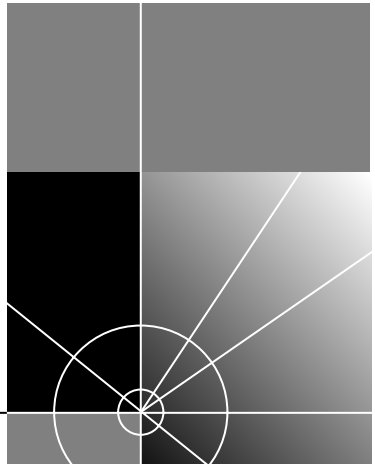
CoreBuilder® 5000 ATM Backbone SwitchModule User Guide



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About This Guide

Introduction

This guide describes how to install, configure, and manage the 3Com CoreBuilder® 5000 ATM Backbone SwitchModule.

If the information in the release notes shipped with your product differs from the information in this guide, follow the release note instructions.

Audience

This guide is intended for the following people at your site:

- Network manager or administrator
- Trained hardware installer or service personnel

How to Use This Guide

The following table shows the location of specific information:

If you are looking for:	Turn to:
ATM Backbone SwitchModule features, descriptions, and example configurations	Chapter 1
An overview of LAN Emulation concepts, components, and operation	Chapter 2
Information on configuring ATM Backbone SwitchModules	Chapter 3
Information on monitoring ATM Backbone SwitchModule operation	Chapter 4
Information about Information Group Management Protocol (IGMP) snooping	Chapter 5
Information on troubleshooting ATM Backbone SwitchModule LEDs, management problems, and resetting ATM Backbone SwitchModules	Chapter 6
Detailed ATM Backbone SwitchModule specifications	Appendix A
3Com technical support information	Appendix B

Conventions

The following tables list conventions used throughout this guide:

Table 1 Notice Icons

Icon	Type	Description
	Information Note	Information notes call attention to important features or instructions.
	Caution	Cautions alert you to personal safety risk, system damage, or loss of data.
	Warning	Warnings alert you to the risk of severe personal injury.

Table 2 Text Conventions

Convention	Description
Enter vs. Type	When the word *enter* is used in this guide, it means type something, then press the Return or Enter key. Do not press the Return or Enter key when instructed to *type*.
Syntax vs. Command	*Syntax* indicates that the general form of a command syntax is provided. You must evaluate the syntax and supply the appropriate port, path, value, address, or string. For example: Enable RIPIP by using the following syntax: `SETDefault !<port> -RIPIP CONTrol = Listen` In this example, you must supply a port number for !<port>. *Command* indicates that all variables in the command have been supplied and you can enter the command as shown in text. For example: Remove the IP address by entering the following command: **`SETDefault !0 -IP NETaddr = 0.0.0.0`**  For consistency and clarity, the full-form syntax (upper- and lowercase letters) is provided. However, you can enter the abbreviated form of a command by typing only the uppercase portion and supplying the appropriate port, path, address, value, and so on. You can enter the command in either upper- or lowercase letters at the prompt.

Table 2 Text Conventions (continued)

Convention	Description
Text represented as `screen display`	`This typeface` is used to represent displays that appear on your terminal screen. For example: `NetLogin:`
Text represented as **`commands`**	**`This typeface`** is used to represent commands that you enter. For example: **`SETDefault !0 -IP NETaddr = 0.0.0.0`**
Keys	Specific keys are referred to in the text as Return key or Escape key, or they may be shown as [Return] or [Esc]. If two or more keys are to be pressed simultaneously, the keys are linked with a plus sign (+). For example: Press [Ctrl]+[Alt]+[Del].
Italics	*Italics* are used to denote new terms or emphasis.

Related Documents

This section provides information on supporting documentation, including:

- 3Com Documents
- Reference Documents

3Com Documents

The following documents provide additional information on 3Com products:

- *CoreBuilder 5000 SwitchModule User Guide* — Provides information on the installation, configuration, operation, and troubleshooting of CoreBuilder 5000 SwitchModules.
- *CoreBuilder 5000 ATM Backbone SwitchModule Quick Start and Reference* — Provides information on the installation and basic configuration of CoreBuilder 5000 ATM Backbone SwitchModules.
- *CoreBuilder 5000 ATM Backbone SwitchModule Command Reference* — Provides a summarized list of DMM/ADMM commands and parameters that apply to the ATM Backbone SwitchModule.
- *Redundant ATM OC-3 Card Installation Instructions* — Provides instructions for installing the redundant ATM OC-3 card on the ATM Backbone SwitchModule.

- *CoreBuilder 5000 Integrated System Hub Installation and Operation Guide* — Provides information on the installation, operation, and configuration of the CoreBuilder 5000 Integrated System Hub. This guide also describes the principal features of the CoreBuilder 5000 Fault-Tolerant Controller Module.
- *CoreBuilder 5000 Distributed Management Module User Guide* — Provides information on the CoreBuilder 5000 Distributed Management Module's operation, installation, and configuration. This guide also describes the software commands associated with the Distributed Management Module.
- *CoreBuilder 5000 Distributed Management Module Commands Guide* — Describes each management command by providing details on command format and use.

For a complete list of 3Com documents, contact your network supplier.

Reference Documents

This section includes the following types of reference documents:

- SNMP and MIB-Based Information
- ATM and LAN Documents

SNMP and MIB-Based Information

The following documents supply related background information on SNMP and networking protocols:

- **Case, J., Fedor, M., Schoffstall, M., and J. Davin**, The Simple Network Management Protocol, RFC 1157, University of Tennessee at Knoxville, Performance Systems International and the MIT Laboratory for Computer Science, May 1990.
- **Rose, M., and K. McCloghrie**, Structure and Identification of Management Information for TCP/IP-based Internets, RFC 1155, Performance Systems International and Hughes LAN Systems, May 1990.
- **Rose, M. and McCloghrie, K.,** Management Information Base for Network Management of TCP/IP-Based Internets: MIB-II, RFC 1213, Performance Systems International and Hughes LAN Systems, March 1991.
- **Decker, E., Langille, P., McCloghrie, K., and Rijsinghani, A.,** Definitions of Managed Objects for Bridges, RFC 1493, Cisco Systems, Inc., Digital Equipment Corporation, and Hughes LAN Systems, July 1993.

- **Kastenholz, F. and McCloghrie, K.,** Evolution of the Interfaces Group of MIB-II, RFC 1573, FTP Software and Hughes LAN Systems, January 1994.
- **Brown, T. and Tesink, K.,** Definitions of Managed Objects for the SONET/SDH Interface Type, RFC 1595, Bell Communications Research, March 1994.
- **Ahmed, M. and Tesink, K.,** Definitions of Managed Objects for ATM Management Version 8.0 using SMIv2, RFC 1695, Bell Communications Research, August 1994.
- LAN Emulation Client Management Specification v1.0, 0038.000, ATM Forum, September 1995.

ATM and LAN Documents

The following documents provide information on ATM and LAN Emulation technology and specifications:

- LAN Emulation Over ATM: Version 1.0 Specification, 0021.000, ATM Forum, January 1995.
- LAN Emulation Over ATM: Version 1.0 Addendum, 0050.000, ATM Forum, January 1996.
- ATM User-Network Interface Specification Version 3.0 ©1993 The ATM Forum. Pub. Prentice-Hall, Inc.
- ITU-TS draft Recommendation Q.93B "B-ISDN User-Network Interface Layer 3 for Basic Call/Bearer Control" May 1993.
- ITU Document DT/11/3-28 (Q.SAAL1) "Service Specific Connection Oriented Protocol (SSCOP) Specification" May 17 1993, Geneva.
- ITU Document DT/11/3-XX (Q.SAAL2) "Service Specific Connection Oriented Protocol (SSCOP) Specification" May 17 1993, Geneva.
- ATM User-Network Interface Specification Version 3.1 ©1994 The ATM Forum
- ITU-T draft Recommendation Q.2931 "B-ISDN User-Network Interface Layer 3 for Basic Call/Bearer Control" March 1994.
- ITU-T Recommendation Q.2110 BISDN — ATM Adaptation Layer — Service Specific Connection Oriented Protocol (SSCOP).

1 INTRODUCTION

This chapter describes the features and components of the 3Com CoreBuilder® 5000 ATM Backbone SwitchModules and how ATM Backbone SwitchModules operate.

This chapter contains the following sections:

- ATM Backbone SwitchModule Overview
- ATM Backbone SwitchModule Architecture
- ATM Backbone SwitchModule Descriptions
- PacketChannel Backplane Description
- Sample ATM Backbone SwitchModule Configurations

ATM Backbone SwitchModule Overview

CoreBuilder 5000 ATM Backbone SwitchModules are high-performance LAN-switching modules for the 3Com CoreBuilder 5000 Integrated System Hub.

This section describes:

- ATM Backbone SwitchModule Features
- Supported CoreBuilder 5000 SwitchModules
- Supported Management Standards

ATM Backbone SwitchModule Features

ATM Backbone SwitchModules provide the following features.

Seamless ATM Migration

The ATM Backbone SwitchModule protects your investment in LAN equipment, wiring, and software by providing seamless LAN-to-ATM communication. You can connect existing Ethernet, Fast Ethernet, and FDDI legacy LANs with 155 Mbps ATM backbones.

Multiple Redundancy Levels

You can configure the ATM Backbone SwitchModule for two levels of redundancy:

- **PHY Redundancy** — A secondary ATM OC-3 card provides PHY redundancy. If the primary ATM OC-3 card or attached cable fails or performance fails or is no longer receiving light, the redundant ATM OC-3 card becomes active to maintain operations, if PHY switchover is enabled.
- **Module Redundancy** — Adding a second ATM Backbone SwitchModule to the CoreBuilder 5000 hub in a dual-homing configuration allows you to load-balance ATM requirements while providing automatic module failover if one of the modules fails.

ATM Forum Specification Compliance

The ATM Backbone SwitchModule is fully compliant with the following ATM Forum specifications:

- UNI 3.0/3.1
- LANE 1.0

CoreBuilder 5000 Chassis Compatibility

You can install and operate the ATM Backbone SwitchModule in any CoreBuilder 5000 17-slot, 10-slot, or 7-slot chassis that contains a PacketChannel backplane.

Switched Virtual Circuit Capacity

Each ATM Backbone SwitchModule supports up to 512 simultaneous switched virtual circuit (SVC) connections.

Emulated LAN (ELAN) Capacity

Each ATM Backbone SwitchModule provides up to 64 LAN Emulation Clients (LECs) for connection to 64 Emulated LANs (ELANs). These virtual LANs can be managed using the 3Com Transcend® Enterprise VLAN Manager (v4.1 or later), a graphical interface tool that greatly simplifies the management of virtual and emulated LANs.

Hot Swap Feature

You can insert or remove ATM Backbone SwitchModules without powering off the CoreBuilder 5000 chassis.

Supported CoreBuilder 5000 SwitchModules

CoreBuilder 5000 ATM Backbone SwitchModules provide ATM connectivity for the following CoreBuilder 5000 SwitchModules:

- 2-Port DAS FDDI SwitchModule (3C96604M-F)
- 2-Port DAS FDDI SwitchModule (3C96604M-F-A)
- 4-Port 100BASE-FX SwitchModule (3C96604M-FX-A)
- 4-Port 100BASE-TX SwitchModule (3C96604M-TX-A)
- 10-Port 10BASE-F SwitchModule (3C96610M-F-ST)
- 10-Port 10BASE-F-A SwitchModule (3C96610M-F-A)
- FDDI CONC (MIC) (3C96612M-FC-A)
- 10-Port 10BASE-T/DAS FDDI SwitchModule (3C96612M-FF-A)
- 12-Port 10BASE-T SwitchModule (3C96612M-TP)
- 12-Port 10BASE-T SwitchModule (3C96612M-TP-A)
- 12-Port 10BASE-T/DAS FDDI SwitchModule (3C96614M-FTP-A)
- 16-Port Ethernet Backplane SwitchModule (3C96616M-BTP-A)
- 18-Port Fast Ethernet 100BASE-T SwitchModule (3C96618M-TX-A)
- 20-port 10BASE-F SwitchModule (3C96620M-F-ST)
- 20-Port 10BASE-F SwitchModule (3C96620M-F-A)
- 20-Port Ethernet 10BASE-T SwitchModule (3C96620M-TP-A)
- 24-Port 10BASE-T SwitchModule (3C96624M-TP-A)
- 24-Port Telco SwitchModule (3C96624M-TPL-A)

Supported Management Standards

CoreBuilder 5000 ATM Backbone SwitchModules support the standards and MIBs shown in Table 1-1.

Table 1-1 Supported Standards and MIBs

Standards	ATM Forum UNI 3.0/3.1
	ATM Forum LANE 1.0
	IEEE 802.1D (Spanning Tree)
	IEEE 802.1H (Translation)
	IEEE 802.3
	SNMP (RFC 1157)
MIBs	Bridge MIB (RFC 1493)
	MIB II (RFC 1213)
	Interfaces MIB (RFC 1573)
	ATM MIB (RFC 1695)
	SONET MIB (RFC 1595)
	ATM Forum LEC MIB
	IANAIFTYPE MIB
	3Com ISD MIB

ATM Backbone SwitchModule Architecture

This section describes the hardware components of the CoreBuilder 5000 ATM Backbone SwitchModule.

Figure 1-1 identifies the significant hardware components of the ATM Backbone SwitchModule.

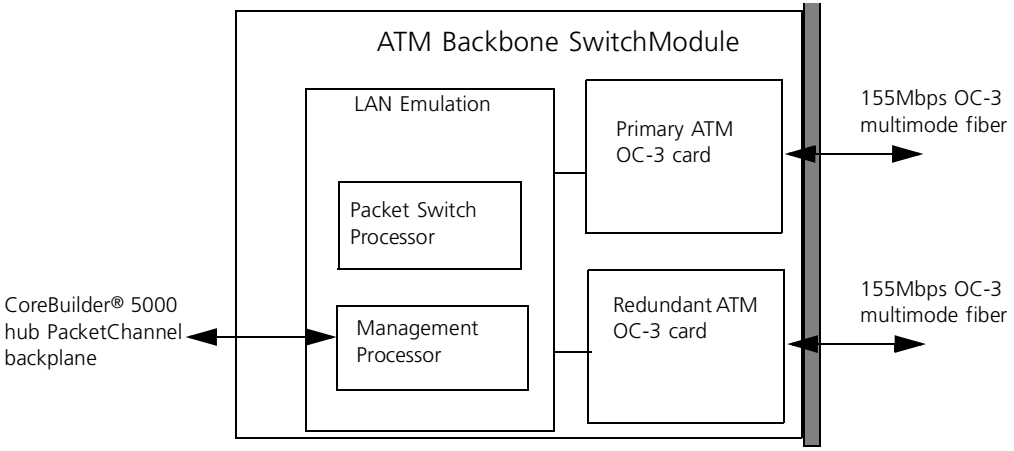


Figure 1-1 ATM Backbone SwitchModule Hardware Components

The significant hardware components of the ATM Backbone SwitchModule include:

- Management Processor
- Packet Switch Processor
- Primary ATM OC-3 Card
- Redundant ATM OC-3 Card

Management Processor

The Management Processor performs processing functions that are not time critical. Its main functions include:

- Network management
- ATM signalling
- ATM LAN emulation client (LEC) functions
- Bridging functions
- Forwarding table maintenance

Packet Switch Processor

The Packet Switch Processor performs time-critical processing functions such as packet forwarding.

