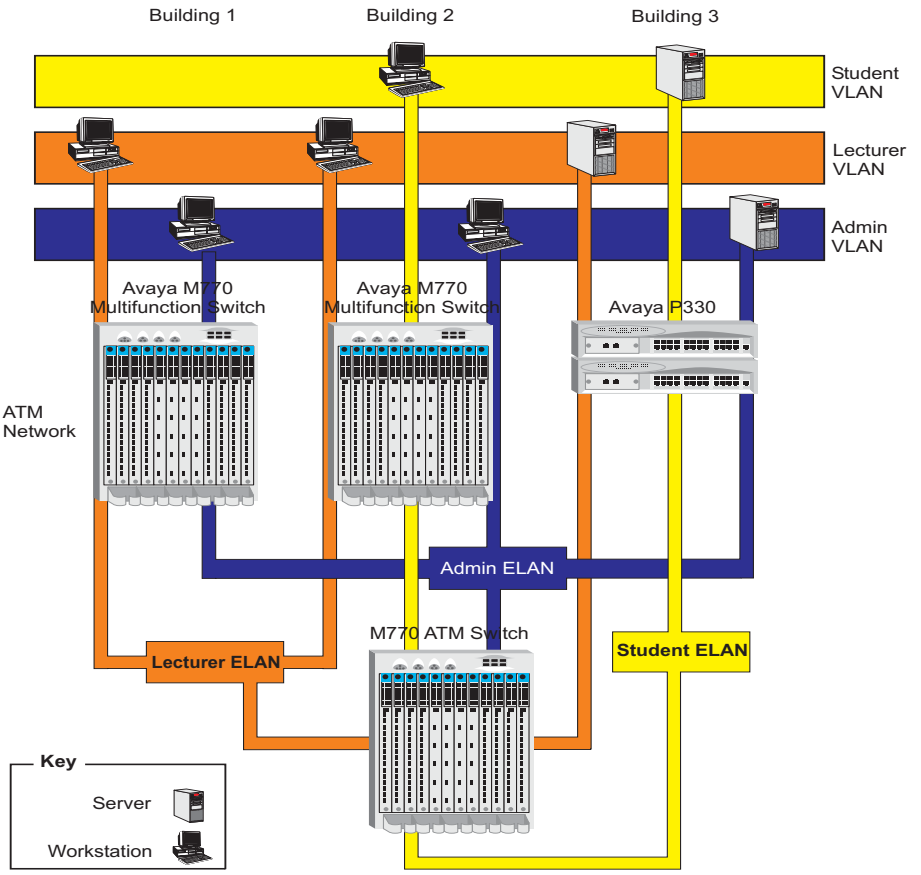


Figure 1.17 Extending VLANs into the ATM Network.



Applications

Putting Your ATM Network Together

This Section takes you through the process of planning your network. Topics include:

- Planning Your Network
- ATM Configuration Rules
- Extending VLANs Through the ATM Network
- ATM Connections Within Your Network.

Planning Your Network

Before installing your ATM devices you should spend some time planning your network structure. This section lists some of the points you should consider.

- **Are routes defined within your ATM network so that your ATM devices can connect to your LAN Emulation services?**
  Examine your existing network topology and decide if further configuration is required. In particular, you should consider the location of your LAN Emulation services.
- **Does your existing ATM network have sufficient resources?**
  Consider the capacity of:
  — Your ATM Switches, and the number of additional connections your ATM device requires.
  — Your LAN Emulation services, and the number of additional *LAN Emulation Clients (LECs)* your ATM edge-device will attempt to join.
- **Can your ATM devices communicate with each other?**
  — Ensure that all of your ATM equipment is using the same line framing and signalling protocols.
  — Ensure that all inter-switch routes are configured correctly.
- **How do you intend to manage the ATM network?**
  Can the network manager communicate with the ATM devices you wish to manage? Check the routing tables.
- **Does your network meet safety specifications?**
  You should always follow safety requirements and ensure that your device environment meets all technical specifications.

Note: For the ATM access module these requirements are specified in Appendix A, Specifications. For other devices, refer to the user guides that accompany those devices.

- **Does your network conform to the ATM configuration rules?**
  Ensure that your network meets the configuration rules described below.

ATM Configuration Rules

There are several things that you should consider before configuring your network:

- **Your cables and equipment must meet all of the technical specifications.**
  The ATM cable you connect to the ATM access module, must conform to the Single-mode Fiber IEC 793-2 and ANSI/TIA/EIA-492CAAA and Multimode Fiber (MMF-PMD) standards defined by ANSI x.3-166-1992.
  Avaya supports two cable technologies - optical and SDH- and design-performances of two types of fiber cable, Single-mode and Multimode.
  - 9 µm Single-mode fiber (SMF) cable. The maximum inter-station distance (including device-to-network connectors) should not exceed 15 km (9.32 miles).
  - supports 62.5/125mm multi-mode fiber (MMF-PMD) cable. The maximum inter-station distance (including device-to-network connectors) should not exceed 500 m (0.31 miles).
- **Allow for attenuation (weakening of signal) when calculating cable lengths.**
- **Ensure that you have sufficient bandwidth.**
  See Appendix A, for more details.

Note: You cannot connect one M-ACC module to another; this is due to the signalling requirements used by ATM and LANE. There must be a standards-based ATM Switch between the two ATM access modules for them to operate correctly.

Warning: You can make a maximum of 16 ELAN-to-VLAN associations per M-ACC ATM Access module (in the range VLAN 1 to 254 only). When you add another M-ACC module to an Avaya M770 domain you can add more associations, however you must ensure that you do **not** make the same associations twice since this will result in a loop. You *can* use the redundancy feature in which case all the associations should be the same. You cannot change or delete the default ELAN-to-VLAN association (Default ELAN associated to VLAN 1) but only Enable/Disable it.

Extending VLANs Through the ATM Network

When setting up VLANs and extending them into the ATM network you should consider the following (see Figure 1.17):

- **What logical network domains, VLANs, do you wish to set up?**
  Traffic from one *Emulated LAN (ELAN)* will not be seen on another ELAN (unless a router is used), as they are logically separate domains. For this reason you should consider:
  — What ELANs you require.
  — How the VLANs will map to the ELANs.
  — If you need to route between any of your ELANs.
- **Will you have sufficient ELAN resources?**
  When calculating the resources you require, you should consider the number of:
  — ELANs that your LAN Emulation services can support.
  — VLANs/ELANs that each edge-device can support.
  — Virtual circuits required.
  — MAC addresses that can be held in the device LAN Emulation ARP Table.
  When a *LAN Emulation Client (LEC)* joins an ELAN, up to five control connections may be required before any data is transferred over a separate data connection (VCC). Each time a LEC connects to another LEC a further connection is required. You should keep this in mind when calculating the number of connections you require.
  The ATM access module provides the following resources:
  — Up to 16 LECs to extend VLANs into the ATM network over ELANs.
  — 3740 Virtual Circuits to/from the ATM network.
  — 8000 remote MAC Addresses.

Note: The ATM access module supports only 16 LECs, but this does not limit your network to 16 ELANs. You can expand your network by adding additional ATM access modules to the Avaya M770 Switch or by configuring additional LECS to other ELANs.

- **Are the LAN Emulation services configured correctly?**
  Is the LAN Emulation service that the *LAN Emulation Client (LEC)* is going to join configured correctly?
  For example, if your network uses a *LAN Emulation Client Server (LECS)*, does the LECS know about the LES, and is the LES active? Have you supplied a valid ELAN name?

Note: Configuring the LECS and LES is outside of the scope of this user guide. Consult the user guide that accompanies the device implementing the LECS or LES.

Alternatively, if your LEC will not be using a LECS and is being configured manually, ensure that:

— The LES address that the LEC is using has been correctly entered via the local management screens.

— The LES is active.

For the ATM access module, you can enter settings using the Port Configuration screen described in the Section Configuring an ATM Port [2]65.

ATM Connections Within Your Network

ATM connections in your ATM network can be established dynamically by the *Signalling* protocol (*Switched Virtual Circuit*).

Note: The ATM access module does not support PVC connections. All ATM access module connections are SVCs. This network concepts section includes PVC configuration concepts for completeness.

- **Switched Virtual Circuits (SVC)** — SVCs are set up dynamically by the signalling protocol. SVCs require very little configuration, and only use the resources you need. For these reasons, SVCs are commonly used in the LAN environment.

Network Configuration Examples

This Section provides examples of possible network configurations using the M-ACC module. If you are unfamiliar with ATM, see the Section, entitled Planning Your Network.

ATM Backbone in the Building

An example of an ATM backbone within a single building, is shown in Figure 2.1.

In this case, the Ethernet Switch on each floor is provided with a high speed (622 Mbps) full duplex link to the backbone. Using ATM as a backbone technology removes bottlenecks by providing scalable bandwidth, low-latency, high-speed data switching.

Ethernet VLANs can be extended into the ATM network using *Emulated LANs (ELANs)*. Ethernet packets are then switched between Ethernet to ATM transparently.

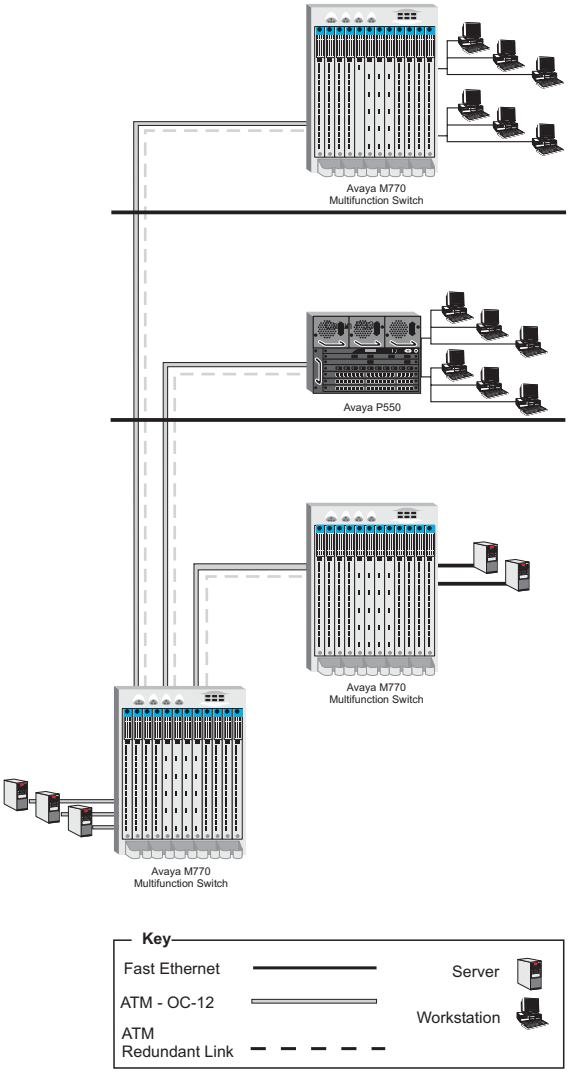
As well as providing a fast switched backbone between Ethernet LANs, ATM equipped file servers and services may be directly attached to the ATM network; giving improved performance to the Ethernet desktop.