Primary ATM OC-3 Card

The primary ATM OC-3 card provides a SONET PHY ATM interface operating at 155 Mbps on OC-3, multimode fiber over an SC-type connector. The maximum distance between links is 2 kilometers.

Redundant ATM OC-3 Card

The redundant ATM OC-3 card is identical to the primary ATM OC-3 card. It becomes active in place of the primary ATM OC-3 card if any of the following characteristics are lost:

- Light
- Frame
- Cell delineation
- ATM signalling
- ILMI (Integrated Local Management interface) channel information

ATM Backbone SwitchModule Descriptions

This section describes the base and redundant hardware configurations of the ATM Backbone SwitchModule.

Base Hardware Configuration

Figure 1-2 shows the ATM Backbone SwitchModule with only the primary ATM OC-3 card installed.

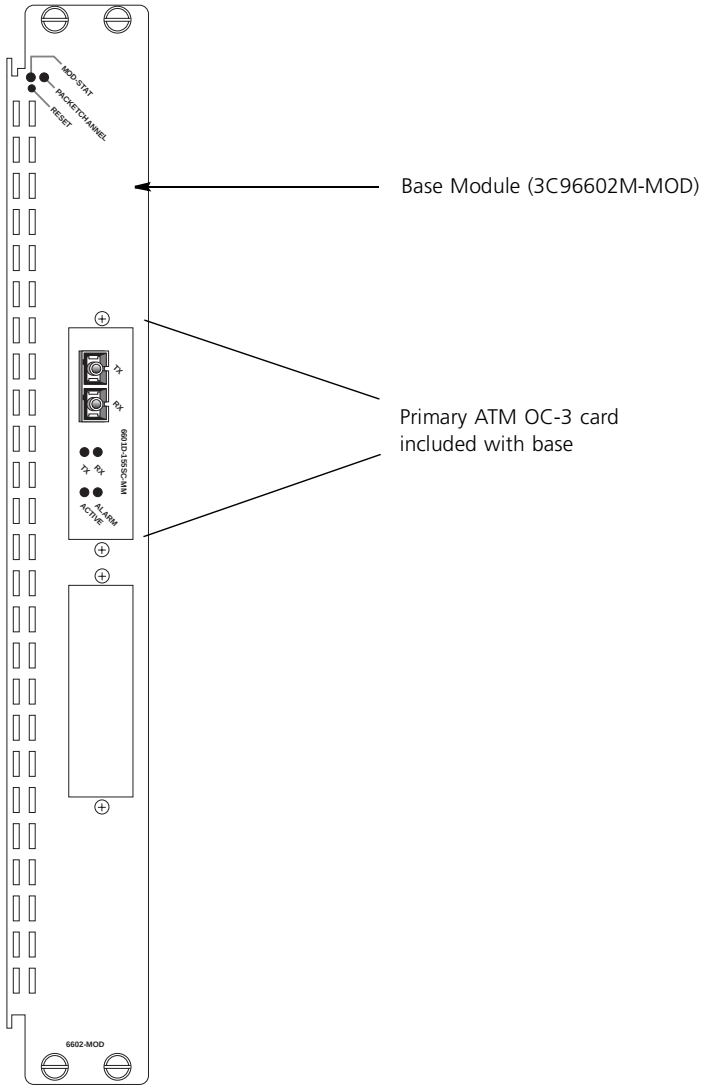


Figure 1-2 ATM Backbone SwitchModule Base Configuration

Redundant Hardware Configuration

Figure 1-3 shows the ATM Backbone SwitchModule with an optional redundant ATM OC-3 card installed.

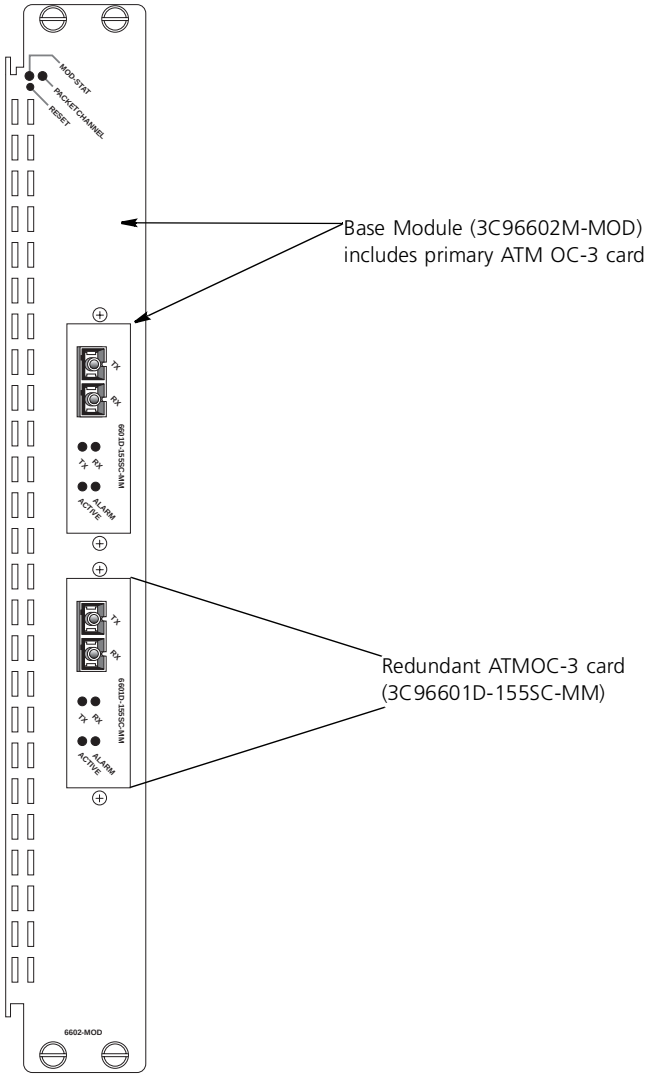


Figure 1-3 ATM Backbone SwitchModule with Redundant ATM OC-3 Card

See the CoreBuilder® 5000 ATM Backbone SwitchModule Quick Start and Reference *for how to install the redundant ATM OC-3 card.*

PacketChannel Backplane Description

An ATM Backbone SwitchModule installed in the CoreBuilder 5000 hub connects to the CoreBuilder 5000 PacketChannel backplane. There are two kinds of PacketChannel backplanes:

- **Standard PacketChannel** — Supports packet-switching. When you display hub information, the hub type is listed with the suffix -xP (x may be A or B) to identify this backplane, and the backplane type is listed as PacketChannel.
- **PacketChannel plus ATM Cell-Switching (SwitchChannel)** — Supports both packet-switching and ATM cell-switching. When you display hub information, the hub type is listed with the suffix -xC (x may be A or B) to identify this backplane, and the backplane type is listed as SwitchChannel.

Both the PacketChannel backplane and the packet-switching part of the SwitchChannel backplane:

- Support LAN-switching technology.
- Switch 3.4 million packets per second.
- Provide a 2 Gigabit-per-second bus.
- Are designed as a passive bus that contains no active components that can break down.
- Occupy the third (upper) backplane slot of the CoreBuilder 5000 hub.

Slot Restrictions Per Backplane

Some slot restrictions apply if the hub uses the SwitchChannel backplane or if the hub contains no backplane in the third backplane slot. Refer to Table 1-2 for information about ATM Backbone SwitchModule installation restrictions and operation.

Table 1-2 SwitchModule Installation Per Backplane

CoreBuilder 5000 Hub	Backplane	Hub Type*	SwitchModule Installation and Operation
17-Slot	PacketChannel (Part Number 30-0433)	3C96017C-AP 3C96017C-BP 3C96017CH-AP	Install ATM Backbone SwitchModule in any slot in the hub.
	SwitchChannel (Part Number 30-0430)	3C96017C-AC 3C96017C-BC 3C96017CH-AC	Install ATM Backbone SwitchModule in slots 1 through 8 or 13 through 17.

Table 1-2 SwitchModule Installation Per Backplane (continued)

CoreBuilder 5000 Hub	Backplane	Hub Type*	SwitchModule Installation and Operation
10-Slot	PacketChannel (Part Number 30-0432)	3C96010C-AP 3C96010C-BP 3C96010CH-AP	Install ATM Backbone SwitchModule in any slot in the hub.
	SwitchChannel (Part Number 30-0434)	3C96010C-AC 3C96010C-BC 3C96010CH-AC	Install ATM Backbone SwitchModule in slots 1 through 8.
7-Slot	PacketChannel (Part Number 30-0471)	3C96007C-AP 3C96007C-BP 3C96007CH-AP	Install ATM Backbone SwitchModule in any slot in the hub.
17-Slot, 10-Slot, or 7-Slot	No PacketChannel or SwitchChannel backplane	3C96017C-A 3C96017C-B 3C96010C-A 3C96010C-B 3C96007C-A 3C96007C-B	Does not support ATM Backbone SwitchModule. Contact 3Com Technical Support for information on upgrading your CoreBuilder® 5000 hub.

* To verify the hub type, enter the DMM command SHOW HUB.

Refer to the *CoreBuilder 5000 Integrated System Hub Installation and Operation Guide* for more information about CoreBuilder 5000 hub backplanes.

Sample ATM Backbone SwitchModule Configurations

This section illustrates three basic configurations of the ATM Backbone SwitchModule:

- Basic Configuration
- Dual-Homing Configuration
- Dual-Homing/Module Redundancy Configuration

Basic Configuration

Figure 1-4 illustrates the basic configuration of an ATM Backbone SwitchModule with only a primary ATM OC-3 card.

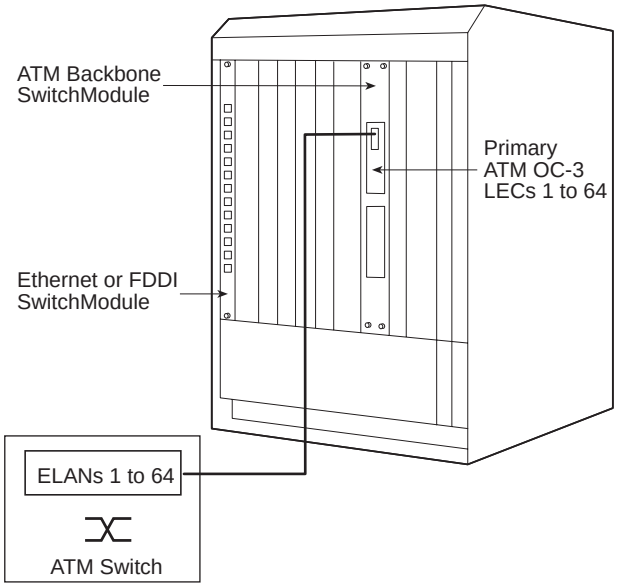


Figure 1-4 Example Base Configuration

See Chapter 2, LAN Emulation Overview, for a description of LAN Emulation components and operation.

Dual-Homing Configuration

Figure 1-5 illustrates the dual-homing configuration of an ATM Backbone SwitchModule with a redundant ATM OC-3 card.

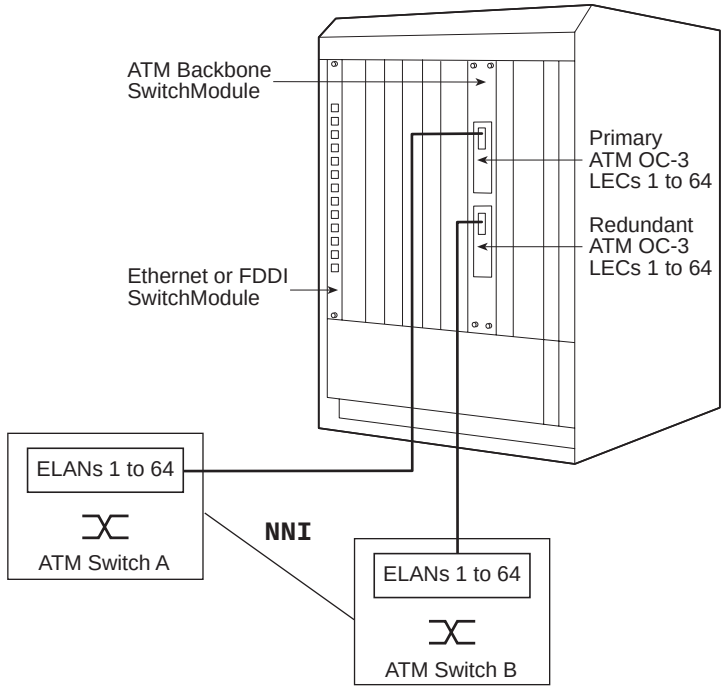


Figure 1-5 Example Dual-Homing Configuration

If the loss of light, frame, or cell delineation is detected, the redundant ATM OC-3 card becomes active and the primary ATM OC-3 card is disabled.

Dual-Homing/Module Redundancy Configuration

Figure 1-6 illustrates the dual-homing/module redundancy configuration of two ATM Backbone SwitchModules with redundant ATM OC-3 cards.

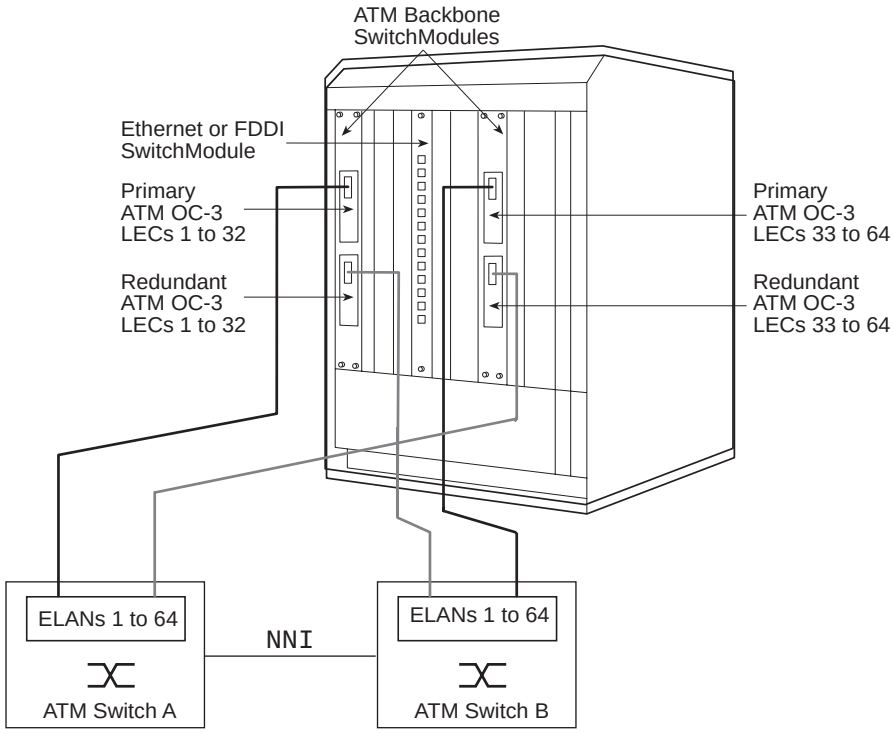


Figure 1-6 Example Dual-Homing/Module Redundancy Configuration

The LECs in the example configuration of Figure 1-6 can be manually distributed between the two ATM Backbone SwitchModules in any combination.

The features of the dual-homing/module redundancy configuration include:

- Load balancing

  LEC support is distributed manually across two ATM Backbone SwitchModules

- ATM PHY redundancy

  On either ATM Backbone SwitchModule, if the loss of any critical function is detected, the redundant ATM OC-3 card becomes active and the primary ATM OC-3 card is disabled.

- Module redundancy

  Using spanning tree parameters, one ATM Backbone SwitchModule assumes the LEC support of the other ATM Backbone SwitchModule if the other ATM Backbone SwitchModule fails.

Refer to the CoreBuilder 5000 SwitchModule User Guide *for information on Spanning Tree parameters and configuration information.*

2 LAN EMULATION OVERVIEW

This chapter describes the LAN emulation technology that provides an interface between Ethernet and FDDI packet-based networks and ATM cell-based networks.

This chapter contains the following sections:

- General Definition of LAN Emulation
- LAN Emulation Components
- LAN Emulation Data Exchange
- LAN Emulation Connections
- LAN Emulation Operation

This chapter provides a general overview of fundamental LAN emulation concepts and terminology. For more detailed information on LAN emulation, refer to ATM Forum specifications LANE 1.0.

General Definition of LAN Emulation

LAN Emulation (LANE) provides an interface between traditional LANs and ATM networks. LAN emulation is defined by ATM specifications LANE 1.0.

An ATM emulated LAN conforms to IEEE 802.3 for Ethernet LANs.

The use of LAN emulation bridge allows you to use a high-speed ATM backbone to connect existing (legacy) Ethernet LANs. Figure 2-1 illustrates the basic function of LAN emulation.

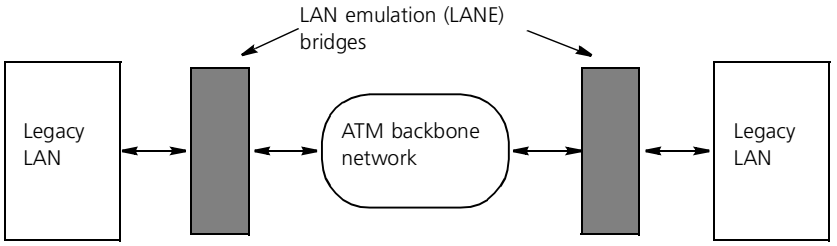


Figure 2-1 LAN Emulation Function

The ATM Backbone SwitchModule provides a LAN emulation bridge between an ATM network and a standard Ethernet-based SwitchModule (Figure 2-2).

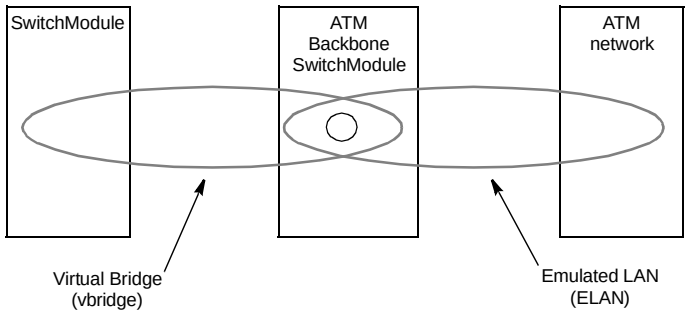


Figure 2-2 ATM Backbone SwitchModule Function

The ATM Backbone SwitchModule accepts Ethernet and FDDI source packets from the SwitchModule over the CoreBuilder 5000 PacketChannel backplane and converts the packets to ATM cells for forwarding to the ATM backbone.

Conversely, ATM cells received by the ATM Backbone SwitchModule from the ATM backbone are converted to Ethernet packets and sent over the CoreBuilder 5000 PacketChannel backplane to the destination SwitchModule.

LAN Emulation Components

This section identifies:

- General LANE Components
- ATM Backbone SwitchModule LANE Components

General LANE Components

The major components of ATM LAN emulation are identified in Figure 2-3.

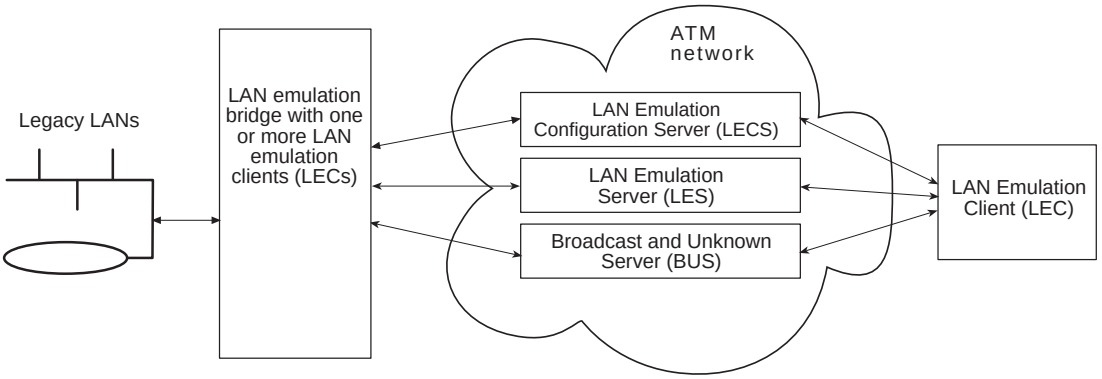


Figure 2-3 General LAN Emulation Components

Each of the major LAN emulation components are defined here.

LAN Emulation Client (LEC)

The LAN Emulation Client is the entity in an end system that performs data forwarding, address resolution, and other control functions for a single end-system within a single ELAN. Each LEC is identified by a unique ATM address and is assigned to an ELAN in the ATM network.

LAN Emulation Configuration Server (LECS)

The LAN Emulation Configuration Server assigns individual LECs to a particular emulated LAN (ELAN) by directing them to the LAN emulation server that corresponds to the ELAN.

LAN Emulation Server (LES)

The LAN Emulation Server implements the control functions for a particular ELAN. There is only one logical LES for each ELAN. A LEC that belongs to a particular ELAN is controlled by the LES for the ELAN.

Broadcast and Unknown Server (BUS)

The Broadcast and Unknown Server is a multicast server that forwards multicast and broadcast traffic to LECs within a specific ELAN. The BUS also floods unknown unicast traffic to all LECs in the ELAN.

ATM Backbone SwitchModule LANE Components

Implementation of the LAN emulation components in the ATM Backbone SwitchModule is illustrated in Figure 2-4.

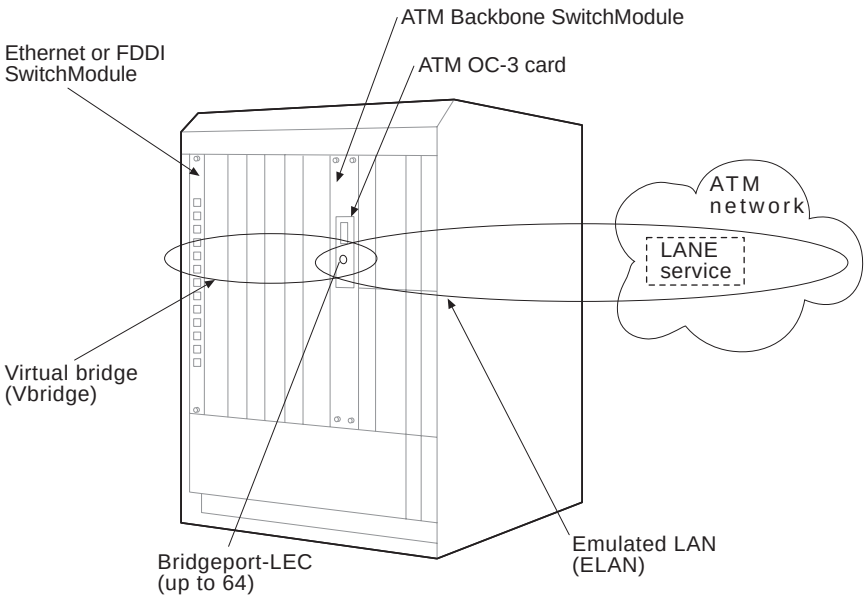


Figure 2-4 ATM Backbone SwitchModule LANE Components

In addition to the standard LANE service components (see Figure 2-3), the ATM Backbone SwitchModule includes the following components:

Bridgeport-LEC

You define up to 64 bridgeport-LECs for each ATM Backbone SwitchModule. A bridgeport-LEC is both a standard ATM LEC that you assign to an emulated LAN and a bridgeport that you assign to a virtual bridge.

Virtual Bridge (vbridge)

You create virtual bridges on CoreBuilder 5000 SwitchModules. You assign each bridgeport-LEC to a vbridge on a SwitchModule in the CoreBuilder 5000 hub.

Emulated LAN (ELAN)

You assign each bridgeport-LEC to an ELAN in the ATM network. An ELAN is a logical LAN grouping of LECs within an ATM network.

LAN Emulation Data Exchange

This section identifies important characteristics of data exchange between a SwitchModule and an ATM network.

Protocol Stacks

The LAN emulation protocol stacks used in the exchange of data between a SwitchModule-based LAN and ATM host are shown in Figure 2-5.

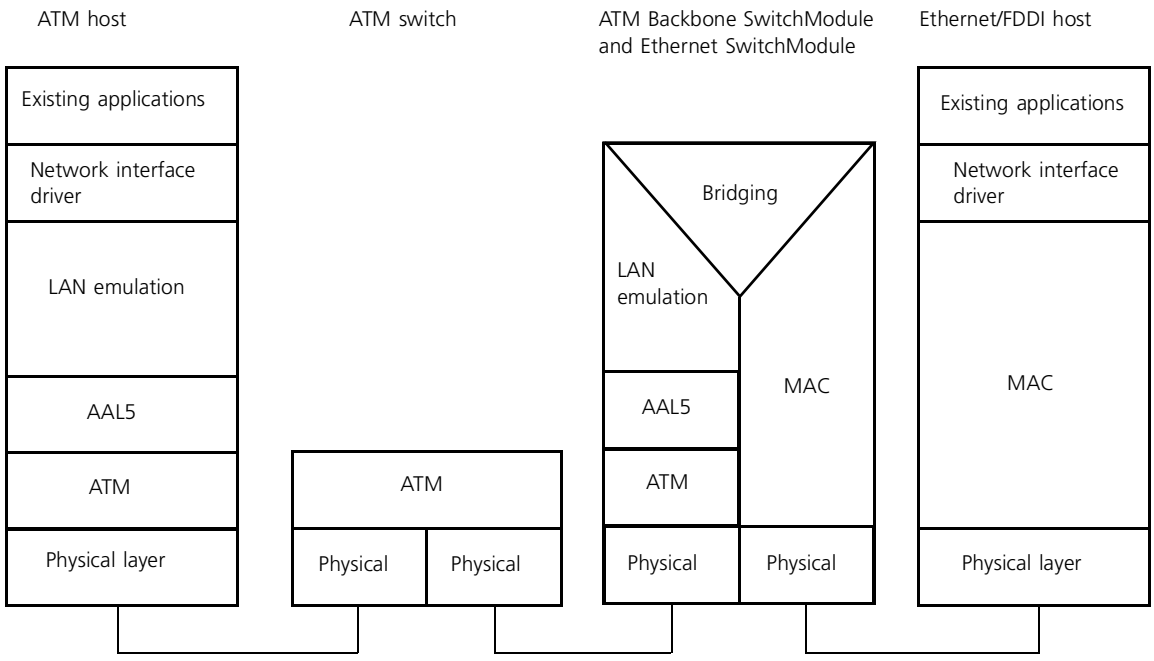


Figure 2-5 LAN Emulation Protocol Stacks

Packets Versus Cells The ATM Backbone SwitchModule converts Ethernet- and FDDI-originated packets to and from ATM cells.

Figure 2-6 illustrates the conversion of SwitchModule packets to and from ATM cells.

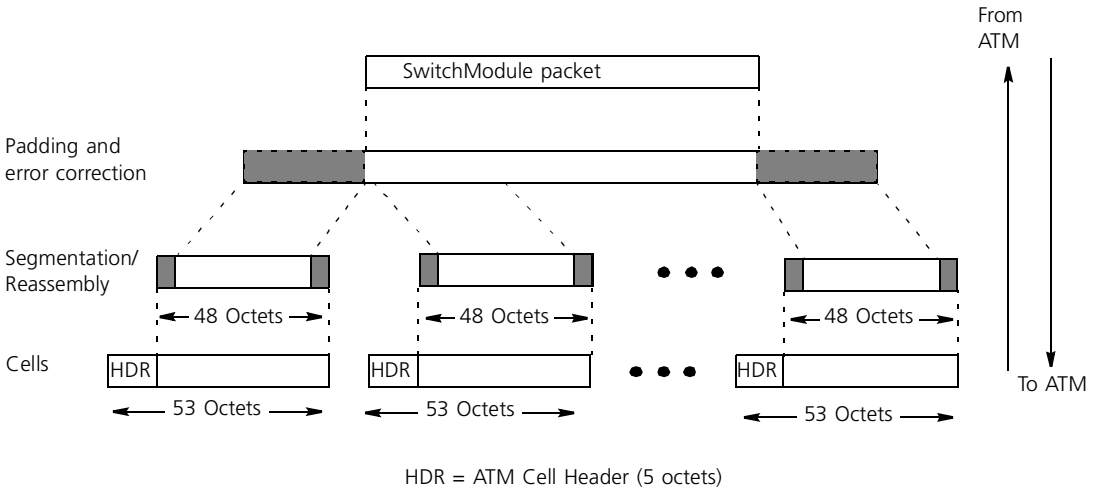


Figure 2-6 Converting SwitchModule Packets to and from ATM Cells

LAN Emulation Connections

LAN emulation uses VCCs (virtual channel connections) to provide communications between a LEC and the LANE service.

There are two types of VCCs:

- Control VCCs
- Data VCCs

Control VCCs

Control VCCs consist of the following three types:

- **Configuration Direct VCC** — A bidirectional point-to-point VCC from the LEC to the LECS
- **Control Direct VCC** — A bidirectional VCC from the LEC to the LES
- **Control Distribute VCC** — A unidirectional VCC from the LES to the LEC; typically, a point-to-multipoint connection from the LES to multiple LECs

Figure 2-7 illustrates the function of the three types of Control VCCs in ATM Backbone SwitchModule LAN emulation.

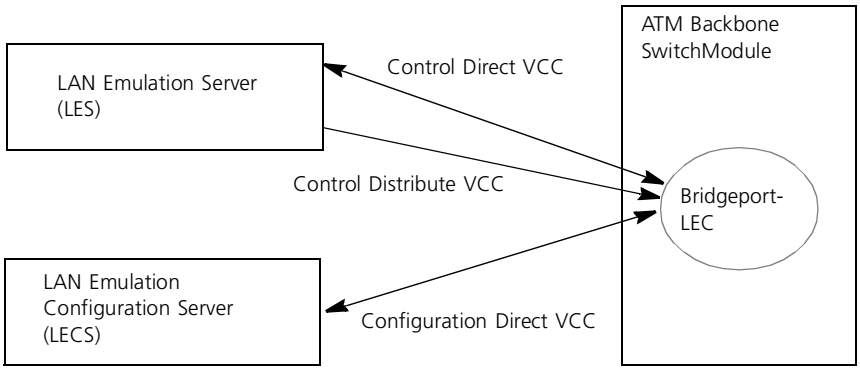


Figure 2-7 Control VCCs in ATM Backbone SwitchModule LAN Emulation

Data VCCs Data VCCs consist of the following three types:

- **Data Direct VCC** — A bidirectional point-to-point VCC set up between two LECs that want to exchange data
- **Multicast Send VCC** — A bidirectional point-to-point VCC between the LEC and the BUS
- **Multicast Forward VCC** — A unidirectional VCC from the BUS to the LEC; typically, a point-to-multipoint connection from the BUS to multiple LECs

Figure 2-8 illustrates the function of the three basic types of Data VCCs in ATM Backbone SwitchModule LAN emulation.