Further advantages are gained in multi-media applications, due to ATM's built-in quality of service.

Figure 2.1 shows ATM link redundancy between the M-ACC module in the Avaya M770 multifunction and Avaya P550 switches and another Avaya M770 Switch.

The lowest Avaya M770 Multifuntion switch includes OC-3 and OC-12 M3-622 and M15-155 ATM modules, an M-MLS Routing module and 32-port M32-100T Fast Ethernet modules.

Figure 2.1 ATM Backbone in the Building

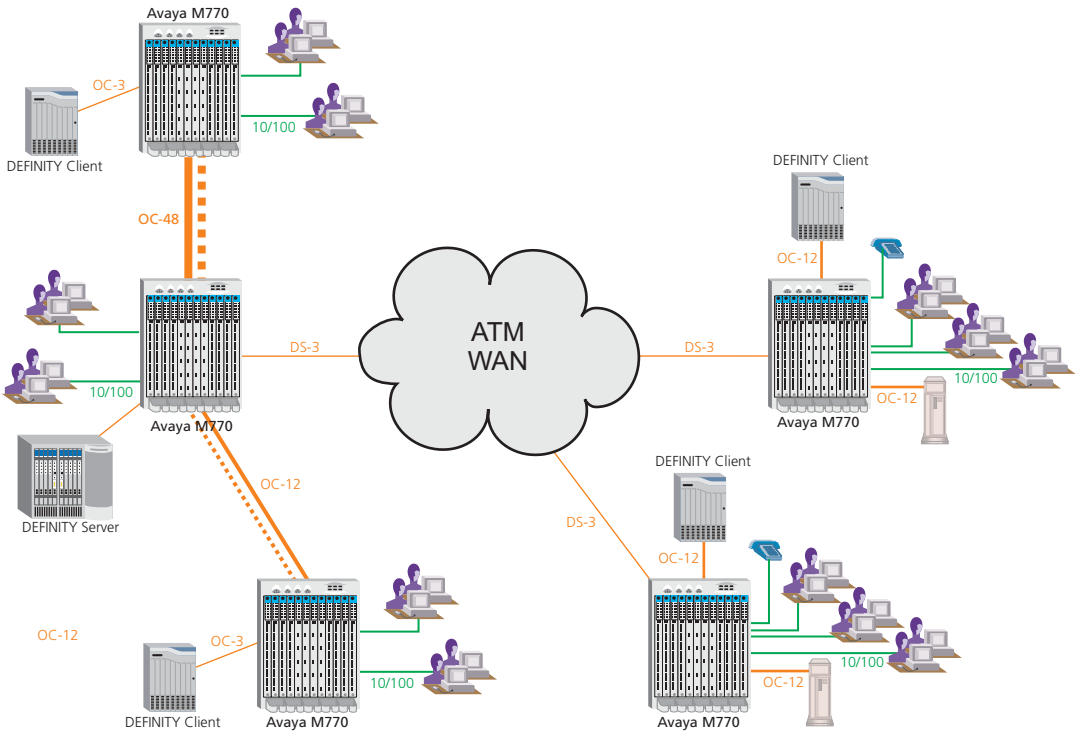


Avaya M770 Multitechnology Functionality

This section gives an example of ATM within a WAN environment connecting various sites. Using the M-ACC module we can leverage the Multifunctionality of the Avaya M770 and connect Fast Ethernet PC desktops to the same single chassis.

In Figure 2.2, ATM was chosen to efficiently transfer both voice and data on a single trunk. The diagram demonstrates the balance between cost and performance requirements by the use of a single high performance Avaya M770. The M-ACC module connects the ATM and Ethernet domains in the Avaya M770.

Figure 2.2 Avaya M770 Multitechnology Functionality



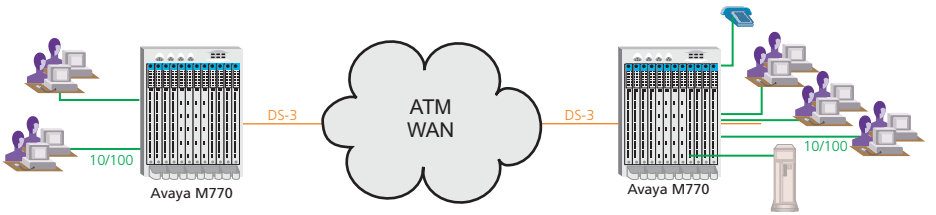
Routing in the X-Switch Domain

The principle behind the Avaya routing evolution is to move routing from the backbone to the edges. This controls the traffic from the moment it enters the LAN and not just after it reaches the backbone.

Figure 2.3 shows how an M-MLS routing module in one of the 2 Avaya M770 Multifunction switches can provide routing for all users on either side of the ATM network. The Avaya M770 is connected to the ATM cloud via the M-ACC ATM Access Modules.

This configuration enables Routing over ATM using LAN Emulation (LANE). LANE can be tunneled across the WAN through the DS-3 link.

Figure 2.3 Routing in the X-Switch Domain.



Installation

Installing the M-ACC Module

Safety Information

Warning: Before installing or removing any components of a device, or carrying out any maintenance work, you must read the safety information provided in Appendix A, Important Safety Information. Disconnect the device from the main power supply.

Warning: Installation and removal of the ATM access module must be carried out by qualified personnel only. Before installing the module into a unit, you must first disconnect the unit from the mains power supply.

Caution: Only hold the ATM module by the edges to avoid damage from static. Do not touch the top or bottom of the circuit board. If possible, wear a wrist-strap and use an anti-static bag.

The multimode Avaya M-ACCF ATM access module is a Class 1 LED product. The single-mode M-ACCSF module is a Class 1 Laser product. They comply with EN 60825-1 and Food and Drug Administration (FDA) 21 CFR 1040.10 and 1040.11.

The modules must be operated under recommended operating conditions.

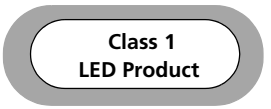
Single-mode Module Laser Classification

Note: Class 1 lasers are inherently safe under reasonably foreseeable conditions of operation.

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

Multi-Mode Module LED Warning

The following warnings apply to the M-ACCF ATM access module equipped with multi-mode fiber.



Warning: Class 1 LED Product. Do not view the LED through any magnifying device while it is powered on. Never look directly at the fiber Tx port and fiber cable ends when powered on.

Agency Approval

See Appendix A, Specifications on Page 85.

Device Support

The ATM access module allows you to connect your Avaya M770 X-Switch domain to an ATM network.

Pre-installation Procedure

This section describes the procedures you need to perform before installing the ATM access module.

Domain Usage Considerations

The M-ACC is a DomainX module of the Avaya M770. The maximum number of DomainX modules you can insert in the hub is determined by domain usage considerations, as follows (M-SPX refers to either the M-SPV, M-SPX or M-SPS in the following examples):

The Avaya M770 allows a maximum of 100 Domain Resource Units (DRUs) for DomainXL (Left DomainX - slots 1-7) and the M-SPX, and 100 DRUs for DomainXR (Right DomainX - slots 8-14) and the M-SPX. Each of the DomainX modules, as well as the M-SPV module, has a DRU budget, as shown in the table below. When planning your chassis configuration, calculate whether it fits the Avaya M770 DRU budget.

Table 3.1 Avaya M770 Module DRU Budget

Module Name	DRU Budget
M-ACCF/M-ACCSF	3 DRUs
M-SPV/M-SPX/M-SPS	10 DRUs
M32-100T	12 DRUs
M12-100T	18 DRUs
M12-100F	18 DRUs
M2-1000SX/LX	15 DRUs
M-MLS	6 DRUs
M14-10F	6 DRUs

Budget Calculation Examples

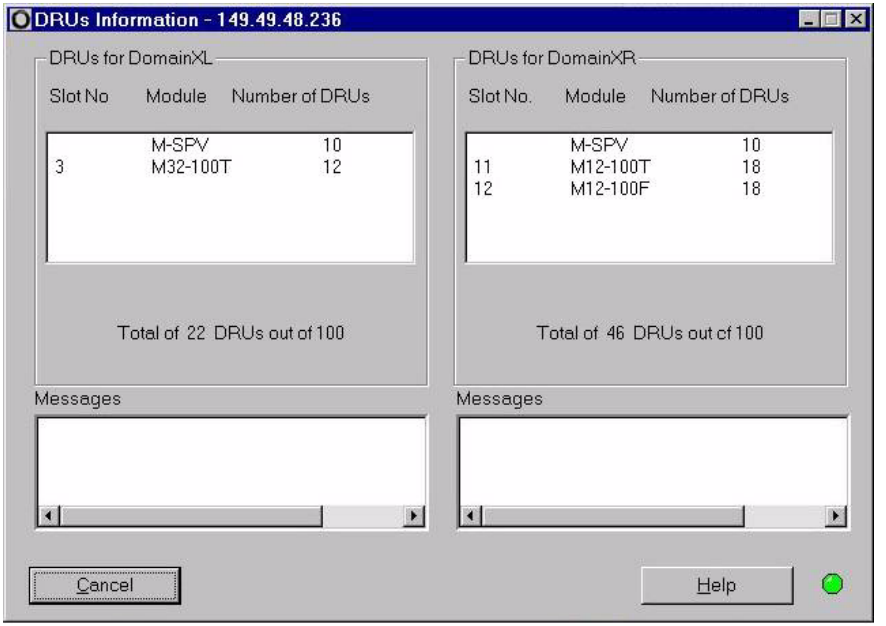
1. If you have one M-ACCF, seven M32-100 modules and the M-SPX you get: 3+7*12+10 = 97 DRUs. Assuming that there are seven modules on both the DomainXL and Domain XR switches you get a total of 448 ports.
2. If you have two M-ACCF, six M14-10F modules, an M2-1000 module and the M-SPX you get: 2*3+6*6+15+10 = 67 DRUs. Assuming that you have the same configuration on the DomainXL and Domain XR switches you get a total of 168 Ethernet, 12 Fast Ethernet and 4 Gigabit ports.
3. If you have one M-ACCF, five M2-1000 modules and the M-SPX you get: 3+5*15+10=88 DRUs. Assuming that there are six modules on both the DomainXL and Domain XR switches you get a total of 24 Gigabit Ethernet ports and 72 Fast Ethernet ports.
4. If you have four M32-100 modules, one M2-1000 and the M-SPX you get: 4*12+15+10=73 DRUs. This is less than 100 DRUs and is therefore another possible configuration.

Note: A redundant M-SPX does not count in the DRU calculations. However you must include the active M-SPX twice, once for DomainXL and once for DomainXR.

DRU Budget Information Window

You can check the DRU budget information for your Avaya M770 hub via the CajunView ‘ Network Management System (NMS). The following window shows an example of a chassis with an M-SPV, M32-100T, M12-100F and an M12-100T module.

Figure 2 DRU Budget Information Window



Installing the Module

Caution: The ATM access modules contain components sensitive to electrostatic discharge. Do not touch the circuit board unless instructed to do so.

Note: The Avaya M770 chassis must not be operated with the module slot open; the slot should be covered with the supplied blanking plate if necessary.

Note: M-ACC modules are hot swapable.

The M-ACC occupies one slot in the Avaya M770 chassis and can be inserted into any available slot.

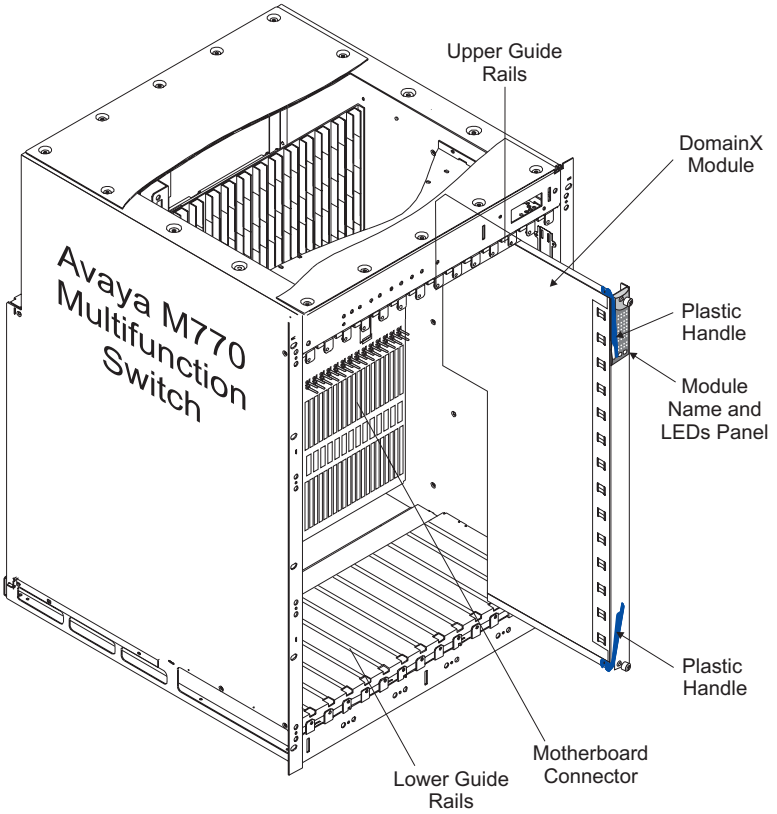
The M-ACC can be installed or removed while power is on.

To install the M-ACC:

1. Hold the module (shaped like an upside down L) using both hands. The colored module name panel and LEDs should be on top (see Figure 3).
2. Fold out the plastic handles on the top and bottom of the front panel.
3. While holding the module by its handles, place it onto the top and bottom guide rails in the hub and gently slide it in.
4. Plug in the module by pressing firmly on the mid-section of the front panel. Fold down the handles and secure the module using the two screws at the top and bottom of the front panel. *Do not over-tighten the screws.*
5. Connect the Switch to the ATM network as described in Connecting a Cable to the ATM Port40.
6. Follow the post-installation checks, as described in Post-Installation Checks42.

Note: Even though the modules are hot-swappable a short self initialization period is required when inserting or removing them from the hub. Allow at least 5 seconds initialization time between modules when inserting or removing several modules.

Figure 3.1 Inserting the Module into the Hub



Power-on Check

When you plug in the M-ACC, all the LEDs light steady for a few seconds. Wait until the Port LEDs blink before commencing work.

Connecting a Cable to the ATM Port

1 Ensure that the cable you wish to connect to the port meets the correct specification. For cable specifications, see ATM Cable Specification85.

2 Each end of the fiber cable has a transmit (Tx) and receive (Rx) connector. Connect the Rx connector to the port's Tx socket. Connect the Tx connector to the port's Rx socket. Do the same at the other end of the connection.

Power On Self Test

When you power up the Avaya M770 switch with an M-ACC module inserted, both pass a self test. This check takes between 10 and 20 seconds to complete, and includes:

— Checksum tests of boot and system areas of *Flash* memory
— System memory tests
— MAC address verification test
— System timer test
— *CAM (Contents Addressable Memory)* tests
— Console Port tests
— Internal packet forwarding tests
— ASIC tests
— Module interface tests
— Module packet forwarding tests.

The LEDs used to indicate self-test failure and other post-installation checks are described in Post-Installation Checks42.

Removing an Existing ATM Access Module

1 Loosen the screws by turning the knobs.
2 Grasp the two knobs one near each side of the front panel, and pull gently but firmly towards yourself.
3 Insert another module or the blanking plate.

Post-Installation Checks

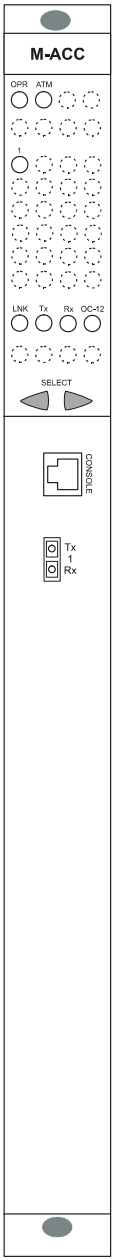


Figure 3.2 shows M-ACC front panel with its LEDs, switches and connectors (described in Table 3.2).

When you insert an M-ACC ATM Access module into the Avaya M770 chassis or after a reset, there is a Startup sequence which takes about 30 seconds before the ATM lights ON.

Table 3.2 M-ACC LEDs Descriptions

LED Name	Description	LED Status
OPR	Module Operational Status	ON – Module is OK
		OFF – Module is not operational
		Blink – Module is not connected to DomainX or DRU overflow problem
ATM	Status of ATM Entity (CPU)	ON – ATM CPU OK, Built-In Test OK
		OFF – Fail
LNK	Port Status	OFF – Port is disabled
		ON – A link is present on the ATM port
		Blink – Port enabled and the link is down
Tx	Transmit to Line	OFF – The ATM port is not transmitting cells
		ON – The ATM port is transmitting data cells
Rx	Receive from Line	OFF – No receive activity
		ON – The ATM port is receiving data cells
OC12	High Speed	OFF: OC-3c ON: OC-12c

Figure 3.2 LED Indications for the M-ACC ATM Access Module

Note: All LEDs are lit during a reset.

Configuring the M-ACC Module

The M-ACC module can be configured using the text-based Command Line Interface (CLI) utility and the Terminal Interface. The LEC Information Table, ATM Access module and ATM port information can be viewed using CajunView™.

For instructions on the text-based utility, see Chapter 4. For information about the graphical user interfaces, see Chapter 5.

For instructions on the use of the graphical user interfaces, refer to the Manager User's Guide on the CD.

M-ACC Module Default Settings

The default settings for the M-ACC module are determined by its software. These default settings are subject to change in newer versions of the software for the M-ACC module which can be downloaded from the Avaya Network Software Download WWW site (http://www.avayanetwork.com/). See the Release Notes for the most up-to-date default settings.

Table 3.3 M-ACC Module Default Settings

Function	Default Setting
Framing Mode	SONET
UNI	3.1
Port Speed	OC-12c
VLANs	VLAN 1, associated with ELAN "default"
SNMP Community	public
ATM Access Module Terminal Menu Interface Passwords	Junior operator: read Senior operator: write Administrator: admin

Connecting to the Serial Port

The M-ACC module has one serial port on the front of the switch for connecting a terminal, a terminal emulator, or a modem (future software release) using the supplied adapter.

Note: Modem connection will require a modem adapter which will supplied by Avaya upon request (future version).

The RJ-45 port on the front of the module is labeled “Console”, and may be used to configure the switch using the built-in Command Line Interface (CLI, Terminal Emulation). In the future, this connector will also be used for out-of-band SNMP management, via a modem.

The port settings are as follows:

- Baud Rate - 9600 bps
- Character Size - 8
- Parity - None
- Stop Bit - 1
- Flow Control - None
- We recommend using a VT-100 terminal to enable access to all CLI features.

The terminal connected to the serial port must be configured with the same settings; this setting will work with any PC COM port over a DB9 to RJ45 connector.

Establishing a Telnet Session

1 Connect your PC to the network

2 Verify that you can communicate with the Avaya M770 M-SPX/S using Ping to the IP of the M-SPX/S. If there is no response using Ping, check the IP address and default gateway of both the M-SPX/S and the PC.

3 From the Microsoft Windows® taskbar of your PC click **`Start`** and then **`Run`** (or from the DOS prompt of your PC), then start the Telnet session by typing:
`telnet` *`<M-SPX/S_IP_address>`*
For example: **`telnet 149.49.32.112`**

Note: One of the possible reasons that you cannot establish a Telnet session to the M-SPX/S, may be because there is already a session in progress.

4 When you are prompted for a Login Name, enter the default name **`super`**

5 When you are prompted for a password, enter the password **`super`** in lower case letters (do NOT use uppercase letters).

6 The Switch Main Menu displays.

7 When you choose Option 1 and enter the M-ACC slot number, you reach the M-ACC’s Setup Main Menu.

8 You can now configure the M-ACC module and change its default IP address.

Setting up the M-ACC Module

Before you can set up the M-ACC module you must power on and set up the Avaya M770 switch as described in the Avaya M770 User Guide.

The following steps describe how to configure the M-ACC module using the Avaya M770 CLI.

Changing the Default IP Address of the M-ACC Module Using the CLI

To begin using the ATM access module you must first assign an IP address and ATM capabilities to the module via the CLI of the X-switch CPU.

You can either connect a VT-100 terminal or PC with VT-100 emulation to the Console port of the M-SPX/S Supervisor module or Telnet the M-SPX/S IP address.

To connect to the M-SPX/S Console port

1 Use the serial cable supplied to attach the RJ-45 console connector to the Console port of the M-SPX/S Supervisor module and the DB-9 connector to the serial (COM) port on your PC/terminal.
2 Ensure that the serial port settings on the PC are 9600 baud, 8 bits, 1 stop bit and no parity.
3 If you connected a PC, run a VT-100 emulation session. (You can use the Windows® HyperTerminal.)
4 After the M-ACC enters setup mode, you are prompted to enter a user name and password. Type the Login Name **`super`** and Password **`super`** and Enter (only if you are connected via Telnet).
5 The Switch Main Menu displays:

```
         Switch Main Menu
---------------------------------
     Select an Agent to configure:
<CR> Refresh the screen
0. Return to Previous Menu
1. Direct Access to specific module
2. M-SPX in slot: 15
   manages modules: 3,4,5,7,9,10,11
>>>Enter your choice
```

When you choose Option 1 and enter the M-ACC slot number, you reach the M-ACC's Setup Main Menu.