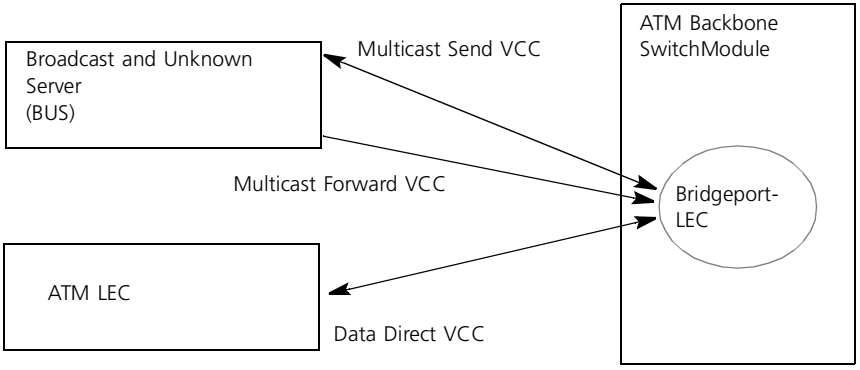


Figure 2-8 Data VCCs in ATM Backbone SwitchModule LAN Emulation

LAN Emulation Operation

This section describes the simplified operation of a LEC in a LAN emulation configuration. LEC operation is defined by the protocols of the LAN Emulation User-Network Interface (LUNI).

LUNI protocol defines each stage of operation for a LEC. The major stages of operation, defined in this section, are:

- Initialization
- LECS Connection
- Configuration
- Joining
- BUS Connection
- Data Movement

Initialization

In the initial state, the LEC configuration is initialized from nonvolatile storage or set to default values.

The next stage of LEC operation depends on the LANE configuration mode of the LEC:

- **Manual configuration mode** — The LEC proceeds directly to the Joining stage and uses a locally configured LES ATM address.
- **Automatic configuration mode** — The LEC proceeds to the LECS Connection stage and attempts to contact the LECS to obtain its configuration, including ELAN/LES assignment.

LECS Connection The LEC must determine the ATM address of its LECS and establish a connection to the LECS. The LEC attempts each of the following methods, in the order provided, to connect to its LECS:

1. Uses a locally configured LECS ATM address.
2. Queries the ILMI Service Registry MIB of the attached ATM switch for one or more LECS ATM addresses.
3. Uses a predefined "well-known" LECS ATM address.

The use of another LANE 1.0 method of LECS connection, a PVC (Permanent Virtual Circuit) connection over VPI/VCI 0/17 (Virtual Path Identifier/Virtual Circuit Identifier), is not supported by the ATM Backbone SwitchModule.

The LEC proceeds to the Configuration stage when it establishes a connection to the LECS.

Configuration During the configuration stage, the LEC:

1. Sends a Configuration Request, containing identifying information about itself, to the LECS.
2. Receives a Configuration Response from the LECS containing the ATM address of the LES to which the LEC is assigned, as well as emulated LAN parameters such as ELAN type, frame size, and ELAN name.

Joining During the Joining stage, the LEC:

1. Connects to the LES and sends a Join Request containing LANE parameter settings that were locally configured (manual mode) or obtained from the LECS (automatic mode).
2. Receives a Join Response from the LES indicating whether the LEC is accepted onto the emulated LAN controlled by that LES.

BUS Connection During the BUS Connection stage, the LEC:

1. Sends an LE-ARP (LAN Emulation-Address Resolution Protocol) request to the LES containing the target MAC address FF-FF-FF-FF-FF-FF (broadcast MAC address).

   The LES returns an LE-ARP response containing the ATM address of the emulated LAN's BUS.

2. Establishes connections to the BUS for transmitting and receiving multicast and unknown unicast traffic.

Data Movement In the Data Movement stage, the LEC:

- Sends and receives multicast MAC frames over the connections to the BUS.
- Sends and receives unknown unicast MAC frames (unicast MAC frames for which the corresponding ATM address on the emulated LAN is unknown) over the connections to the BUS. At the same time, the LEC conducts an LE-ARP exchange to associate the MAC address with the ATM address of another station on the emulated LAN.
- After a MAC/ATM address binding is resolved using LE-ARP, establishes a Data Direct VCC to that ATM address. After the Data Direct VCC is set up between two LECs, a Flush request is sent via the bus to signal to the receiving LEC to stop sending Data via the bus and to start sending data over the established Data Direct VCC. The receiving LEC responds with a Flush response via the bus to clear the bus channel. Any unicast frames received from the ATM address from the time the LEC sends out the Flush request until the time it receives the Flush response are buffered. The buffered frames are sent out over Data Direct VCC after the LEC receives the Flush command instead of over the bus.
- Disconnects a Data Direct VCC that remains idle for a specified timeout period.

3 CONFIGURING THE ATM BACKBONE SWITCHMODULE

This chapter provides procedures for configuring the CoreBuilder® 5000 ATM Backbone SwitchModule.

This chapter contains the following sections:

- Configuration Tools
- Setting Up DMM Access
- Configuration Process Overview
- Configuring LAN Emulation Parameters
- Configuring ATM OC-3 Card Redundancy
- Configuring IGMP Snooping Parameters

Configuration Tools

This section identifies the management tools that are available for you to manage CoreBuilder 5000 ATM Backbone SwitchModules. ATM Backbone SwitchModule configuration tools include:

- 3Com CoreBuilder 5000 Distributed Management Module (DMM) (includes Advanced DMM)
- Advanced Management Tools

Distributed Management Module

The CoreBuilder 5000 Distributed Management Module (DMM) and Advanced DMM (ADMM) provide commands that allow you to configure and monitor the ATM Backbone SwitchModule.

The ATM Backbone SwitchModule requires DMM/ADMM Version v5.20 or later.

DMM access to the ATM Backbone SwitchModule is obtained in either of two ways:

- Connect a terminal directly to the console port of the DMM
- TELNET to the IP address of the DMM from which the ATM Backbone SwitchModule is accessible

Refer to Setting Up DMM Access later in this chapter for more information.

Advanced Management Tools

This section identifies the advanced management tools that are available for managing CoreBuilder 5000 ATM Backbone SwitchModules, including:

- Transcend Network Control Services for UNIX
- Transcend Network Management Software for Windows
- Third-Party SNMP-Based Tools

Transcend Network Control Services for UNIX

3Com Transcend® Network Control Services for UNIX provides a suite of advanced graphical tools for network management. Figure 3-1 illustrates the Transcend UNIX graphical tools you can use to configure CoreBuilder 5000 ATM Backbone SwitchModules.

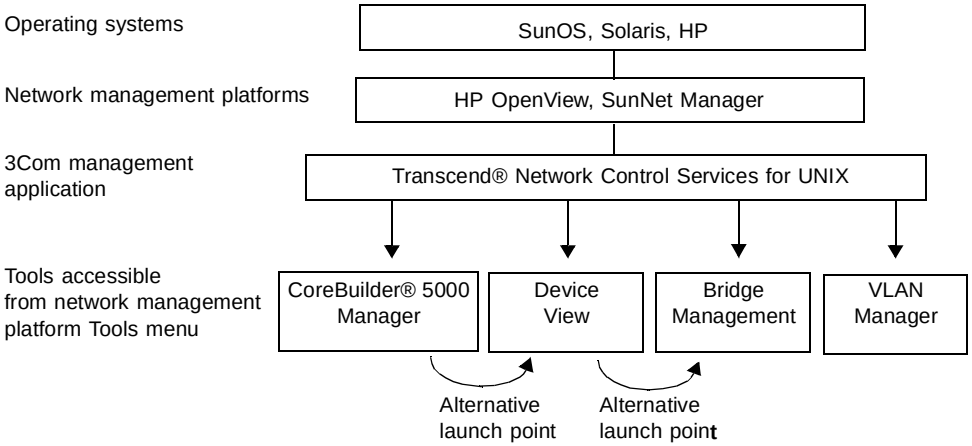


Figure 3-1 UNIX Tools for Configuring ATM Backbone SwitchModules

Transcend Network Control Services for UNIX applications are accessed by:

- Selecting the application directly from the Tools menu of the network platform (for example, HP OpenView)
- Selecting a launch point from one application to another

You can access VLAN Manager from the network platform Tools menu only.

Transcend Network Management Software for Windows

3Com Transcend Network Management Software for Windows provides a suite of advanced graphical tools for network management. Figure 3-2 illustrates the Transcend Windows tools that you can use to configure CoreBuilder 5000 ATM Backbone SwitchModules.

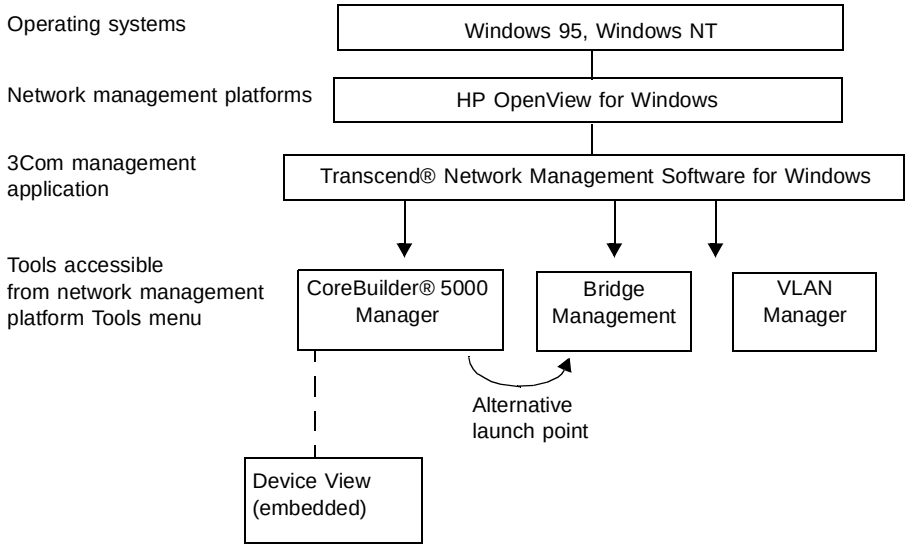


Figure 3-2 Windows Tools for Configuring ATM Backbone SwitchModules

Transcend Network Management Software for Windows applications are accessed by:

- Selecting the application directly from the Tools menu of the Network Platform (for example, HP OpenView)
- Selecting a launch point from one application to another

You can access VLAN Manager from the Windows NT Tools menu only.

Third-Party SNMP-Based Tools

After you set up the DMM access, you can use any SNMP network manager for management (if the Management Information Base (MIB) is correctly installed on your network management station).

To manage the ATM Backbone SwitchModule with a network manager purchased from another vendor, verify that you have the correct MIB. Contact your network supplier for advice.

Setting Up DMM Access

This section provides procedures you must follow to set up access to DMM management tools.

You can access the DMM by:

- Direct terminal access
- TELNET access

Setting Up Direct Terminal Access to the DMM

Refer to the *CoreBuilder 5000 Distributed Management Module User Guide* for procedures to set up a direct terminal connection to the DMM.

Configuring TELNET Access to the DMM

You can configure in-band access to the DMM, which allows you to manage the CoreBuilder 5000 hub from a remote terminal or SNMP manager such as the 3Com Transcend Network Control Services application.

The CoreBuilder 5000 SwitchModules have embedded network connectivity to the DMM across the hub management channel.

Be sure that TELNET Access to the DMM is established through the CoreBuilder 5000 SwitchModule or another module in the hub.

For procedures on setting up Telnet access to the DMM, see the *CoreBuilder 5000 SwitchModule User Guide*.

Configuration Process Overview

This section provides an overview of the following configuration information:

- Configuration Components
- Configuration Defaults

Configuration Components

ATM Backbone SwitchModule configuration consists of three main components, described in the following sections:

LAN Emulation Configuration

Defines up to 64 LECs (LAN Emulation Clients) and assigns each to a unique ELAN. LEC configuration also involves defining various ELAN parameters for created LECs.

Initial LEC configuration requirements are specified in Configuring LAN Emulation Parameters later in this document.

Bridge Configuration

After it is created, a LEC must be assigned to an existing SwitchModule vbridge and can be configured as a normal SwitchModule bridge port, except that the SwitchModule never elects a bridgeport-LEC as master bridge port.

See the CoreBuilder 5000 SwitchModule User Guide *for more information on master bridge ports*.

Initial bridge configuration requirements are specified in Configuring LAN Emulation Parameters later in this chapter. For a complete list of configurable bridging parameters, see the *CoreBuilder 5000 SwitchModule User Guide*.

ATM Configuration

CAUTION: *Changes to the ATM parameters can cause problems with system operation. Only qualified ATM service personnel should attempt to modify these parameters. We recommend that you do not attempt to change these parameters.*

Various ATM parameters are available to control ATM operating characteristics but, with the exception of the UNI Version parameter, ATM parameters typically do not require modification.

The default UNI Version of the ATM Backbone SwitchModule is 3.0. If necessary, use the following command to change the UNI Version to match that of the ATM switch:

```
CB5000> set atm slot uni_version version
```

The valid UNI Version settings are:

- 3_0
- 3_1

See the following for more information on ATM configuration:

- *ATM Backbone SwitchModule Command Reference for* ATM-related DMM commands and parameters
- *DMM Commands Guide* for commands and examples
- ATM Forum specifications UNI 3.0/3.1 and LANE 1.0

Configuration Defaults

After installing the ATM, the following default configuration parameters are in effect:

- The number of LECs on the module is set to 8.
- LE_ARP Quiet Time is set to 5 seconds.
- UNI version is set to 3_0.
- LEC 1 is set to the following parameter values:
  - Configuration mode is Automatic.
  - Interface mode is Enabled.
  - ELAN Name is Admin.
  - Vbridge assignment is vbridge_1.

- LECs 2 through 8 are set to the following parameter values:
  - Configuration mode is Manual.
  - Interface mode is Disabled.
  - ELAN Name is None.
  - Vbridge assignment is Unassigned.

Configuring LAN Emulation Parameters

The procedure you use to configure the LAN Emulation parameters for a LAN Emulation Client depends on whether the LEC is configured for automatic or manual configuration.

Automatic Bridgeport-LEC Configuration Mode

By default, the configuration mode of LEC 1 of the ATM Backbone SwitchModule is set to Automatic. Upon initial power-on, a LEC that is set to Automatic configuration mode attempts to establish connection with the LECS according to established autoconfiguration guidelines. Refer to Chapter 2, LAN Emulation Overview, for more information.

After the automatic bridgeport-LEC configuration is complete, you must assign the LEC to a vbridge. Only one bridgeport LEC from the same ATM Backbone SwitchModule may be assigned to each virtual bridge. In this example, LEC 1 of a ATM Backbone SwitchModule in slot 4 is assigned to vbridge 2:

```
CB5000> set bridge_port 4.1 vbridge 2
```

Before the LEC can exchange data, a bridgeport on the Ethernet or FDDI SwitchModule must also be assigned to the vbridge.

Manual Bridgeport-LEC Configuration Mode

If the module cannot successfully autoconfigure, use the following procedure to manually configure the required initial parameters.