Module Setup Main Menu

```
           Setup Main Menu
M-ACCF   S/W Version: 4.0.7   Slot #: 5
<CR>  Refresh the screen
 0.  Return to Previous Menu
----------------------------------
 1. Reset the Module
 2. Software Download …
 3. Set Primary Version …
 4. Set Factory Defaults
 5. Create Report
 6. Clear Mac Address Table
 7. Configuration Copy
 8. ATM IP Configuration …
 >>>Enter your choice:
```

The module Setup Main Menu lists the various categories of M-ACC configurable parameters. You have the 8 options listed above.

ATM IP Configuration

Option 8 from the Main Menu 'ATM IP Configuration', allows you to show and set the IP Configuration of the ATM entity of the M-ACC.

```
ATM IP Configuration Menu
-------------------------
0. Return to Previous Menu
1. Set  IP Configuration
2. Show IP Configuration

   Please enter your choose:2

        IP Address        Netmask           Default Gateway
        ---------------   ---------------   ---------------
        149.49.54.249     255.255.255.0     149.49.54.1
```

Assigning the M-ACC module IP address, Gateway and Netmask:

1 Select Option 1 “Set IP Configuration”
2 Check that the LED labelled OPR, on the ATM access module front panel is ON.
3 Type the IP address, net mask and default gateway of the ATM access module when prompted.

Note: The default Gateway must be on the same Subnet as the IP address assigned in Step 2 (above) for the ATM access module.

4 There is no need to perform a reset.
Configuration Example:

```
Enter IP Address (149.49.54.249): 149.49.44.80
Enter Netmask (255.255.255.0): 255.255.255.0
Enter Default Gateway (149.49.54.1): 149.49.44.120
```

Note: If there are any errors, the new configuration settings are not saved. To save the new configuration settings, you must correct the errors by repeating the command.

Setting up the ATM Access Module

Once you have assigned an IP address, Netmask and Default Gateway to the ATM access module you can begin configuring ATM Edge Device parameters such as LECS, LES and BUS.

You can connect to the ATM access module Terminal Interface either by disconnecting the console port from the M-SPX/S module and connecting it to the ATM access module or by establishing a Telnet session to the IP address you assigned to the ATM access module in the previous section. This is described in Chapter 4, ATM Access Module Terminal Interface for Configuring ATM Parameters58.

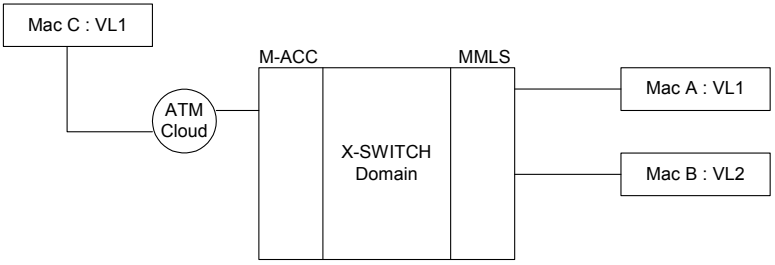
You can now proceed to configure the ATM access module using CajunView, the Embedded Web Manager or the CLI interface.

Note: The only way to change the Default Port Speed (from OC-12 to OC-3 or from OC-3 to OC-12) is via option *[4] Port Speed* in the *ATM Port Menu* (see Figure 4.11 on page 66). The Framing Mode can be either SONET or SDH.

Note:

M-MLS Bridging

While the M-ACC and M-MLS bridge may be installed in the same Avaya M770 chassis, Layer 2 Bridged Packets cannot pass the ATM cloud.



The M-MLS bridges between Mac A and Mac B

Mac C can only connect to Mac A, not to Mac B

X-Switch CLI & ATM Terminal Interface

Introduction

There are several interfaces for configuring the ATM access module:

- **X-Switch Command Line Interface (CLI)**
  Basic module configuration via the Console port of the M-SPX/S Avaya M770 Supervisor Module or Telnet to the Switch IP address.
- **M-ACC ATM Access Module Terminal Menu Interface**
  ATM Edge Device parameters setup such as LECS, LES and BUS via the Console port of the M-ACC or to the M-ACC module IP address.
- **SNMP Management**
  You can use the CajunView™ M770 Device Manager and LANEMaster™.

This chapter provides instructions for the configuration of your Avaya M770 using the Cajun Campus Command Line Interface (CLI) and the Menu-based Terminal Interface. You can also configure your Avaya M770 and ATM access module using the M770 Manager with its graphical user interface (see Chapter 5).

The configuration procedure involves establishing a Telnet session or a serial connection and then using the M-ACC module's internal CLI and Terminal Interface. The CLI is command-line driven and does not have any menus whereas the Terminal Interface is menu-driven. To activate a configuration option in the CLI, you must type the desired command at the prompt and press Enter.

M-ACC Module Architecture

The M-ACC module consists of separate X-Switch and ATM entities.

- The X-switch CPU connects the M-ACC module to the Avaya M770 X-Domain.
- The ATM CPU performs all ATM signalling.

Since each entity has it's own embedded software, ensure that you download X-Switch software updates (filename: **Macc**) via the X-Switch CLI and ATM software updates using the ATM Terminal interface (filename: **Piccolo.tsl**).

Conventions Used

The following conventions are used in this document to convey instructions and information:

- Mandatory keywords are in boldface
- Variables that you supply are in pointed brackets <>
- Optional keywords are in square brackets [ ]
- Alternative but mandatory keywords are grouped in braces { } and separated by a vertical bar |
- If you enter an alphanumeric string of two words or more enclose the string in inverted commas.
- Information displayed on screen is displayed in `text` font

X-Switch Command Line Interface (CLI)

This is the Command Line Interface (CLI) used with the ATM module. Most parameters are set using the Terminal Interace (see ATM Access Module Terminal Interface for Configuring ATM Parameters58).

To begin using the ATM access module you must first assign an IP address and ATM capabilities to the module via the CLI (see ATM IP Configuration46).

You can either connect a VT-100 terminal or PC with VT-100 emulation to the Console port of the M-SPX/S Supervisor module or Telnet the M-SPX/S Switch IP address.

Following is a list of commands available using this CLI:

Commands Summary Table

Following is a table of the `show` commands:

To connect to the M-SPX/S Console port

1 Use the serial cable supplied to attach the RJ-45 console connector to the Console port of the M-SPX/S Supervisor module and the DB-9 connector to the serial (COM) port on your PC/terminal.

2 Ensure that the serial port settings on the PC are 9600 baud, 8 bits, 1 stop bit and no parity.

3 If you connected a PC, run a VT-100 emulation session. (You can use the Windows® HyperTerminal.)

4 The Switch Main Menu displays:

```
         Switch Main Menu
---------------------------------
     Select an Agent to configure:
<CR> Refresh the screen
0. Return to Previous Menu
1. Direct Access to specific module
2. M-SPX in slot: 15
   manages modules: 3,4,5,7,9,10,11
>>>Enter your choice
```

When you choose Option 1 and enter the M-ACC slot number, you reach the M-ACC's Setup Main Menu.

Module Setup Main Menu

```
           Setup Main Menu
M-ACCF   S/W Version: 4.2.2   Slot #: 5
<CR>  Refresh the screen
 0.  Return to Previous Menu
---------------------------------
 1. Reset the Module
 2. Software Download …
 3. Set Primary Version …
 4. Set Factory Defaults
 5. Create Report
 6. Clear Mac Address Table
 7. Configuration Copy
 8. ATM IP Configuration …
 >>>Enter your choice:
```

The module Setup Main Menu lists the various categories of M-ACC configurable parameters. You have the 8 options listed above.

Reset the Module

Before exiting a Setup session, select Option 1. 'Reset the Module' from the Setup Main Menu if you wish the parameter changes you made to take effect. You will be asked to confirm the reset before it is executed.

Note: The "Reset the Module" option does not reset the entire hub; it resets the selected module only.

Software Download to the X-Switch CPU

You can download software to the X-Switch entity (CPU) of the M-ACC module using the TFTP/IP protocol. To enable the process, make sure there's a reachable TFTP server in the network.

To download a software update to the M32-100T, use the Software Download option (option 2 from the Setup Main Menu). A screen similar to the following displays:

```
Software Download parameters (Using TFTP/IP).
M-ACCF   S/W Version: 4.0.7   Slot #: 5
<CR> Refresh the screen
 0.  Return to Previous Menu
 1.  Save the Session
 2.  List
----------------------------
 3.  TFTP Server and File parameters...
 4.  Start Software Download process
 5.  Monitor software download process...
 >>>Enter your choice:
```

Entering Software Download Parameters

Select option 3 to enter the TFTP server, file and version parameters. The following prompts are displayed, with the current parameters displayed in every line:

```
     TFTP Server IP address: 149.49.39.12
     File Name: /home3/users/gk/vx/960cf/M-ACCF
     Downloaded file will override the old version (4.0.7)
-----------------------------------------------------------
>>>Enter Server IP address [nnn.nnn.nnn.nnn]:135.49.60.115
>>>Enter File Name: c:\mng\agents\Macc
>>>Override version: 1 - (Version 4.0.7), [2 - (Version 4.0.7)]: 1
```

1 Enter the TFTP Server IP address.
2 Enter the filename (Macc) of the new software version (full path).
3 Enter the version you wish to overwrite.
The M-ACC stores two software versions. It is recommended that you overwrite the oldest version. See the version number to find out which is the

oldest version.

4 If you wish the M-ACC to load and run the new software version, select option Set Primary Version (option 4) from the Setup Main Menu. Specify the new software version as the Primary version (refer to section *Set Primary Version*).

Note: The M-ACC does not perform a reset after the software download process. To reboot, select the Reset the M-ACC option from the Setup Main Menu.

Starting the Software Download Process

To start the software download process, select option number 4 in the Software Download menu. You are queried whether to start the software download. Answer 'Y' for the download to start.

Monitoring the Software Download Process

To monitor the software download process, select option number 5 in the Software Download menu. The download state, activity status, and downloaded size display on the screen.

```
M-ACC   S/W Version: 2.4.4   Slot #: 5
  TFTP Server IP Address: 149.49.39.12
  File Name: /home3/users/gk/vx/960cf/Macc
  Destination: Flash Bank B (Application)
Download State: tftp-running-ip
Activity Status: Testing...
Downloaded size: 21344
--------------------------------
<CR> Refresh the screen.
 0.  Return to Previous Menu.
--------------------------------
>>>Enter your choice:
```

For troubleshooting the software download process, refer to Section *Software Download Troubleshooting* in Chapter 4.

Set Primary Version

The M-ACC stores two software versions. The version which is currently running is called the Primary version. A pointer (asterisk - *) shows which version is currently the primary one.