1. Configure initial ATM Backbone SwitchModule parameters using the commands in the following example (configuring LEC 1 on a module in slot 4):

```
CB5000>set bport_lec 4.1 mode disable
CB5000>set bridge_port 4.1 vbridge 2
CB5000>set bport_lec 4.1 config_mode manual
CB5000>set bport_lec 4.1 les_atm_address <address>
CB5000>set bport_lec 4.1 elan_name <name> (may not be required)
CB5000>set bport_lec 4.1 mode enable
```

2 Save the settings as follows:

```
CB5000> save all
```

3 Repeat steps 1 and 2 for each LEC you require.

4 Assign a unique LES address for each bridgeport LEC on the same module. If a bridgeport LEC has an address configured that is a duplicate of another bridgeport LEC, it never joins the ELAN.

For a complete list of optional DMM LAN Emulation commands and parameters, see the ATM Backbone SwitchModule Command Reference*. For descriptions and examples of the LAN Emulation commands, refer to the* DMM Commands Guide*.*

Verifying Bridgeport-LEC Status

After Automatic or Manual LEC configuration, use the SHOW BPORT_LEC STATUS command to verify that the bridgeport-LEC is successfully joined to the intended ELAN.

Configuring ATM OC-3 Card Redundancy

If you install a second ATM OC-3 card on your ATM Backbone SwitchModule, use the following procedure to configure the module for ATM OC-3 card redundancy:

1 Use the following command to designate one of the two ATM OC-3 cards as the active ATM OC-3 card.

```
CB5000> set module <slot>.1 phy_selection <1 or 2>
```

The ATM OC-3 card near the top of the ATM Backbone SwitchModule is 1. The lower ATM OC-3 card is 2.

The ATM OC-3 card you do not make active becomes the redundant ATM OC-3 card.

2 Use the following command to enable the ATM Backbone SwitchModule to automatically make the redundant ATM OC-3 card active if the primary ATM OC-3 card fails (or performance degrades significantly):

```
CB5000> set module <slot>.1 phy_automatic_failover enable
```

If you disable automatic failover and a primary ATM OC-3 card failure occurs, you must use the command in step 1 to make the redundant ATM OC-3 card active.

There is a configurable feature called the loss of signalling delay. The default is 0 seconds, and the maximum is 60 seconds. PHY failover can take from 0 through 60 seconds when the automatic failover feature is enabled. The command is:

```
CB5000> set atm <slot>.1 loss_of_signalling_delay <seconds>
```

Configuring IGMP Snooping Parameters

IGMP snooping must be enabled on both the ATM backbone SwitchModule and the vbridge on which you plan to use IGMP snooping.

To enable IGMP snooping on the ATM Backbone SwitchModule:

Before you can enable IGMP snooping, you must set up an IP address for each vbridge that is configured on the ATM Backbone SwitchModule. You must setup a subnet mask before you can assign an IP address. The correct commands are:

```
SET IP SUBNET_MASK <FF.FF.FF>.00 VBRIDGE 1

SET IP IP_ADDRESS <XXX.XXX.XX>.00 VBRIDGE 1

SAVE ALL  (This saves the address parameters for vbridge 1.)

SHOW IP  (This displays the IP address you just created for vbridge 1.)
```

1. Enable IGMP snooping on the ATM Backbone SwitchModule.

   For example, the following command enables IGMP snooping on an ATM Backbone SwitchModule in slot 9:

   ```
   CB5000> set module 9.1 igmp_snooping enable
   ```

2. Enable IGMP snooping on a vbridge configured on the ATM Backbone SwitchModule.

   For example, the following command enables IGMP snooping on vbridge 1 on the ATM Backbone SwitchModule in slot 9:

   ```
   CB5000> set vbridge 1 igmp_snooping mode enable
   ```

3 View the status of IGMP snooping on a vbridge configured on the ATM backbone SwitchModule.

For example, the following command displays the status of IGMP snooping on vbridge 1 on the ATM Backbone SwitchModule in slot 9:

```
CB5000> show vbridge 1 igmp_snooping status
```

4 Save the parameter changes you made.

For example, the following command saves the parameter changes you made to the ATM Backbone SwitchModule in slot 9:

```
CB5000> save all
```

This command only saves the parameter changes in RAM. To actually effect the changes on the ATM Backbone SwitchModule, you must reset the module.

5 Reset the ATM Backbone SwitchModule to enable IGMP snooping on the SwitchModule and the vbridge.

For example, the following command resets the ATM Backbone SwitchModule in slot 9, thus enabling IGMP snooping on the SwitchModule and vbridge 1:

```
CB5000> reset module 9.1
```

CAUTION: *Do not use the* RESET HUB *command in this instance. Parameters saved in NVRam may not get updated if you use the* RESET HUB *command. Use only the* RESET MODULE *command in this instance.*

4 STATUS MONITORING AND STATISTICS

This chapter describes the tools that you can use to monitor module status and gather statistics that help you to analyze the CoreBuilder® 5000 ATM Backbone SwitchModule and network performance.

This chapter contains the following sections:

- Using DMM/ADMM Commands
- Using Graphical Interface Tools

Using DMM/ADMM Commands

You can use the following DMM/ADMM commands to display configuration and status information about the ATM Backbone SwitchModule and its ports.

- SHOW VBRIDGE
- SHOW MODULE
- SHOW BRIDGE_PORT
- SHOW COUNTER BRIDGE_PORT
- SHOW ATM
- SHOW BPORT_LEC
- SHOW SONET
- SHOW IGMP SNOOPING

See the CoreBuilder 5000 ATM Backbone SwitchModule Command Reference *for a complete list of available DMM/ADMM commands and a full list of parameters for each command.*

SHOW VBRIDGE

Use the SHOW VBRIDGE command to display the following vbridge configuration information about the ATM Backbone SwitchModule:

- General vbridge configuration information
- Detailed vbridge configuration information
- IGMP snooping information on a vbridge

Displaying General Vbridge Configuration Information

The following command shows general vbridge configuration information about an ATM Backbone SwitchModule in a CoreBuilder 5000 hub:

You do not have to enter no_verbose to see the general information.

```
CB5000> show vbridge all configuration no_verbose

VBridge   Bridge Identifier       Ports    Spanning Tree General Information
--------  ---------------------- -------  ------------ ------------------
1         80-00-08-00-8f-20-e5-f8     41    ENABLED       vbridge_1
2         80-00-08-00-8f-11-c5-fa      2    ENABLED       vbridge_2  (root)
11        80-00-08-00-8f-11-2e-1b      3    ENABLED       vbridge_11 (root)
```

Displaying Detailed Vbridge Configuration Information

The following command shows detailed vbridge configuration information about an ATM Backbone SwitchModule in a CoreBuilder 5000 hub:

```
CB5000> show vbridge all configuration verbose

Interface Number:                    4
Interface Mode:                      ENABLED
Aging Time:                          300
Learned Entry Discards:              0
Spanning Tree Priority:              32768
Spanning Tree Bridge Max Age:        20.00
Spanning Tree Bridge Forward Delay:  15.00
Spanning Tree Bridge Hello Time:     2.00
Spanning Tree Hold Time:             1.00
Spanning Tree Max Age:               20.00
Spanning Tree Hello Time:            2.00
Spanning Tree Forward Delay:         15.00
Designated Root:                     80-00-00-02-9c-06-3b-40
Root Cost:                           102
Root Port:                           289
Topology Changes:                    302
Time Since Topology Changed:         1358.83
IGMP Snooping Mode:                  ENABLED
```

Displaying IGMP Snooping Vbridge Information

The following command shows IGMP snooping status information for vbridge 11 configured on an ATM Backbone SwitchModule installed in the hub:

```
CB5000> show vbridge 11 igmp_snooping status

IGMP Snooping Status of VBridge 11
-----------------------------------------------------------
IGMP Snooping                       ENABLED
IGMP Querying                       ENABLED
Port Aging Time (seconds)           300
Querier IP Address                  0.0.0.0
Querier State                       DISABLED
Querier Listen Time (seconds)       120
Querier Interval                    60
Sent Query Packets                  0
Group Aging Time (seconds)          300
```

Table 4-1 lists the other options you can use with the SHOW VBRIDGE <VBRIDGE_NUMBER> IGMP_SNOOPING command and the information that appears:

Table 4-1 Other Vbridge IGMP Snooping Options

Option	Information Shown
bridge_port	IGMP snooping bridge port information for the vbridge <number>
mac	IGMP snooping mac address information for the vbridge <number>
ip	IGMP snooping IP address information for the vbridge <number>
router_ports	IGMP snooping router ports information for the vbridge <number>

SHOW MODULE Use the SHOW MODULE command to display module-level information about the ATM Backbone SwitchModule.

The following command shows detailed module information about an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show module 4.1 verbose

Slot    Module       Version  Network    General Information
------  ------------ -------  ---------  -------------------
04.01   6602M-MOD    3.0      N/A

6602M-MOD: ATM Backbone SwitchModule

Boot Version:               v2.05
RMON Analyzer:              NONE
CPU RAM Size (Mb):          8
FLASH Memory (Mb):          4
Packet Memory (Mb):         16
Shared Memory (Mb):         2
Descriptor Memory (Mb):     1
SAR Control Memory (Kb):    64
Address Cache Entries:      1024
PHY Configuration Select:   2
PHY Current Select:         2
PHY Automatic Failover:     ENABLED
IGMP Snooping:              ENABLED
```

SHOW BRIDGE_PORT Use the SHOW BRIDGE_PORT command to display:

- General status information for all bridge ports on the module
- Detailed information about one bridge port on the module

Displaying General Status Information

The following command displays information about all defined bridge ports (LECs) on an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show bridge_port 4.all

Bridge Port Display for Module 6602M-MOD:

BPort   I/F Status  Stp State    Vbridge  Logical General Info
-----   ----------  ---------    -------- ------- ------------
04.01   ENABLED     FORWARDING   11          73
04.02   ENABLED     BLOCKED      1           73
04.03   DISABLED    DISABLED     UNASSGN     73
04.04   DISABLED    DISABLED     UNASSGN     73
04.05   DISABLED    DISABLED     UNASSGN     73
04.06   DISABLED    DISABLED     UNASSGN     73
```

Displaying Detailed Information

The following command displays information about bridge port 2 on an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show bridge_port 4.2 verbose

Bridge Port Display for Module 6602M-MOD:

BPort   I/F Status  Stp State    Vbridge  Logical General Info
-----   ----------  ---------    -------- ------- ------------
04.02   ENABLED     BLOCKED      1        73

MAC Address:                       08-00-8f-40-a5-41
Port Name:
Bridge Port STP Mode:              NORMAL
Interface Mode:                    ENABLED
Spanning Tree Priority:            128
Spanning Tree Path Cost:           6
Spanning Tree Forward Transitions:0
Designated Root:                   80-00-00-02-9c-06-3b-40
Designated Cost:                   102
Designated Bridge:                 80-00-08-00-8f-13-e0-d3
Designated Port:                   80-79
RMON Monitor Supported:            NOT_SUPPORTED


RMON Monitor Source:               DISABLED
```

SHOW COUNTER BRIDGE_PORT

Use the SHOW COUNTER BRIDGE_PORT command to display statistics for a bridge port on the module.

The following command displays statistics about bridge port 2 on an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show counter bridge_port 4.2 interface

Interface Statistics for Module 6602M-MOD Bridge Port 4.2
-------------------------------------------------------------
Bridge Received Frames          551932
Bridge Received Discards        0
Bridge Transmitted Frames       1
Bridge Delay Exceeded Discards  0
Received Octets                 403424960
Received Unicast Packets        551942
Received Non-Unicast Packets    551932
Received Discards               23
Received Errors                 0
Received Unknown Protocols      0
Transmitted Octets              498
Transmitted Unicast Packets     4
Transmitted Non-Unicast Packets 1
Transmitted Errors              0
% Non-Unicast Packets           50.0%
% Utilization                   0.0%
% Error Frames                  0.0%
```

The following command displays IGMP snooping statistics about bridge port 2 on an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show count bridge_port 4.2 igmp_snooping

IGMP Snooping Statistics for Module 6602M-MOD Bridge Port 4.2
-------------------------------------------------------------
Transmitted Report Packets      0
Transmitted Query Packets       0
Transmitted Join Packets        0
Transmitted Leave Packets       0

Received Report Packets         0
Received Query Packets          0
Received Join Packets           0
Received Leave Packets          0
```

SHOW ATM

Use the SHOW ATM command to display the following ATM information:

- ATM Interface Parameters
- ATM ILMI Configuration
- ATM Q93b Parameters
- ATM QSAAL Parameters
- ATM Signal Configuration
- ATM Statistics
- ATM Traffic Description
- ATM VCCs

ATM Interface Parameters

The following command displays information about ATM interface parameters for an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 interface

Slot   Module       Version  Network    General Information
------ ------------ -------  --------- -------------------
04     6602M-MOD    3.0      N/A

                            Current         Next Reset
                            ----------      -------------
Max VCCs:                   512             512
Active VPI/VCI Bits:        0/9             0/9
Number of LECs:             8               8
UNI Version:                3.0             3.0
LEARP Quiet Time (secs)     5               -
Loss of Signal Delay:       0               0
Neighbor IP Address:        192.83.237.19
Neighbor Interface Name:    <none>
```

ATM ILMI Configuration

The following command displays information about the ATM ILMI configuration for an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 ilmi_configuration

Slot   Module       Version  Network    General Information
------ ------------ -------  ---------- -------------------
04     6602M-MOD    3.0      N/A

                                    Current    Next Reset
                                    ---------- -------------
ILMI PVC:                           0/16       0/16
LMI Peak Cell Rate (%line rate):    5          5
LMI Sust Cell Rate (%line rate):    1          1
ILMI Burst Size (cells):            11         11
ILMI Request Timeout (secs):        5          5
ILMI Request Retries:               2          2

ILMI Admin Vbridge:                 1          –
```

ATM Q93b Parameters

The following command displays information about ATM Q93b parameters for an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 q93b

Slot   Module       Version  Network    General Information
------ ------------ -------  ---------- -------------------
04     6602M-MOD    3.0      N/A

                                    Current    Next Reset
                                    ---------- -------------
T303 (secs):                        4          4
T308 (secs):                        30         30
T309 (secs):                        90         90
T310 (secs):                        10         10
T313 (secs):                        4          4
T316 (secs):                        120        120
T317 (secs):                        60         60
T322 (secs):                        4          4
```

ATM QSAAL Parameters

The following command displays information about ATM QSAAL parameters for an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 qsaal

Slot   Module       Version  Network    General Information
------ ------------ -------  --------- -------------------
04     6602M-MOD    3.0      N/A

                                    Current    Next Reset
                                    ---------- ------------
Poll Timer (msecs):                 100        100
Keepalive Timer (secs):             1          1
No Response Timer (secs):           300        300
Idle Timer (secs):                  15         15
CC Timer (secs):                    2          2
Max CC Retries:                     4          4
Max PD Retries:                     25         25
Stat Max Ranges:                    67         67
```

ATM Signal Configuration

The following command displays information about the ATM signal configuration for an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 signal_configuration

Slot   Module       Version  Network    General Information
------ ------------ -------  --------- -------------------
04     6602M-MOD    3.0      N/A

                                    Current    Next Reset
                                    ---------- ------------
Sig PVC:                            0/5        -
Sig Peak Cell Rate (% line rate):5             5
Sig Sust Cell Rate (% line rate):1             1
Sig Max Burst Size (cells):         11         11
```

ATM Statistics

The following command displays ATM statistics for an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 statistics

Slot    Module        Version  Network    General Information
------  ------------  -------  ---------  -------------------
04      6602M-MOD     3.0      N/A

                                          ATM        AAL5
                                          ---------- ----------
In Octets:                                996327390  709247719
In Frames:                                18798630   8030817
In Errors:                                0          0
In Discards:                              0          0
In Unknown Protocols:                     0          0
Out Octets:                               456665649  278670149
Out Frames:                               8616333    4607911
Out Errors:                               0          0
Out Discards:                             0          0
```

ATM Traffic Description

The following command displays descriptive statistics for ATM traffic on an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 traffic_descriptor all

Slot    Module        Version  Network    General Information
------  ------------  -------  ---------  -------------------
04      6602M-MOD     3.0      N/A

Index Descr Type                PeakCellRate SustCellRate MaxBurstSize
----- ----- ---------------------- ------------------------------
1     ILMI  NoClpScr   17661       3533         11
2     SIG   NoClpScr   17661       3533         11
3     155M  NoClpNoScr 353208      0            0
4     100M  NoClpNoScr 260417      0            0
5     50M   NoClpNoScr 130208      0            0
6     25M   NoClpNoScr 60377       0            0
7     8M    NoClpNoScr 18120       0            0
8     6M    NoClpNoScr 13590       0            0
9     2M    NoClpNoScr 4530        0            0
```

ATM VCCs The following command displays information about ATM VCCs for an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show atm 4 vcc all

Slot      Module      Version   Network      General Information
------    ----------  -------   ---------    -------------------
04        6602M-MOD   3.0       N/A

VCC    Status  TxDescr  RxDescr  Type   TxSDU  RxSDU  Encap
-------------  -------  -------  ------ ------ --------------------
0/5    UP      SIG      N/A      AAL5   500    500    OTHER
0/16   UP      ILMI     N/A      AAL5   500    500    OTHER
0/105  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/106  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/107  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/108  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/109  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/110  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/111  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/112  UP      155M     N/A      AAL5   1516   1516   LANE 8023
0/113  UP      155M     N/A      AAL5   1516   1516   LANE 8023
```

SHOW BPORT_LEC Use the SHOW BPORT_LEC command to display the following bridgeport-LEC information:

- BPORT_LEC Configuration
- BPORT_LEC Statistics
- BPORT_LEC Status
- BPORT_LEC Server Circuits
- BPORT_LEC LE_ARP Table

BPORT_LEC Configuration

The following command displays configuration information for bridgeport-LEC 2 on an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show bport_lec 4.2 configuration

Bridge Port LEC Display for Module 6602M-MOD:

BP LEC     Mode          I/F Status      General Info
---------  ------------ -------------   -------------------
04.02      ENABLED       ENABLED

Configuration Mode:                    MANUAL
ELAN Name:                             cpsw_2
ELAN Type:                             UNSPECIFIED
Maximum Data Frame Size:               UNSPECIFIED
LES ATM Address:
39.99.99.99.99.99.99.00.00.99.99.02.02.99.99.99.99.99.99.03
LECS ATM Address:                      <none>
Aging Time (secs):                     300
BUS Rate Limit (packets/secs):         5000
Connection Complete Timer (secs):      4
Control Timeout (secs):                120
Expected ARP Response Time (secs):     1
Flush Timeout (secs):                  4
Forward Delay Time (secs):             15
Maximum Retry Count:                   1
Maximum Unknown Frame Count:           1
Maximum Unknown Frame Time (secs):     1
Number of ELAN VCCs:                   512
Path Switching Delay (secs):           6
VCC Timeout Period (secs):             1200
```

BPORT_LEC Statistics

The following command displays statistics for bridgeport-LEC 2 on an ATM Backbone SwitchModule in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show bport_lec 4.2 statistics

Bridge Port LEC Display for Module 6602M-MOD:

BP LEC     Mode          I/F Status      General Info
---------  ------------  -------------   -------------------
04.02      ENABLED       ENABLED

LEARP Request Out:         1
LEARP Request In:          1
LEARP Replies Out:         0
LEARP Replies In:          1
Control Frames Out:        4
Control Frames In:         580907
SVC Failures:              0
```

BPORT_LEC Status

The following command displays status information for bridgeport-LEC 2 on an ATM Backbone SwitchModule in slot 4:

```
CB5000> show bport_lec 4.2 status

BP LEC     Mode          I/F Status      General Info
---------  ------------  -------------   -------------------
04.02      ENABLED       ENABLED

Actual ELAN Name:                 cpsw_2
Actual ELAN Type:                 AFLANE 8023
Actual Maximum Data Frame Size:   1516
LECS ATM Address:                 <none>
LECS Address Source:              DID NOT USE LECS
Actual LES ATM Address:
39.99.99.99.99.99.99.00.00.99.99.02.02.99.99.99.99.99.99.03
LEC ID:                           17
Link Trap:                        DISABLED
Interface State:                  OPERATIONAL
Last Failure Response Code:       INSUFF RESOURCES
Last Failure State:               BUS CONNECT
LANE Protocol:                    1
LANE Version:                     1
Topology Change:                  OFF
Proxy Client:                     YES
LEC ATM Address:
39.99.99.99.99.99.99.00.00.99.99.02.02.08.00.8f.40.a5.41.02
```

BPORT_LEC Server Circuits

The following command displays the server circuits for bridgeport-LEC 2 on an ATM Backbone SwitchModule in slot 4:

```
CB5000> show bport_lec 4.2 server_circuits

Bridge Port LEC Display for Module 6602M-MOD:

BP LEC     Mode          I/F Status      General Info
---------  ------------ -------------   -------------------
04.02      ENABLED      ENABLED

Configuration Direct VPI/VCI:   0/0
Control Direct VPI/VCI:         0/105
Control Distribute VPI/VCI:     0/106
Multicast Send VPI/VCI:         0/107
Multicast Forward VPI/VCI:      0/108
```

BPORT_LEC LE_ARP Table

The following command displays information for an ATM Backbone SwitchModule in slot 4:

```
CB5000> show bport_lec 4.2 learp_table all

Bridge Port LEC Display for Module 6602M-MOD:

BP LEC     Mode          I/F Status      General Info
---------  ------------ -------------   -------------------
04.02      ENABLED      ENABLED

MAC Address        ATM Address
-----------        ------------------------
08-01-20-05-05-e3  39.99.99.99.99.99.99.00.00.99.99.05.07.08.00.8f.40.a4.c0.02
```

SHOW SONET Use the SHOW SONET command to display the following ATM SONET information:

- SHOW SONET Status
- SHOW SONET Statistics

SHOW SONET Status The following displays SONET status information for an ATM Backbone SwitchModule in slot 13:

```
CB5000> show sonet 13.1 status

Slot    Module       Version  Network    General Information
------ ------------ -------  --------- -------------------
04      6602M-MOD    3.0      N/A

Medium Type:                        SONET
Medium Time Elapsed (sec):          665
Medium Valid Intervals:             13
Medium Line Coding:                 NRZ
Medium Line Type:                   MULTI-MODE
Medium Clock Source:                EXTERNAL

Section Current Status:             OKAY
Line Current Status:                OKAY
Path Current Status:                OKAY
Path Current Width:                 STS3C

M/S/L Speed (Mbps):                 155520000
M/S/L Admin Status:                 ENABLED
M/S/L Oper Status:                  UP
M/S/L Last Change:                  0

Path Speed (Mbps):                  155520000
Path Admin Status:                  ENABLED
Path Oper Status:                   UP
Path Last Change:                   0
```

SHOW SONET Statistics The following command displays SONET statistics for an ATM Backbone SwitchModule in slot 7:

```
CB5000> show sonet 7.1 statistics interval all

Slot    Module        Version  Network    General Information
------ ------------ -------  --------- ------------------
04      6602M-MOD     3.0      N/A


                    SECTION            LINE              PATH
-------------------------------------------------------------------------
Int   hh:mm     ES  SES  SFS  CV  ES  SES  UAS  CV  ES  SES  UAS
-------------------------------------------------------------------------
 1   -00:15     0    0    0    0   0    0    0    0   0    0    0
 2   -00:30     0    0    0    0   0    0    0    0   0    0    0
 3   -00:45     0    0    0    0   0    0    0    0   0    0    0
 4   -01:00     0    0    0    0   0    0    0    0   0    0    0
 5   -01:15     0    0    0    0   0    0    0    0   0    0    0
 6   -01:30     0    0    0    0   0    0    0    0   0    0    0
 7   -01:45     0    0    0    0   0    0    0    0   0    0    0
 8   -02:00     0    0    0    0   0    0    0    0   0    0    0
 9   -02:15     0    0    0    0   0    0    0    0   0    0    0
 10  -02:30     0    0    0    0   0    0    0    0   0    0    0
 11  -02:45    10    0   11    0   0    0    0    0   0    0    0
 12  -03:00     0    0    0    0   0    0    0    0   0    0    0
 13  -03:15     0    0    0    0   0    0    0    0   0    0    0
 14  -03:30    11    0   38   88  11    0   21   54   0    0    0
```

SHOW IGMP SNOOPING

Use the SHOW IGMP SNOOPING command to display the IGMP snooping information on a module. You can view the IGMP snooping information on all of the modules installed in a CoreBuilder 5000 hub using the SHOW IGMP_SNOOPING MODULE ALL command or IGMP snooping information on a specific module using the SHOW IGMP_SNOOPING MODULE <SLOT.SUBSLOT> command.

The following command shows IGMP snooping information about the ATM Backbone SwitchModule installed in slot 4 of a CoreBuilder 5000 hub:

```
CB5000> show igmp_snooping module 4.1

IGMP Snooping Information
-------------------------------------------------------------
IGMP Snooping is currently ENABLED.
IGMP Snooping after Module Reboot is ENABLED.