To set a different primary version, select option 4 from the Setup Main Menu. A menu similar to the following displays:

```
Primary Version Screen
M-ACCF   S/W Version: 4.2.2   Slot #: 5
<CR>  Refresh the screen
  0.  Return to Previous Menu
  1.  Save the Session
-----------------------------------
     Select the Primary version
     (The current primary is marked by *)
  2.   Version 1.0.3
  3. * Version 1.0.1
   >>>Enter your choice:
```

Once you select and save the desired primary version, you are prompted to reboot the M-ACC. Type y and the M-ACC will set the pointer accordingly, and reboot from the newly-defined primary version. If you don't wish to reboot at this time, the pointer is saved, but the M-ACC continues running from the old version.

Set Defaults to Factory Settings

You can set the M-ACC's configuration back to its default factory settings by selecting item number 3 in the Module Setup Main Menu. The following confirmation and warning messages are displayed:

```
***  Set default values  ***,   Confirm [y/n]?y
***WARNING*** - Management parameters were changed. Reset the agent!!
```

Before exiting this session, select the option Reset the M-ACC from the Module Setup Main Menu.

Create Report

This command is intended for use by *Avaya Technical Support personnel* and provides a comprehensive report of the status the M-ACC module of each port.

Clear Mac Address Table

Option 6 from the Main Menu 'Clear Mac Address Table', allows you to clear the MAC address table of the entire Avaya M770 domain from a single point. This is performed as follows (from the Main Menu):

```
>>>Enter your choice: 6
Proceed with clearing the MAC address table ? [Y/N] y
   ...MAC address table was cleared.
   Reset is required to make the change effective. Reset now ? [Y/N] y
   Resetting. Please Wait ...
<CR> Refresh the screen
```

Note: The above command takes effect only after you perform a reset (wait at least half a minute before resetting).

After system reset, the MAC address table on all modules in the DomainX is cleared.

Configuration Copy

Option 7 from the Main Menu 'Configuration Copy', allows you to copy the configuration of another M-ACC module to the current module.

```
Which module configuration do you wish to copy from ?
Enter slot number (range 1 to 7) or 'q' to quit :
```

ATM IP Configuration

Option 8 from the Main Menu 'ATM IP Configuration', allows you to show and set the IP Configuration of the ATM entity of the M-ACC.

```
ATM IP Configuration Menu
-------------------------
0. Return to Previous Menu
1. Set  IP Configuration
2. Show IP Configuration

   Please enter your choose:2

        IP Address        Netmask           Default Gateway
        ---------------   ---------------   ---------------
        149.49.54.249     255.255.255.0     149.49.54.1
```

Assigning the M-ACC module IP address, Gateway and Netmask:

1 Select Option 1 “Set IP Configuration”
2 Check that the LED labelled OPR, on the ATM access module front panel is ON.
3 Type the IP address, net mask and default gateway of the ATM access module when prompted.

Note: The default Gateway must be on the same Subnet as the IP address assigned in step 2 (above) for the ATM access module.

4 There is no need to perform a reset.
Configuration Example:

```
Enter IP Address (149.49.54.249): 149.49.44.80
Enter Netmask (255.255.255.0): 255.255.255.0
Enter Default Gateway (149.49.54.1): 149.49.44.120
```

Note: If there are any errors, the new configuration settings are not saved. To save the new configuration settings, you must correct the errors by repeating the command.

ATM Access Module Terminal Interface for Configuring ATM Parameters

To use this terminal interface you must connect the terminal to the ATM Access module Console port or start a Telnet session to the ATM module IP address.

You can establish a connection only after the ATM module has an IP address and connectivity to the server. Use the M-ACC CLI to perform these two prelimiary tasks (see the Section, X-Switch Command Line Interface (CLI)51).

Commands Tree Chart

Figure 4.1 shows a chart of available local management screens.

Logging On

1 To begin a Telnet session, open it to the ATM access module IP address. You will be prompted by the following:

```
ATM Access Module

Select access level (read, write, admin):
```

2 Type in your access level followed by your password. Note that they are both case-sensitive:
- — If you are logging on for the first time (after installation or initialization), use a default user name and password to match your access requirements and privileges, in accordance with Table 4.1.
- — If you have been assigned a user name, access level and password, type in these details.

Table 4.1 Users and their Privileges

User Type	Access Level/ Default Password	Privilege
junior operator	read	Read but not Write
senior operator	write	Read and Write
administrator	admin	Read, Write and can change passwords

For access rights to Switch screens, see the user guide that accompanies your Switch.

When you have logged on, the Main Menu screen is displayed.

Logging Off

When you have finished using the facility, select the option `quit` from the bottom of the Main Menu. If you accessed the facility using a Telnet session or modem, the connection will be closed automatically.

To disconnect a session, the disconnect command may be used. Alternately, it is enough simply to drop ATM connectivity in order to free resources. In addition, it is better to use the disconnect command rather than the quit option, so that another user may immediately operate the terminal interface. The connection will then be dropped by the foreign host.

Managing the ATM Access Module

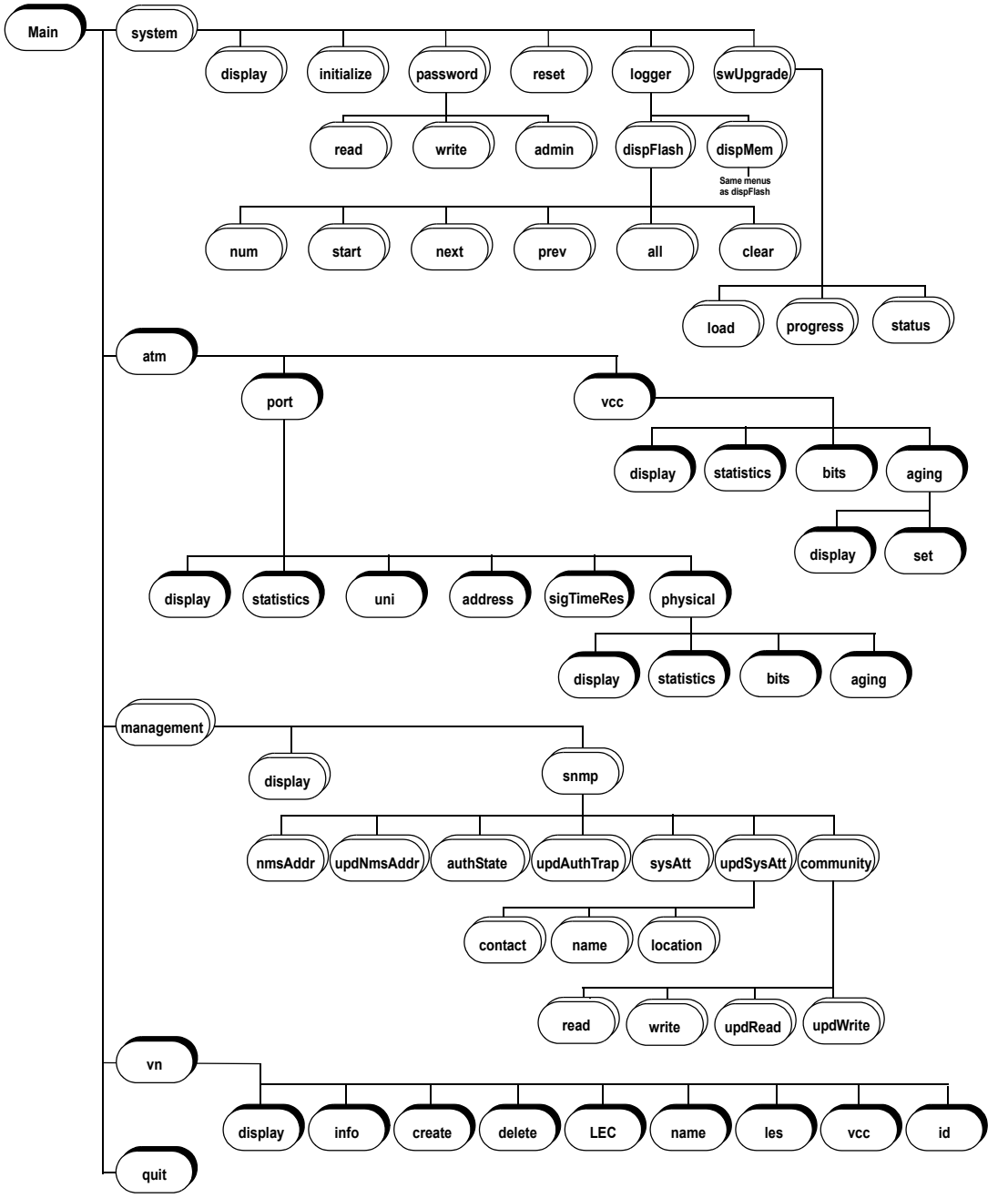
The following Section describes how to manage the ATM access module. If you wish to view statistics, see Chapter 5, Network Management and Monitoring.

Submenus

Figure 4.1 shows the menu tree structure for the ATM access module options.

Figure 4.1 Management Submenu Map

Menu Structure of the ATM Access Module



Main Menu Options

The Main menu, see Figure 4.2, provides the following options:

Figure 4.2 Main Menu

```
Main Menu
=========

[1] system      - Administer system level functions ->
[2] atm         - Administer ATM resources ->
[3] management  - Administer IP and SNMP ->
[4] vn          - Administer virtual networks ->
[5] quit        - Logout of the administration console
```

Configuring System Parameters [1]

The System menu, see Figure 4.3, allows you to administer system level functions.

System Menu

Figure 4.3 System Menu

```
System Menu
===========

[1] display     - Display system attributes
[2] initialize  - Reset flash memory to default values
[3] password    - Update the console passwords ->
[4] reset       - Reset and reboot the device
[5] logger      - System logger ->
[6] swUpgrade   - Download system software ->
```

Display Submenu [1,1]

This option provides the general software version parameters. See Figure 4.4.

Figure 4.4 Display Submenu

```
Time since reset:        002 Days 01 Hrs 17 Mins 25 Secs
Operational version:     1.8
Creation date:           Apr 11 2000 17:57:19
Hardware version:        503A0130-1C  6
Monitor version:         2.5
MAC address:             00:C0:DA:89:E8:F0
Serial number:           BE90460003
Power up diag results:   OK
```

Initialize Submenu [1,2]

This option initializes the parameters to their factory default settings.

Passwords Submenu [1,3]

This option, see Figure 4.5, allows you to change the login password at the access level for the ATM access module.

Figure 4.5 Passwords Submenu

```
Passwords Menu
==============

[1] read        - Update the read access password
[2] write       - Update the write access password
[3] admin       - Update the admin access password
```

Reset Submenu[1,4]

This option resets the ATM access module.

System Logger Submenu [1,5]

The Logger submenu is shown in Figure 4.6.

Figure 4.6 Logger Submenu

```
System Logger Menu
==================

[1] dispFlash    - Display FLASH log messages ->
[2] dispMem      - Display memory log messages ->
```

Display FLASH Log Messages Submenu [1,5,1]

Figure 4.7 shows the Display FLASH Log Messages submenu.

Figure 4.7 Display FLASH Log Messages Submenu

```
Display FLASH Log Messages Menu
===============================

[1] num         - Number of messages
[2] start       - Display log message
[3] next        - Display next log message
[4] prev        - Display previous log message
[5] all         - Display all log message
[6] clear       - Clear log messages
```

Table 4.2 Operational Meanings of Display FLASH Log Submenu Items

Display Submenu Item	Operational Meaning
[1] num	Number of the message that were stored in the flash memory. The maximum number of stored messages is 255, when exceeded, the older messages are overwritten.
[2] start	The index (record) number where the display begins.
[3] next	Displays the next message.
[4] prev	Displays the previous message.
[5] all	Displays all the logged records.
[6] clear	Clears the log messages from the flash memory.

Display Memory Log Messages Submenu [1,5,2]

Figure 4.8 shows the Display Memory Log Messages submenu.

Figure 4.8 Display Memory Log Messages Submenu

```
Display Memory Log Messages Menu
================================

[1] num          - Number of messages
[2] start        - Display log message
[3] next         - Display next log message
[4] prev         - Display previous log message
[5] all          - Display all log message
[6] clear        - Clear log messages
```

Table 4.3 Operational Meanings of Display Memory Submenu Items

Display Submenu Item	Operational Meaning
[1] num	Number of the message that were stored in the memory log. The maximum number of stored messages is 255, when exceeded, the older messages are overwritten.
[2] start	The index (record) number where the display begins.
[3] next	Displays the next message.
[4] prev	Displays the previous message.
[5] all	Displays all the logged records.
[6] clear	Clears the log messages from the flash memory.

System Software Download Submenu [1,6]

This option (see Figure 4.9) is used for the TFTP procedure for downloading new software versions. See Upgrading Software on 75 for more details.

Figure 4.9 System Software Download Submenu

```
System SW Download Menu
=======================

[1] load         - Download system software
[2] progress     - Display download progress
[3] status       - Display last download status
```

Configuring an ATM Port [2]

This menu allows you to configure and set the ATM port parameters.

ATM access module Configuration

The submenus show the settings and standards used by the ATM access module to communicate with other devices on the ATM network.

Note: It is unlikely that you will need to change the value of these settings once they have been set.

The ATM access module configuration submenu can be accessed from the Main Menu by selecting the ATM[2] option. See Figure 4.10.

Figure 4.10 ATM Access Module Configuration Submenu

```
ATM Menu
========

[1] port  - Administer the ATM port ->
[2] vcc   - Administer VCCs ->
```

Note: Ensure that the ATM access module and the ATM Switch to which it is connected are set up to use the same signalling and SONET/SDH standards. The two devices should also use the same ILMI VCC, signaling VCC, and UNI version. If the devices do not use the same standards, they cannot communicate with each other.

Port Submenu [2,1]

The Port submenu enables port attributes display, statistics, and settings. See Figure 4.11.

Figure 4.11 Port Submenu

```
ATM Port Menu
=============

[1] display      - Display port attributes
[2] statistics   - Display port statistics
[3] uni          - Change UNI version 3.0/3.1
[4] address      - Display local ATM addresses
[5] sigTimeRes   - Change Signalling Time Resolution
[6] physical     - Administer ATM port physical parameters ->
```

Table 4.4 below explains the operational meaning of each of the submenu items above.

Table 4.4 Operational Meanings of Port Submenu Items

Port Submenu Item	Operational Meaning
[1] display	Shows the current ATM port attributes. See Figure 4.12.
[2] statistics	Displays ATM port cell traffic statistics. See Monitoring the ATM Access Module76
[3] uni	Allows you to set the system to network interface version 3.0 or 3.1
[4] address	Displays the local ATM addresses
[5] sigTimeRes	Changes the Signalling time resolution
[6] physical	See ATM Port Physical Submenu below.

Figure 4.12 Display Results

```
Admin Status               : Up
Oper Status                : Up
UNI version                : 3.1
ILMI VCC                   : 0/16
Signaling VCC              : 0/5
Signaling Time Resolution  : 100
Speed                      : OC-12
Type                       : SONET
Fiber mode                 : MULTI
Fast link recovery state   : On
ILMI synchronization mode  : Enable
```

ATM Port Physical Submenu [2,1,6]

The ATM Port Physical submenu allows you to set the ATM Port Speed (either OC-12c or OC-3c)[1], the framing protocol SONET/SDH, fast link recovery state and ILMI synchroniztion mode.

Figure 4.13 ATM Port Physical Submenu

```
ATM Port Physical Menu
======================

[1] speed  - Change port speed OC-3/OC-12c
[2] type   - Change port physical type SONET/SDH
[3] fast   - Change fast link recovery state
[4] sync   - Change ILMI synchronization mode
```

VCC Submenu [2,2]

The VCC submenu enables you to see ATM VCC attributes and display statistics and settings. See Figure 4.14**.**

Figure 4.14 VCC Submenu

```
ATM VCC Menu
============

[1] display     - Display VCC information
[2] statistics  - Display per VCC statistics
[3] bits        - Display significant VPI/VCI bits
[4] aging       - Administer VCC aging ->
```

Table 4.5 explains the operational meanings of the submenu items.

Table 4.5 VCC Submenu Items and their Operational Meanings

Item	Operational Meaning
[1] display	Displays a table of source and destination ATM addresses and VPI/VCI associated with the addresses.
[2] statistics	Displays statistics for each Virtual Circuit (VCC). See the Section, Monitoring the ATM Access Module76 for more details.
[3] bits	Shows the current significant VPI/VCI bit settings. The default is 3/9.
[4] aging	The time in seconds after which the MAC-ATM address table is cleared

Aging Submenu [2,2,4]

The Aging submenu displays the time in seconds after which the MAC-ATM address table is cleared. See Figure 4.15**.**

Figure 4.15 Aging Submenu

```
ATM Aging Menu
==============

 [1] display     - Display VCC aging time
 [2] set         - Set VCC aging time
```

Administering IP and SNMP Management [3]

This menu option, see Figure 4.16, allows you to configure the ATM access module IP and SNMP information for use with the SNMP Network Management Station (NMS).

Figure 4.16 Management Submenu

```
Management Menu
===============

[1] ip      - Administer IP ->
[2] snmp    - Administer SNMP ->
```

IP Submenu [3,1]

This menu displays IP configuration. To change the IP, subnet mask or default gateway, you must use the X-Switch Command Line Interface (CLI)51.

SNMP Configuration Submenu [3,2]

Figure 4.17 displays the SNMP submenu.

Figure 4.17 SNMP Submenu

```
SNMP Menu
=========

[1] nmsAddr      - Display NMS IP address
[2] updNmsAddr   - Update NMS IP address
[3] authState    - Display authentication trap generation state
[4] updAuthTrap  - Update authentication trap generation
[5] sysAtt       - Display system attributes
[6] updSysAtt    - Administer system attributes ->
[7] community    - Administer community strings ->
```

Table 4.6 describes the operational meanings of the SNMP Configuration options.

Table 4.6 Configure Submenu Items and their Operational Meanings

Item	Operational Meaning	Entry/Display	Entry/Display/ Change Meaning
[1]nmsAddr	Display NMS IP address		Displays the NMS IP address
[2]updNmsAdd r	Update NMS IP address	Allows you to configure the NMS IP address used for sending traps.	
[3]authState	Display authentication trap generation state		Displays the current state.
[4] upAuthTrap	Update authentication trap generation	Allows you to change the authentication trap state.	
[5]sysAtt	Display system attributes		Displays system administrator's details.
[6]updSysAtt	Administer system attributes	Allows you to change the system contact, system name, and system location. See Figure 4.18.	
[7]community	Administer community strings	Allows you to change the community string settings. See Figure 4.19.	Displays the community string settings for read and write access.

Figure 4.18 updSysAtt Submenu [3,2,6]

```
Attribute Menu
==============

[1] contact     - Update System Contact
[2] name        - Update System Name
[3] location    - Update System Location
```

Figure 4.19 Community Submenu [3,2,7]

```
Community Menu
==============

[1] read        - Display read community string
[2] write       - Display write community string
[3] updRead     - Update read community string
[4] udpWrite    - Update write community string
```

Extending VLANs into the ATM Network [4]

This section describes how to extend VLANs into the ATM network. The ATM port can be in one or more VLANs. Each VLAN is associated with a LEC on the ATM access module, and each LEC is mapped to an ATM ELAN.

Note: You can make a maximum of 16 ELAN-to-VLAN associations per M-ACC ATM Access module (in the range VLAN 1 to 254 only). When you add another M-ACC module to an Avaya M770 domain you can add more associations, however you must ensure that you do **not** make the same associations twice since this will result in a loop. You *can* use the redundancy feature in which case all the associations should be the same. You cannot change or delete the default ELAN-to-VLAN association (Default ELAN associated to VLAN 1) but only Enable/Disable it.

Warning: If you want to use redundancy between 2 M-ACC modules:
i) Insert the 2nd module without any cables connected to it.
ii) Define the same ELAN/VLAN associations on both modules.
iii)Define S/W redundancy using CajunView and activate it.
iv) Connect the cables.

VN Configuration Menu

The VN Configuration submenu can be accessed from the Main Menu. Select the VN option from the Main Menu. This generates the Virtual Net Configuration submenu appearing in Figure 4.20.

Figure 4.20 Virtual net Submenu

```
Virtual Net Menu
================

[1] display   - Display active virtual nets
[2] info      - Display virtual net information
[3] create    - Create virtual net
[4] delete    - Delete virtual net
[5] lec       - Enable / Disable / Restart LEC
[6] name      - Change ELAN name
[7] les       - Set LES ATM address
[8] vcc       - Display LEC VCC's
[9] id        - Set 802.1Q VLAN ID
```

Table 4.7 explains the operational meanings of the submenu items.

Table 4.7 Configure Submenu Items and their Operational Meanings

Item	Operational Meaning	Entry/ Display	Entry/Display/Change Meaning
[1] display	Displays the LEC status for each VN.		VN 17 is for internal use only and is always UP.
[2] info	Displays VLAN/ ELAN information.	VLAN/ ELAN ID.	Used to display internal VLAN/ELAN identifier (1-16).
		Configured ELAN name.	Used to display Emulated LAN name used to retrieve LES/BUS information from the LECS.
		Actual ELAN name.	ELAN name used by the LES, possibly different from the ELAN name (see above) due to the Aliasis used in the system.
		LEC status	Operational status of the LEC Up/ Down.
		LEC ATM address	20-Byte ATM address of the LEC.
		LES/BUS/ LECS address	20-Byte ATM address of the LES, BUS, and LECS to which this LEC is connected.
[3] create	Adds new ELAN/ VLAN association.	VN Number	Creates a new VLAN/ELAN Association.
		802.1Q tag	ATM access module VLAN tag.
		ELAN name	Emulated LAN name used to retrieve LES/BUS information from the LECS.

Table 4.7 Configure Submenu Items and their Operational Meanings

Item	Operational Meaning	Entry/ Display	Entry/Display/Change Meaning
[4] delete	Deletes an ELAN/ VLAN association.	VN Number	Deletes a new VLAN/ELAN Association.
[5] lec	Allows you to control LEC status.	VN Number, Enable, Disable Restart.	You can enable, disable or restart a VN LEC.
[6] name	Allows you to change an ELAN name for a selected VN.	VN Number, ELAN Name	
[7] les	Changes the LES ATM address (in the absence of a LECS)	VN Number, LES ATM address	
[8] vcc	Displays the LEC VCC's for a selected VN.	VN Number	
[9] id	Changes the 802.1Q VLAN ID for a selected VN.	VN Number, 802.1 VLAN ID	

Setting up an ATM VLAN/ELAN

1 Go to the VN [4] submenu.
2 Select [3] Create.
3 Enter the VN number (2 to 16), the 802.1Q tag as configured in the ATM access module VLAN settings (2 to 254, not 17 - for internal use) and the ELAN name as configured in the LECS.
4 Observe creation and enabling of a new VLAN/ELAN using the Display [1] option in the VN menu.

Upgrading Software

This section describes how to upgrade the ATM access module software. You can upgrade software either via the CajunView NMS or by using the Terminal Interface.

Preliminaries

Upgrading the ATM access module software takes place in three stages via a TFTP server:

- Preparing local management
- Actual downloading (filename: Piccolo.tsl)
- Resetting the device.

Before starting the TFTP upgrade procedure, make sure that the software file resides on the TFTP local disk.

Downloading

1 Set the TFTP server to server mode.
2 Change the TFTP server directory to the directory where the software version file is located.
3 Open a Telnet session to the ATM access module Control port.
4 From the correct ATM access module menu, select `System/swUpgrade/load [1,6,1]` to perform the TFTP download.

The following message appears:

```
Server IP address:
File to be downloaded:
```

5 Type the correct TFTP Server IP address and press **<Enter>**.
6 Type in the file to be loaded and press **<Enter>**.
7 You can use the System Progress [1,6,2] menu item to check the progress of the download. Progress is reported in percentage of the file size until completion.
8 Menu Item Status [1,6,3] displays the latest download status (see Caution).

Caution: Before you reset the ATM access module, please check that the download is complete (`download_success` should be displayed in step 8 above). Any reset before the download is complete may make the module unusable.

9 After the software upgrade procedure is completed, you must reset the ATM access module in order to validate the new software version.

Monitoring the ATM Access Module

This Section describes how to monitor the status and performance of your ATM access module and provides a brief overview of the additional statistics that are available when you install an ATM access module.

See the user guide that accompanies the ATM Switch for information about the statistics that are provided by the ATM Switch software.

ATM access module statistics screens are updated every 2 seconds to show the latest information.

The ATM access module provides the following statistics:

- ATM Port Statistics
- VCC Statistics

ATM Port Statistics

The ATM Port Statistics screen provides a top level summary of traffic levels on the ATM port. You can use the summary to estimate the amount of traffic on your network backbone, and to check the validity of the incoming connection.

To view the ATM Port statistics:

1 Select the `[2] atm` option from the Main Menu. The ATM submenu is displayed, as shown in Figure 4.21.

Figure 4.21 ATM Submenu

```
ATM Menu
========

[1] port         - Administer the ATM port ->
[2] vcc          - Administer VCCs ->
```

Select the `[1] port` option from the ATM submenu. The atm/port submenu appears. Then select the `[2] statistics` option.

Select the `[2] vcc` option to generate the Atm Port Statistics display. Then select the `[2] statistics` option.

An example of the ATM Port Statistics screen is shown in Figure 4.22.

Figure 4.22 ATM Port Statistics Screen

```
In Cells:           23
In Frames:          11
In Errored Frames:   0
Out Cells:          14
Out Frames:          5
Out Errored Frames:  0
```

Note: The figures shown for each statistic on this screen include ATM management traffic and normal Ethernet traffic.

The parameters of this display are explained in Table 4.8 below.

Table 4.8 Port Statistics Display Items and their Meanings

Display Item	Meaning
In Cells	Number of incoming ATM cells received
In Frames	Number of incoming Ethernet frames received by port
In Errored Frames	Number of incoming Ethernet frames with error
Out Cells	Number of ATM cells transmitted
Out Frames	Number of Ethernet frames transmitted by port
Out Errored Frames	Number of outgoing Ethernet frames with error

VCC Statistics

The VCC Statistics screen provides an overview of traffic flow in each VCC.

To view the VCC statistics:

1 Select the [2] `atm` option in the Main Menu. The ATM submenu (see Figure 4.21) appears.
2 Select the [2] `vcc` option in the ATM submenu and observe the ATM/VCC submenu (see Table 4.5) appear.
3 Select the [2] `Statistics` option.
4 Enter the VPI /VCI of the VCC traffic you want to monitor.
5 The VCC Statistics display (see Figure 4.23) appears.

Figure 4.23 VCC Statistics Display Example

```
In Cells      : 434
Bad CRC Frames: 0
Out Cells     : 0
```

The parameters of this display are explained in Table 4.9 below.

Table 4.9 Statistics Display Items and their Meanings

Display Item	Meaning
In Cells	Number of incoming ATM cells received by VCC
Bad CRC Frames	Number of incoming ATM frames with CRC error
Out Cells	Number of ATM cells transmitted by VCC

Network Management and Monitoring

Introduction

The M-ACC ATM Access module can be managed using several NMS tools in addition to the Command Line Interface (CLI) and Terminal Interface described in Chapter 4:

- **CajunView M770 Device Manager (version 4.0):**
  The M770 Device Manager enables you to see the LEC information table for the ATM access module, information about the ATM access module and the ATM port.
- **Cajun LANEMaster (version 2.1):**
  This application enables you to easily manage LAN Emulation on an ATM network by providing an overall view of both the physical and logical structure of the network, and the configuration parameters of the LANE components. Cajun LANEMaster also enables you to easily associate ELANs to VLANs.

The full M770 Device Manager User's Guide (Acrobat PDF Ver. 4.0 file) can be found on the CD accompanying the Avaya M770 Chassis.

Software updates are available at Avaya Network's World Wide Web site when they are released: http://www.avayanetwork.com/

Note: The CajunView M770 Device Manager and Cajun LANEMaster applications are part of the CajunView software suite which can be purchased separately.

Note: Port Mirroring is not supported on the M-ACC module.

CajunView M770 Device Manager

The M770 Device Manager provides full management capabilities for the Avaya M770. This includes the ability to view the following aspects of device management:

- **Device Manager** - Provides a view of the configuration of the device including VLAN configuration, configured LAGs, port mirroring, traps, etc.
- **Routing Manager** - Provides a view of the third layer routing and forwarding functions of the device.
- **Device SMON** - Provides advanced monitoring capabilities for the device. For information specific to M770 Device SMON, refer to The *M770 Device SMON User's Guid*e.

Starting the M770 Manager

This section provides instructions for starting the M770 Manager.

M770 Manager as Part of CajunView

If you installed the M770 Manager as part of the CajunView suite, the following sections will provide instructions for starting M770 Manager.

Running M770 Manager from HP-OV for Windows

From the management platform map:

1 Double-click the icon representing the M770 Device you want to manage.
OR
1 Select an Avaya M770 Device.
2 Open the Avaya menu and select **Device Manage**r.

Running M770 Manager from HP (Windows NT)

From the management platform map:

1 Select the M770 Device you want to manage.
2 Click  in the OpenView toolbar.
OR
Open the Tools menu and select Avaya -> **Device Manage**r.
OR
Right-click on the M770 Device you want to manage.
Select **Device Manager.**

LANEMaster

Overview

Cajun LANEMaster provides a simple method of managing LAN Emulation on an ATM network using Avaya M770 ATM Devices (see Figure 5.1). Cajun LANEMaster provides an overall view of both the physical and logical structure of the network, and the configuration parameters of the LANE components. Cajun LANEMaster also provides an easy way to associate ELANs to VLANs. Tools are provided to help you search for a specific LANE component, and to print any of the information provided.

Cajun LANEMaster contains the following wizards:

- LANE Wizard which enables you to:
  - — Set up LANE on an ATM network using default parameters for the network.
  - — Set up LANE on an ATM network via a series of simple steps using parameters you select.
  - — Modify the configuration of LANE components after LANE has been set up.
  - — Configure ELAN to VLAN association parameters.
- Association Wizard which enables you to:
  - — Associate ELANs to VLANs.
  - — Disassociate ELANs from VLANs.
  - — Limit ELAN to VLAN Associations to specific devices.

Starting Cajun LANEMaster

- To start Cajun LANEMaster from CajunView Console:
  - — Select **Tools > Cajun LANEMaster**.
- To start Cajun LANEMaster from HP-OVWin:
  - — Select **Avaya > Cajun LANEMaster**.
- To start Cajun LANEMaster from HP NNM (UNIX or Windows NT):
  - — Select **Tools > Avaya > Cajun LANEMaster**.

Cajun LANEMaster opens.

Cajun LANEMaster Views

This section provides a detailed description of the ways you can view the network. It includes the following sections:

- **Overview** - An overview of the different views of the network.
- **Using the Tree View** - A detailed description of the Tree View and its hierarchy.
- **Using the Table View** - A detailed description of the Table View and the corresponding Form View, detailed descriptions of the fields that appear in Tables and Forms, and methods for creating, deleting, and modifying network components using the Table View.

Overview

When viewing the ATM network, you may want to view the structure of the network, or you may want to view information about specific elements within the network. Cajun LANEMaster's user interface provides an integrated view of the structure of the network along with details about specific elements.

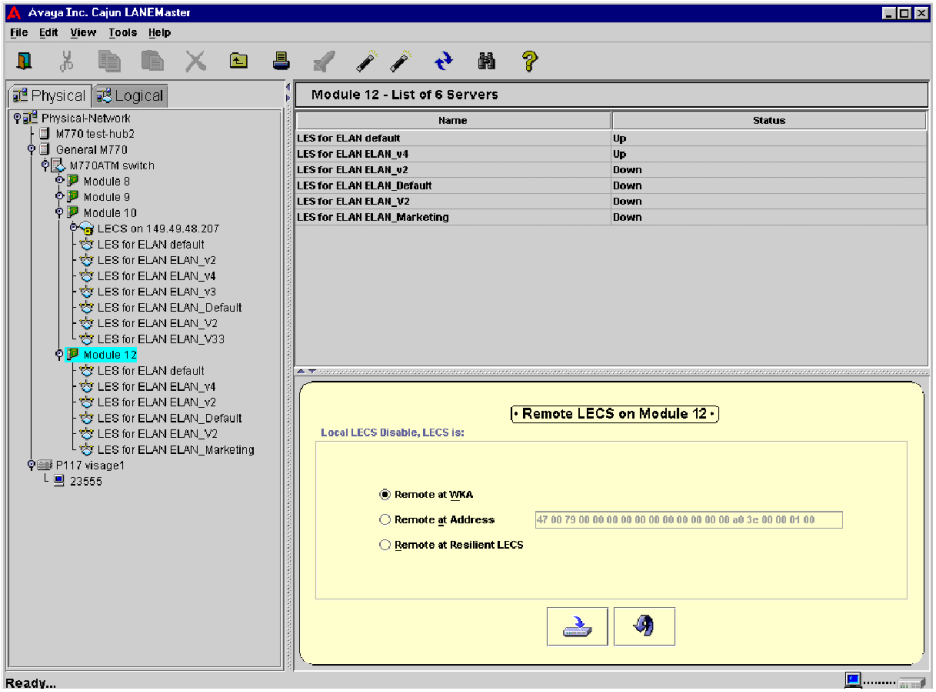
The left side of the user interface is the Tree View. This provides a view of the physical or logical structure of the network. The right side of the user interface contains the Table View and the Form View. These views provides details about specific elements in the network.

When an element in the tree is selected, the leaf elements appear in the Table View and the Form View for the selected item opens under the Table View. Elements in the Table View are accompanied by fields providing details about the elements. Elements with configurable parameters also have an associated Form View. When an element is selected, the Form View opens under the Table View.

The Form View can be used to modify the parameters of the selected element. Right-clicking on some elements opens a menu enabling various actions to be performed on the element.

Note: You can make a maximum of 16 ELAN-to-VLAN (in the range VLAN 1-254) associations per M-ACC ATM Access module. When you add another M-ACC module to an Avaya M770 domain you can add more associations, however you must ensure that you do **not** make the same associations twice since this will result in a loop. You *can* use the redundancy feature in which case all the associations should be the same. Note that you cannot change or delete the default ELAN-to-VLAN association (Default ELAN associated to VLAN 1) but only Enable/Disable it.

Figure 5.1 Cajun LANEMaster Window



Specifications

M-ACC ATM Access Module Technical Specifications

This appendix describes the following topics:

- Environmental, Safety, and EMC Specifications
- ATM Cable Specification

Environmental, Safety, and EMC Specifications

The environmental, safety, and EMC specifications for the ATM Access module are shown in Table A.1 and Table A.2.

Table A.1 Environmental Specifications

Operating Temperature	-5 to 50° C (23–122°F)
Operating Humidity	10–95% relative humidity, non-condensing

Table A.2 Safety and EMC Standards Compliance

Safety	General	UL 1950 EN60950 CSA C22.2 No. 950
	Laser	EN60825-1 FDA 21 CFR 1040.10 and 1040.11
Electromagnetic Compatibility	Emission	Europe - EN55022 class A US - FCC Part 15 Subpart B class A Japan - VCCI Class A
	Immunity	Europe - EN55024

ATM Cable Specification

The specifications in this section relate to the applicable standards for two cable technologies - optical and SDH and design performances of two types of fiber cable, multi-mode and single-mode.

Optical Standard Supported

ATM Forum

- LANE 1.0
- UNI 3.0, 3.1
- ILMI 3.0, 3.1

ITU-T

- OC-12c/3c: ITU-T G.957 and G.958

SDH Standard Supported

ITU-T

- OC-12c/3c: I.432 , G.707-9

Avaya supports 62.5/125mm Multi-Mode Fiber (MMF-PMD). The maximum inter-station distance (including device-to-network connectors) should not exceed 2 kilometers (1.25 miles).

Table A.3 shows the cable specifications for standard multi-mode cabling:

Table A.3 Standard Multi-mode Cable Specifications

SONET Type	Alternative Cable Specifications			Distance	Modal BW	Wavelength Range	Cable (Optical Fiber) Specification
	Core (μm)	Cladding (μm)	Numerical Aperture				
OC-12c MMF	62.5	125	0.275	500m	500Mhz-Km at 1300nm	1270-1380nm	IEC 793-2 Type A1b and TIA/EIA-492AAAA-A
(LED Based)	50	125	0.2				IEC 793-2 Type A1a
OC-3c MMF	62.5	125	0.275	500m	500Mhz-Km at 1300nm	1270-1380nm	IEC 793-2 Type A1b and TIA/EIA-492AAAA-A
(OC-12c Transceiver Based)	50	125	0.2				IEC 793-2 Type A1a

Table A.4 Standard Multi-mode Cable Specifications (continued)

SONET Type	Attenuation (db)	Mean Launched Power (dBm)	Minimum Receiver Sensitivity (dBm)
OC-12c MMF	6.0	-20 to -14	-26
(LED Based)	2.0	-24 to -14	-26
OC-3c MMF	6.0	-20 to -14	-26
(OC-12c Transceiver Based)	2.0	-24 to -14	-26

Table A.5 shows the cable specifications for standard single-mode cable specifications (OC-12c/OC-3c Short Reach).

Table A.5 Standard Single-Mode Cable Specifications (OC-12c/OC-3c Short Reach)

Specification	Description
Core	9 μm diameter
Cladding	125 μm diameter nominal
Maximum distance between nodes	15 km (9.32 miles)
Wavelength range	1261-1360
Optical fiber specification	IEC 793-2 and ANSI/TIA/EIA-492CAAA
Attenuation range	0 to 12 dB
Mean launched power	-15 to -8 dBm
Minimum receiver sensitivity	-28dBm

Safety Information

You must read the following safety information before carrying out any installation or removal of components, or any maintenance procedures.

Important Safety Information

Warning: Warnings contain directions that you must follow for your personal safety. Follow all instructions carefully.

Please read the following safety information thoroughly in conjunction with the safety information supplied with the Switch before installing the ATM Access module.

- Installation and removal of the unit must be carried out by qualified personnel only.
- This unit operates under SELV (Safety Extra Low Voltage) conditions, according to IEC 950, the conditions of which are maintained only if the equipment to which it is installed is also operational under SELV.
- Optical Safety. Under normal viewing conditions there is no hazard from the Transmit LED. It is recommended however that the LED is not viewed through any magnifying device while it is powered on. It is advisable that the fiber TX port and fiber cable ends are never viewed directly when powered on.

Note: Do not remove the ATM Access module or transceiver module blanking plate with the power still connected.

Warning: The single mode fiber add-on is a Class 1 laser product and as such constitutes an eyesight hazard. Do not look directly at the laser either with a naked eye or through a magnifying device.

Troubleshooting

Use the table below to troubleshoot common problems. If you still experience problems, please contact Avaya's Technical Support.

Table B.1 Troubleshooting Tips

Problem	Probable Cause	Solution
1)The ATM Access module IP does not answer Ping (general)	1)Not inserted correctly in M770 switch. 2)No power 3)Incorrect IP parameters	1)Check that it is inserted all the way into the switch and that the screws are tightened. 2)Verify IP configuration by connecting a terminal to the M-ACC Access module's Console port. Check whether IP and gateway addresses have been defined for the module. 3)Check that the OPR and ATM LEDs are ON?
2)No response to ping when your PC is connected via a Cajun M770 X-Switch Ethernet Port	1)VLAN of the port is not set to VLAN 1	1)VLAN of the port is not set to VLAN 1
3)No response to ping when the pinging station is in the ATM network	ELAN default state is either down or disable	1)Set ELAN default to the up state 2)Check the ATM switch configuration
LNK LED is blinking even though cable is connected	Incompatible port speed	Check the speed of the ATM Access module port and ATM switch
ELAN/VLAN Association problems	Misconfiguration of LANE services to this ELAN	Check ATM switch LANE parameters

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How to Contact Us

To contact Avaya's technical support, please call:

In the United States

Dial 1-800-237-0016, press 0, then press 73300.

In the EMEA (Europe, Middle East and Africa) Region

Country	Local Dial-In Number
Albania	+31 70 414 8001
Austria	+43 1 36 0277 1000
Azerbaijan	+31 70 414 8047
Bahrain	+800 610
Belgium	+32 2 626 8420
Belorussia	+31 70 414 8047
Bosnia Herzegovina	+31 70 414 8042
Bulgaria	+31 70 414 8004
Croatia	+31 70 414 8039
Cyprus	+31 70 414 8005
Czech Rep.	+31 70 414 8006
Denmark	+45 8233 2807
Egypt	+31 70 414 8008
Estonia	+372 6604736
Finland	+358 981 710 081

Country	Local Dial-In Number
France	+33 1 4993 9009
Germany	+49 69 95307 680
Ghana	+31 70 414 8044
Gibraltar	+31 70 414 8013
Greece	+00800 3122 1288
Hungary	+06800 13839
Iceland	+0800 8125
Ireland	+353 160 58 479
Israel	+1 800 93 00 900
Italy	+39 02 7541 9636
Jordan	+31 70 414 8045
Kazakhstan	+31 70 414 8020
Kenya	+31 70 414 8049
Kuwait	+31 70 414 8052
Latvia	+371 721 4368

Country	Local Dial-In Number
Lebanon	+31 70 414 8053
Lithuania	+370 2 756 800
Luxemburg	+352 29 6969 5624
Macedonia	+31 70 414 8041
Malta	+31 70 414 8022
Mauritius	+31 70 414 8054
Morocco	+31 70 414 8055
Netherlands	+31 70 414 8023
Nigeria	+31 70 414 8056
Norway	+47 235 001 00
Oman	+31 70 414 8057
Pakistan	+31 70 414 8058
Poland	+0800 311 1273
Portugal	+351 21 318 0047
Qatar	+31 70 414 8059
Romania	+31 70 414 8027
Russia	+7 095 733 9055
Saudi Arabia	+31 70 414 8022

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Slovakia	+31 70 414 8066
Slovania	+31 70 414 8040
South Africa	+0800 995 059
Spain	+34 91 375 3023
Sweden	+46 851 992 080
Switzerland	+41 22 827 8741
Tanzania	+31 70 414 8060
Tunisia	+31 70 414 8069
Turkey	+800 4491 3919
UAE	+31 70 414 8036
Uganda	+31 70 414 8061
UK	+44 0207 5195000
Ukraine	+31 70 414 8035
Uzbekistan	+31 70 414 8046
Yemen	+31 70 414 8062
Yugoslavia	+31 70 414 8038
Zimbabwe	+31 70 414 8063

In the AP (Asia Pacific) Region

Country	Local Dial-In Number
Australia	+1800 255 233
Hong Kong	+2506 5451
Indonesia	+800 1 255 227
Japan	+0 120 766 227
Korea	+0 80 766 2580

Country	Local Dial-In Number
Malaysia	+1800 880 227
New Zealand	+00 800 9828 9828
Philippines	+1800 1888 7798
Singapore	+1800 872 8717
Taiwan	+0 80 025 227

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In the CALA (Caribbean and Latin America) Region

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