Entry      VBridge      IGMP Mode
-------------------------------------------------------------
1          1            ENABLED
2          11           ENABLED
```

Using Graphical Interface Tools

Transcend® Network Control Services provides advanced graphical management capabilities that enable you to monitor ATM Backbone SwitchModule operation and collect and display statistics. Transcend Network Control Services graphical management tools include:

- CoreBuilder 5000 Manager
- Device Management for Hubs
- VLAN Manager
- LANE Manager

You can also use a third-party network management application for SNMP-based monitoring and analysis.

CoreBuilder 5000 Manager

3Com CoreBuilder 5000 Manager uses the Simple Network Management Protocol (SNMP) to poll devices for status, configuration, and traffic information.

CoreBuilder 5000 Manager monitoring and display functions include:

- Display of hub status
- Display of module and port configuration and status
- Display and logging of traffic statistics
- Display and logging of alarm conditions and messages (traps)

The ATM Backbone SwitchModule supports the following MIBs:

- MIB II – RFC 1213
- Bridge MIB – RFC 1493
- Interfaces MIB – RFC 1573
- ATM MIB – RFC 1695
- SONET MIB – RFC 1595
- ATM Forum LEC MIB
- IANAIFTYPE MIB
- 3Com ISD MIB

For specific information on displaying information and statistics using CoreBuilder 5000 Manager, refer to the CoreBuilder 5000 Manager documentation for the platform you are running (UNIX or Windows).

Device Management for Hubs

Device Management for Hubs allows you to display the operating status of a selected device, configure the device, or display statistics.

When you launch Device Management for Hubs, an image of the selected device, known as *Device View*, appears. The Device View depicts the current configuration of the device. For example, ports displayed on the Device View are color-coded to indicate the current state of the port. By selecting various areas of the Device View and using menus, you can monitor and manage the objects represented by the selected area of the Device View.

VLAN Manager

VLAN Manager displays all local VLANs and ATM-based ELANs. You can move segments between VLANs and view a graphical description of the path between two segments within a VLAN.

LANE Manager

LANE Manager discovers all 3Com-based LECS, LES, and LEC components in the network and shows you their interconnections.

5 INTERNET GROUP MANAGEMENT PROTOCOL (IGMP) SNOOPING

This chapter provides the following information about IGMP snooping:

- Overview
- CoreBuilder 5000 Support
- Locating Multicast Routers in the Network
- No Multicast Routers on the Network
- Enabling IGMP Snooping on CoreBuilder 5000 SwitchModules

Overview

The Internet Group Management Protocol (IGMP) runs between hosts and their immediate neighboring multicast routers. This protocol is not a client/server protocol, but rather a routing protocol.

Through IGMP, a host to inform its local router that it wants to receive transmissions that are addressed to a specific multicast group. Also, routers periodically query the LAN to determine if known group members are still active.

Based on the group membership information learned from the IGMP, a router can determine which (if any) multicast traffic needs to be forwarded to each of its subnetworks. Multicast routers use this information in conjunction with a multicast routing protocol to support IP multicasting across the Internet. Layer 2 switches flood multicast packets to all ports without the presence of management specified filters.

Disabling IGMP snooping

The default setting for IGMP snooping is enabled. To disable it, enter the SET VBRIDGE <X> IGMP_SNOOPING DISABLE command.

Before implementing IGMP snooping

Before you implement IGMP snooping within your network, be aware of how the CoreBuilder® 5000 SwitchModule and your software vendor's multicast applications function with respect to IGMP. Inherently, all IGMP-compliant viewer applications on your network issue IGMP Membership Report packets (in response to IGMP Query Packets sent out from a local IGMP-compliant switch or router) requesting either to start or to continue sending the multicast stream to that port. However, some multicast applications do not send IGMP reports onto the network from the broadcasting server.

Depending on how your network is configured, broadcasters that do not send report packets onto the network can potentially cause excessive flooding for that vbridge or subnet. The CoreBuilder 5000 filters multicast traffic on a per-stream basis after receiving an IGMP report packet on the local vbridge or subnet. If IGMP report packets are never seen for a particular multicast session, that stream continues to flood within that vbridge or subnet. This situation may appear as if IGMP snooping is not functioning properly, when actually it is the limitation of the broadcasting application that fails to send IGMP Report packets to the querying switch or router on that subnet.

Placement of IGMP servers

Placement of IGMP multicast servers that do not issue IGMP Report packets is critical to the proper functioning of IGMP snooping on the CoreBuilder 5000 product. If your IGMP Broadcasting application does not issue IGMP report packets, 3Com recommends that you either place at least one multicast client within the same subnet or vbridge as the IGMP multicast server or run the viewer software at the same time on the broadcasting server.

Figure 5-1 shows a typical packet path before snooping occurs.

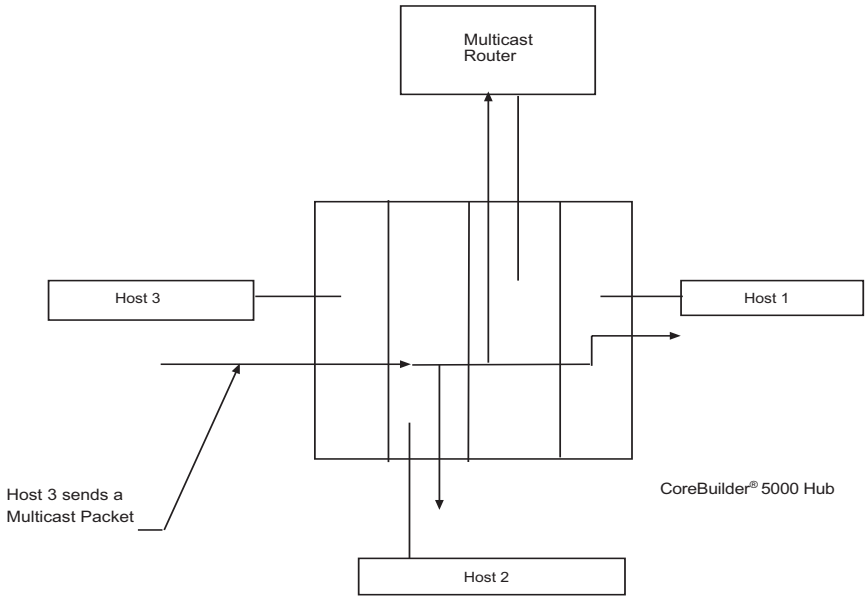


Figure 5-1 Multicast Packet Path before Snooping

Eliminating unwanted IP multicast protocols

IGMP snooping switch and multicast MAC address filters work together to eliminate unwanted IP multicast routing protocols as follows:

- The IGMP snooping switch filters IP multicast packets based on IGMP/IP and IP multicast packets to only the subset of ports that are in a multicast group.
- The multicast MAC address filters *restrict* multicast packets to only the subset of ports that request this traffic, thus freeing up bandwidth for useful traffic.

Figure 5-2 shows the format of a typical IGMP snooping version 1 message that is received after an IGMP snooping query in a multicast group has been completed.

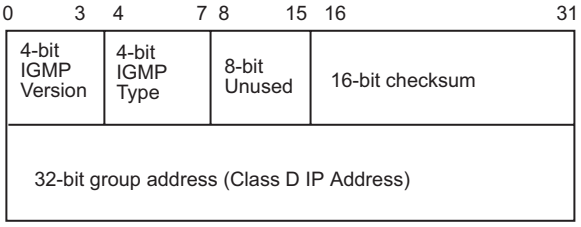


Figure 5-2 Format of an IGMP Version 1 Message

When IGMP snooping is running on a CoreBuilder® 5000 hub, it allows multicast traffic to ports where:

- IGMP Report packets for that multicast group have been observed.
- Multicast routing protocols have been observed.

Figure 5-3 shows a typical multicast packet path after snooping has occurred.

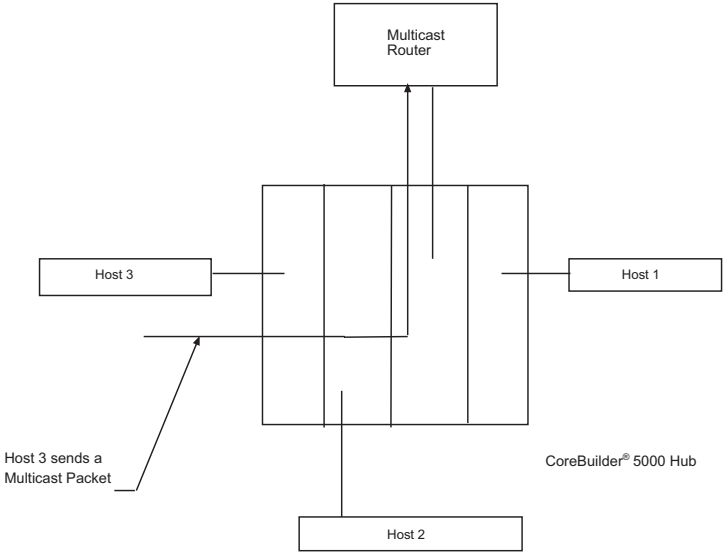


Figure 5-3 Multicast Packet Path after Snooping

The result is that multicast traffic is flooded through a multicast group-specific subset of the switched fabric, namely that subset that contains either end stations that have joined the given multicast group, or multicast routers.

The location of multicast group members is determined by snooping on the IGMP/IP report packets sent from the hosts. This information is aged out and refreshed by hearing new reports. the location of the multicast routers can either be configured by management or be determined by snooping on protocols such as:

- Protocol-Independent Multicast (PIM)
- Multicast Open Shortest Path First (MOSPF)
- Distance Vector Multicast Routing Protocol (DVMRP)

The CoreBuilder 5000 hub uses the following two types of IGMP packets to determine the flow of multicast data:

- **Queries** — Query packets (IGMP Type = 1) are flooded to all ports in the vbridge.
- **Reports** — Report packets (IGMP Type = 2 and 6) are only sent to multicast router ports. They are not forwarded to other ports because they inhibit hosts on those ports from reporting their own membership in those groups. This results in overly restrictive filtering by the hub.

IGMP is a host-to-router protocol that assumes there is shared medium between both types of IGMP packets. Because of this assumption, when a host hears a report for a host group IP that wants to join, that host assumes that it does not need to send a report to receive this host group traffic. This occurs when the IGMP protocol is optimized to minimize the number of reports sent. This is not true for filtering switches that interconnect the multicast routers to hosts, however.

CoreBuilder 5000 Support

The CoreBuilder 5000 supports 46 IP multicasting groups by IP relay. If no multicast router is detected, the CoreBuilder 5000 hub acts as an IGMP querier to allow the network to determine hosts that are members of a group.

The CoreBuilder 5000 allows the user to create ports in the vbridge that are classified as router ports. This ensures that multicast data is always flowing over the link.

Locating Multicast Routers in the Network

Multicast packets are received by all multicast routers on the LAN because the switches always flood all multicast packets. Routing protocol packets and data packets are flooded toward all ports on which routing protocols have been received. To decrease the flooding of multicast packets through a hub multicast router, the ports must be identified.

The location of the multicast routers can either be configured by management or determined by snooping on protocols such as PIM, MOSPF, and DVMRP. After the router ports are determined, filters are set up within the CoreBuilder 5000 hub to identify these ports and the specific multicast packets flowing to each port.

No Multicast Routers on the Network

To receive the IGMP reports, networks that do not have multicast capable routers need to have a designated querying device. The CoreBuilder 5000 hub can be the designated querier in a network without any multicast routers.

The designated querier is the IGMP query-capable device with the lowest IP address in a flooding domain. If a multicast router is found on the network, the CoreBuilder 5000 SwitchModule does not send IGMP queries, even if it has the lowest IP address. However, in a switched fabric that does not have any multicast routers, the CoreBuilder 5000 hub elects a designated querier in the absence of query packets.

You must assign an IP address to a vbridge via the DMM console to designate the CoreBuilder 5000 SwitchModule as a querying device.

Enabling IGMP Snooping on CoreBuilder 5000 SwitchModules

IGMP snooping can be enabled on the following CoreBuilder 5000 SwitchModules:

- FTE SwitchModule v1.2
- GigaFTE SwitchModules

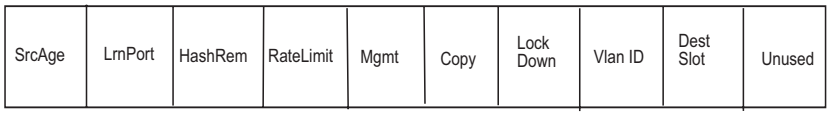
IGMP snooping on a CoreBuilder 5000 SwitchModule

When you enable IGMP snooping on either an FTE SwitchModule, v1.2, or a GigaFTE SwitchModule, the IP multicast bit is enabled in the module's Receive Control Register. This causes the module's receive state machine to parse all IP packets looking for the IGMP protocol. If the packet is an IGMP packet, it is directed to the management processor queue for snooping purposes.

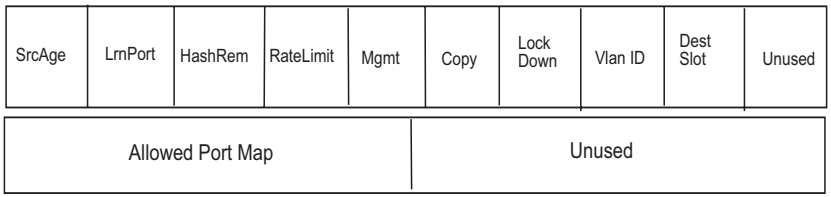
The management processor then learns the multicast address and adds it to the module's forwarding tables. When the IP multicast bit in the module's Receive Lookup Control Register is enabled, the forwarding table entries have a 36-bit destination port map. When a packet enters the module, the processor looks up the address and directs the packet to the allowed destination port map. Figure 5-4 shows a typical FTE DRAM address forwarding entry.

The only difference between the modules when IGMP snooping is enabled is that the IP Multicast Bit is Bit <20> in the FTE, v1.2 module and Bit<13> in the GigaFTE module.

Figure 5-4 shows a typical FTE DRAM address forwarding entry.



FTE Address Forwarding Entry When IGMP Multicast Bit is Disabled



FTE Address Forwarding Entry When IGMP Multicast Bit is Enabled

Figure 5-4 FTE DRAM Address Forwarding Entry

Frame Tagging can be set on a CoreBuilder 5000 SwitchModule after it is enabled for IGMP snooping.

6 TROUBLESHOOTING

This chapter describes:

- Troubleshooting Using LEDs
- Recovering from Problems
- Resetting the ATM Backbone SwitchModule
- Obtaining Technical Assistance

Troubleshooting Using LEDs

This section identifies possible causes and solutions for ATM Backbone SwitchModule LED indications. This section describes:

- Troubleshooting Base Module LEDs
- Troubleshooting ATM OC-3 Card LEDs

Troubleshooting Base Module LEDs

This section explains the procedures for:

- Verifying Base Module LED Operation
- Reading the Base Module LEDs
- Refer to Determining Corrective Action.

Verifying Base Module LED Operation

If a ATM Backbone SwitchModule LED is not illuminated, use the CoreBuilder 5000 Controller Module or CoreBuilder 5000 Advanced DMM/Controller Module LED test button to verify operation of the base module LEDs. The LED test does not disrupt network operation.

When you press the LED test button:

1 The Controller Module initiates a test to all modules in the hub. All LEDs should respond by lighting continuously for approximately 5 seconds.

2 During this time, the bi-color LEDs should alternate between green and yellow approximately every ½ second.

See Appendix B for instructions about contacting 3Com Technical Support for your product.

Reading the Base Module LEDs

Table 6-1 identifies the normal phases of operation of the base module LEDs upon power-on or hardware reset.

Table 6-1 Base Module LED Status

Module Status	LED State	
	MOD STAT	**PACKET CHANNEL**
Prior to power-on	Off	Off
Diagnostics upon power-on	Yellow	Off
Failed diagnostics	Yellow	Green
Passed diagnostics; ready to exchange data	Green	Green
Receiving ATM cells and forwarding them to the packetchannel backplane	Green	Yellow
Module problem indications during normal operation*	Steady yellow or Off	Off

* Refer to Determining Corrective Action.

Determining Corrective Action

Table 6-2 identifies appropriate corrective actions for each base module LED indication.

Table 6-2 Base Module LED Corrective Actions

LED	LED State	Possible Cause	Corrective Action
MOD STAT	Green	Normal operating indication.	None required.
	Off	No power to hub.	Check the controller module power LEDs.
		The hub does not have enough available power for a new module installation.	Add another power supply to the hub.
			Use the SHOW POWER BUDGET command to ascertain available power in the hub.
		The ATM Backbone SwitchModule is faulty.	Insert a different ATM Backbone SwitchModule.
	Yellow	Module failed power-on diagnostics.	Reset ATM Backbone SwitchModule (page 6-12).
			Re-seat ATM Backbone SwitchModule in CoreBuilder 5000 hub.
			Refer to "Recovering from Problems" on page 6-5.
PACKETCHANNEL	Green	SwitchModule is correctly inserted in hub and recognizes PacketChannel backplane.	None required.
	Off	ATM Backbone SwitchModule is not connected to backplane.	Re-seat the ATM Backbone SwitchModule in the slot.
		Slot does not support PacketChannel operation. To verify, enter the command SHOW MODULE. The General Information field states "ATM Slot" if the slot is reserved for ATM.	Install the ATM Backbone SwitchModule in slots 1 through 8 or 13 through 17.
		PacketChannel backplane not installed or incorrectly installed in the hub.	Re-install the PacketChannel backplane or purchase a PacketChannel backplane. Contact your supplier.
	Yellow	ATM Backbone SwitchModule transmitting heavy traffic levels to the PacketChannel backplane.	None required.
	Yellow Blinking	ATM Backbone SwitchModule transmitting normal traffic levels to the PacketChannel backplane.	None required.

Troubleshooting ATM OC-3 Card LEDs

This section explains how to read the ATM OC-3 card LEDs and determine appropriate corrective action

The LEDs on the base module and ATM OC-3 cards function independent of each other.

Table 6-3 identifies possible causes and corrective actions for each LED state.

Table 6-3 ATM OC-3 Card LED Corrective Actions

LED	LED State	Possible Cause	Corrective Action
TX	Green	ATM signal detected.	None required.
	Yellow	Transmitting ATM cells.	None required.
	Off	Problem with ATM switch connection (such as cable not connected to ATM OC-3 card).	Check ATM switch connection and interface.
		ATM OC-3 card failed.	If alternate ATM OC-3 card is installed, check that switchover to alternate ATM OC-3 card occurred.
RX	Green	ATM signal detected.	None required.
	Yellow	Receiving ATM cells.	None required.
	Off	Problem with ATM switch connection (such as cable not connected to ATM OC-3 card).	Check ATM switch connection and interface.
		ATM OC-3 card failed.	If alternate ATM OC-3 card is installed, check that switchover to alternate ATM OC-3 card occurred.
ACTIVE	Green	Identifies active ATM OC-3 card.	None required.
	Off	ATM OC-3 card inactive.	If alternate ATM OC-3 card is installed, check that an alternate ATM OC-3 card is active.
		ATM OC-3 card failed.	If alternate ATM OC-3 card is installed, check that switchover to alternate ATM OC-3 card occurred.
ALARM	Green	ATM OC-3 card failed.	If alternate ATM OC-3 card is installed, check that a switchover to alternate ATM OC-3 card occurred.
			Refer to "Recovering from Problems" on page 6-5.
	Off	Normal operating condition.	None required.

Recovering from Problems

Use the following procedure to recover from operating problems or module failure. Each of these steps is explained in more detail in the sections that follow.

1. Verify that the DMM can communicate with the ATM Backbone SwitchModule
2. Verify that the correct software versions are installed.
3. Verify that the critical configuration parameters settings of the ATM Backbone SwitchModule match those of the ATM switch to which it is connected.
4. Verify ATM OC-3 Card Functions.
5. Verify ATM Signalling Functions.
6. Verify LEC Functions.
7. Verify Bridging Configuration.
8. Verify that a CoreBuilder 5000 SwitchModule has a vbridge configured on the same bridge port as the CoreBuilder 5000 ATM Backbone SwitchModule bridge port.
9. Verify Data Movement.
10. Verify ATM OC-3 Switchover Functions.

Record your results for the following procedures. The information may be required if you need to contact your technical support representative.

Verifying DMM Communication

To isolate a problem in the ATM Backbone SwitchModule, you must be able to communicate with the ATM Backbone SwitchModule from the DMM.

Use the following command to verify that the DMM can communicate with the ATM Backbone SwitchModule:

```
CB5000> show module all
```

Check that the display lists the ATM Backbone SwitchModule model number (6602M-MOD).

If the ATM Backbone SwitchModule model number is not listed, try each of the following corrective actions:

If the DMM can communicate with the ATM Backbone SwitchModule, proceed to Verifying Software Versions.

1. Reset the ATM Backbone SwitchModule by pressing the Reset button on the module front panel (refer to Resetting the ATM Backbone SwitchModule later in this chapter).
2. Remove and carefully reinsert the ATM Backbone SwitchModule.
3. Ensure that IP connectivity for the DMM is established. Refer to the *CoreBuilder 5000 SwitchModule User Guide* for more information.
4. If necessary, obtain Technical Assistance (refer to Obtaining Technical Assistance later in this chapter).

Verifying Software Versions

Be sure that ATM Backbone SwitchModule is using the correct software versions for the following hub components:

- ATM Backbone SwitchModule (Model Number 6602M-MOD)
- CoreBuilder 5000 Ethernet or FDDI SwitchModule (version v3.0 or later)
- DMM or ADMM (version v6.0 or later)

Use the following command to display the software versions of these components:

```
CB5000> show module all
```

Contact your network supplier to determine the correct versions of software and arrange to update the software if necessary.

Verifying Critical Parameters

Verify that the settings of the following critical parameters match those of the ATM switch to which the ATM Backbone SwitchModule is connected:

- UNI version (default is 3.0)
- LEARP Quiet Time (default is 5 seconds)
- Configuration mode (LEC 1 default is Auto, default for other LECs is Manual)
- Interface mode (LEC 1 default is Enabled, default for other LECs is Disabled)
- ELAN Name (LEC 1 default is Admin, default for other LECs None)
- Vbridge assignment (LEC 1 default is vbridge 1, default for other LECs is Unassigned)

See the CoreBuilder 5000 ATM Backbone SwitchModule Command Reference *for more information on these parameters.*

Verifying ATM OC-3 Card Functions

Use the following procedure to verify each of the following ATM OC-3 card functions:

1. With the OC-3 fiber cables attached, verify that the Alarm LED of the ATM OC-3 card is illuminated green.

   If the Alarm LED is illuminated green, reverse the fiber optic cable connections to the ATM OC-3 card and reverify the Alarm LED.

2. Use the following command to check the additional port status indicators for the ATM OC-3 card:

   ```
   CB5000> show port <slot.phy_num>
   ```

   Verify that the display lists the following indicators:

   - Status for the (PHY) port is OK
   - Mode for the (PHY) port is Enabled

3 Use the following command to check the following SONET status indicators:

```
CB5000> show sonet <slot.phy_num> status
```

Verify that the display lists status is OK for the following indicators:

- Line Current Status
- Section Current Status
- Path Current Status

4 Record any indications that are not as expected and proceed to Verifying ATM Signalling Functions.

Verifying ATM Signaling Functions

Use the following procedure to verify ATM signaling functions:

1 Use the following command to check the UNI Version setting of your ATM Backbone SwitchModule:

```
CB5000> show atm <slot> interface
```

Examine the setting of the UNI Version parameter of the ATM Backbone SwitchModule. It must match the ATM switch setting to which it is connected. The valid settings are:

- 3_0
- 3_1

Contact your network supplier for the UNI version setting of the ATM switch.

2 If necessary, reset the UNI Version parameter and corresponding ATM signalling times using the following command:

```
CB5000> set atm <slot> uni_version 3_1
        (or 3_0)
```

3 If you made any changes in Step 2, reset the module using the following command:

```
CB5000> reset module <slot>
```

ATM commands do not take effect until you reset the module. Use the DMM RESET MODULE command to enable any ATM parameter changes.

4 Use the following command to display vcc parameters:

```
CB5000> show atm <slot> vcc all
```

Verify the following parameters settings:

- SIG is 0/5
- ILMI is 0/16

5 If necessary, use the following command to reset the ILMI parameter:

```
CB5000> set atm <slot> ilmi pvc 0/16
```

ATM commands do not take effect until you reset the module. Use the DMM RESET MODULE command to enable any ATM parameter changes.

6 If the SIG parameter is not set to 0/5, contact your network supplier to set the SIG parameter to 0/5 at the ATM switch.

7 Record the final settings of your ATM signalling parameters before continuing.

Verifying LEC Functions

Use the following procedure to verify the functions of a LEC:

1 Use the following command to display the configuration mode of the LEC:

```
CB5000> show bport_lec <slot.lec> configuration
```

- If the configuration mode is manual, check the command display to verify that the correct LES ATM Address is listed. The LES ATM Address of the LEC must match the LES ATM Address of the ELAN to which the LEC is assigned.
- If the configuration mode is automatic, check the command display to verify that the ELAN Name parameter is set to the ELAN Name required by the ATM switch.

Contact your ATM switch service representative to determine the correct LES ATM Address and ELAN Name setting.

2 Check the command display in step 1 to verify that the Mode parameter for the LEC is set to Enabled.

If the Mode parameter is not set to Enabled, use the following command to reset the Mode parameter to Enabled:

```
CB5000> set bport_lec <slot.lec> mode enable
```

3 Use the following command to display the LAN/E status of the LEC:

```
CB5000> show bport_lec <slot.lec> status
```

Check the indication of the Interface State parameter. The possible status indications are:

- Initial
- Configure
- Join
- Bus connect
- Operational

If the Interface State is Operational, the LEC and ATM parameters are configured correctly.

If there is any other indication, record the result and continue with the procedure.

4 Check the command display in step 3 and record the Last Failure State parameter.

If the Last Failure State indicates:

- **Configure** — The ATM Backbone SwitchModule is having problems with the LECS. Contact your ATM switch service representative to verify the LECS configuration.
- **Join** — The ATM Backbone SwitchModule is having problems connecting with the LES. Contact your ATM switch service representative to verify the LES address and ELAN name and the operation of the BUS service provider.
- **Bus Connect** — Contact your ATM switch service representative to verify the operation of the BUS service provider.

Verifying Bridging Configuration

Use the following procedure to verify the bridging configuration of the ATM Backbone SwitchModule:

1. Use the following command to display information about the LEC bridging configuration.

   ```
   CB5000> show bridge_port <slot.lec> verbose
   ```

   Verify that the bridge port is set to a valid vbridge (1 through 240).

   If the bridge port is not set to a valid vbridge, use the following command to reset it to the correct vbridge:

   ```
   CB5000> set bridge_port <slot.lec> vbridge <vbridgenumber>
   ```

2. Use the following command to display information about the vbridge configuration:

   ```
   CB5000> show bridge_port <slot.bridgeport>
   ```

   Verify that the vbridge is assigned to the correct Ethernet or FDDI SwitchModule port.

Verifying Data Movement

Use the following procedure to determine if there is packet and ATM cell data movement through the ATM Backbone SwitchModule:

1. Use the following command to display ATM statistics:

   ```
   CB5000> show atm <slot> statistics
   ```

   Note the values for the ATM and AAL5 ATM cell counters.

2. Reissue the ATM statistics command and check that the counters have changed.

3. Use the following command to display bridge port interface statistics:

   ```
   CB5000> show counter bridge_port <slot.lec> interface
   ```

   Note the values for the Packet Counters statistic

4. Reissue the bridge port interface command and check that the Packet Counters statistic has changed.

Verifying ATM OC-3 Switchover

If the Redundant ATM OC-3 card does not become active upon failure of the primary ATM OC-3, use the following command to verify that the PHY Automatic Failover parameter is Enabled:

```
CB5000> show module <slot.phy> verbose
```

If the PHY_Automatic_Failover parameter is not Enabled, use the following command to enable it:

```
CB5000> set module <slot>.1 phy_automatic_failover enable
```

If the ATM Backbone SwitchModule is still experiencing problems after you complete the procedures above, refer to Obtaining Technical Assistance later in this chapter.

Resetting the ATM Backbone SwitchModule

You can reset the ATM Backbone SwitchModule by either pressing the front panel Reset button or issuing the DMM Reset command.

CAUTION: *If you reset the ATM Backbone SwitchModule using the DMM RESET command, the module does not lose saved setup information. However, performing a reset may cause some of the data being transmitted at that moment to be lost and statistic counters to be reset to zero.*

Using the Reset Button

Each ATM Backbone SwitchModule front panel houses a Reset button. The Reset button resets the ATM Backbone SwitchModule and executes power up self-test diagnostics.

CAUTION: *Use the Reset button only if you suspect a problem with the ATM Backbone SwitchModule. Using the Reset button to reset an ATM Backbone SwitchModule disrupts network traffic.*

To ensure that you do not lose any configuration information, before you use the Reset button:

- Save any configuration changes
- Wait at least 30 seconds after saving configuration changes

Obtaining Technical Assistance

You can receive assistance for installing and troubleshooting an ATM Backbone SwitchModule by calling either your 3Com reseller or 3Com network supplier. Be prepared to supply a representative with the following information:

- Description of the problem
- Steps you have taken to try and correct the problem
- Type and software version of the CoreBuilder 5000 management module being used
- Version of software installed on your ATM Backbone SwitchModule, Ethernet or FDDI SwitchModule, and DMM
- Status of the front panel LEDs
- Configuration of your hub. (You may find it helpful to refer to the Slot Usage Chart shipped with the *CoreBuilder 5000 Integrated System Hub Installation and Operation Guide* for a record of this information.)

See Appendix B for instructions on how to get technical support for your product.

A SPECIFICATIONS

This appendix lists the following specifications for the CoreBuilder 5000 ATM Backbone SwitchModules:

- Environmental Specifications
- Mechanical Specifications
- Power Specifications
- ATM OC-3 Card Fiber Optic Specifications

Environmental Specifications

Table A-1 lists the ATM Backbone SwitchModule environmental specifications.

Table A-1 Environmental Specifications

Specification	Value
Operating Temperature	32 to 122 °F (0 to 50 °C)
Storage Temperature	–40 to 151 °F (–40 to 66 °C)
Operating Humidity	Less than 95%, noncondensing

Mechanical Specifications

Table A-2 lists the ATM Backbone SwitchModule mechanical specifications.

Table A-2 Mechanical Specifications

Model Number	Approximate Dimensions	Weight
3C96602M-MOD*	16 in. x 10.3 in. x 2 in. (40.6 cm x 26.2 cm x 5.1 cm)	3.0 lb (1.36 kg)
3C96601D-155SC-MM	3.6 in. x 3.5 in. x 1.0 in. (9.1 cm x 8.9 cm x 2.5 cm)	0.1 lb (0.05 kg)

* Includes one ATM OC-3 card (3C96601D-155SC-MM) installed on the base module.

Power Specifications

Table A-3 lists the ATM Backbone SwitchModule power specifications.

Table A-3 Power Specifications

Unit	Model Number	+5 Volts	+12 Volts
Base Module	**3C96602M-MOD***	60 W	5 W
Redundant ATM OC-3 Card	**3C96601D-155SC-MM**	5 W	0 W

* Includes one ATM OC-3 card (3C96601D-155SC-MM) installed on the base module.

ATM OC-3 Card Fiber Optic Specifications

Table A-4 lists the ATM Backbone SwitchModule OC-3 fiber optic specifications.

Table A-4 ATM Backbone SwitchModule Fiber Optic Specifications

Specification	Value
Fiber type	62.5/125 µ
Wavelength	1300 nm
Maximum distance	2 km
Transmit power	–18.5 dBm
Receive power	–14 dBm

B

TECHNICAL SUPPORT

3Com provides easy access to technical support information through a variety of services. This appendix describes these services.

Information contained in this appendix is correct at time of publication. For the most recent information, 3Com recommends that you access the 3Com Corporation World Wide Web site.

Online Technical Services

3Com offers worldwide product support 24 hours a day, 7 days a week, through the following online systems:

- World Wide Web site
- 3Com Knowledgebase Web Services
- 3Com FTP site
- 3Com Bulletin Board Service (3Com BBS)
- 3Com Facts℠ Automated Fax Service

World Wide Web Site

To access the latest networking information on the 3Com Corporation World Wide Web site, enter this URL into your Internet browser:

`http://www.3com.com/`

This service provides access to online support information such as technical documentation and software, as well as support options that range from technical education to maintenance and professional services.

3Com Knowledgebase Web Services

This interactive tool contains technical product information compiled by 3Com expert technical engineers around the globe. Located on the World Wide Web at **`http://knowledgebase.3com.com`**, this service gives all 3Com customers and partners complementary, round-the-clock access to technical information on most 3Com products.

3Com FTP Site

Download drivers, patches, software, and MIBs across the Internet from the 3Com public FTP site. This service is available 24 hours a day, 7 days a week.

To connect to the 3Com FTP site, enter the following information into your FTP client:

- Hostname: **`ftp.3com.com`**
- Username: **`anonymous`**
- Password: **`<your Internet e-mail address>`**

You do not need a user name and password with Web browser software such as Netscape Navigator and Internet Explorer.

3Com Bulletin Board Service

The 3Com BBS contains patches, software, and drivers for 3Com products. This service is available through analog modem or digital modem (ISDN) 24 hours a day, 7 days a week.

Access by Analog Modem

To reach the service by modem, set your modem to 8 data bits, no parity, and 1 stop bit. Call the telephone number nearest you:

Country	Data Rate	Telephone Number
Australia	Up to 14,400 bps	61 2 9955 2073
Brazil	Up to 28,800 bps	55 11 5181 9666
France	Up to 14,400 bps	33 1 6986 6954
Germany	Up to 28,800 bps	4989 62732 188
Hong Kong	Up to 14,400 bps	852 2537 5601
Italy	Up to 14,400 bps	39 2 27300680
Japan	Up to 14,400 bps	81 3 5977 7977
Mexico	Up to 28,800 bps	52 5 520 7835
P.R. of China	Up to 14,400 bps	86 10 684 92351
Taiwan, R.O.C.	Up to 14,400 bps	886 2 377 5840
U.K.	Up to 28,800 bps	44 1442 438278
U.S.A.	Up to 53,333 bps	1 847 262 6000

Access by Digital Modem

ISDN users can dial in to the 3Com BBS using a digital modem for fast access up to 64 Kbps. To access the 3Com BBS using ISDN, call the following number:

1 847 262 6000

3Com Facts Automated Fax Service

The 3Com Facts automated fax service provides technical articles, diagrams, and troubleshooting instructions on 3Com products 24 hours a day, 7 days a week.

Call 3Com Facts using your Touch-Tone telephone:

1 408 727 7021

Support from Your Network Supplier

If you require additional assistance, contact your network supplier. Many suppliers are authorized 3Com service partners who are qualified to provide a variety of services, including network planning, installation, hardware maintenance, application training, and support services.

When you contact your network supplier for assistance, have the following information ready:

- Product model name, part number, and serial number
- A list of system hardware and software, including revision levels
- Diagnostic error messages
- Details about recent configuration changes, if applicable

If you are unable to contact your network supplier, see the following section on how to contact 3Com.

Support from 3Com

If you are unable to obtain assistance from the 3Com online technical resources or from your network supplier, 3Com offers technical telephone support services. To find out more about your support options, call the 3Com technical telephone support phone number at the location nearest you.

When you contact 3Com for assistance, have the following information ready:

- Product model name, part number, and serial number
- A list of system hardware and software, including revision levels
- Diagnostic error messages
- Details about recent configuration changes, if applicable

Here is a list of worldwide technical telephone support numbers:

Country	Telephone Number	Country	Telephone Number
Asia, Pacific Rim			
Australia	1 800 678 515	P.R. of China	10800 61 00137 or
Hong Kong	800 933 486		021 6350 1590
India	+61 2 9937 5085	Singapore	800 6161 463
Indonesia	001 800 61 009	S. Korea	
Japan	0031 61 6439	From anywhere in S. Korea:	00798 611 2230
Malaysia	1800 801 777	From Seoul:	(0)2 3455 6455
New Zealand	0800 446 398	Taiwan, R.O.C.	0080 611 261
Pakistan	+61 2 9937 5085	Thailand	001 800 611 2000
Philippines	1235 61 266 2602		
Europe			
From anywhere in Europe, call:	+31 (0)30 6029900 phone +31 (0)30 6029999 fax		
Europe, South Africa, and Middle East			
From the following countries, you may use the toll-free numbers:			
Austria	0800 297468	Netherlands	0800 0227788
Belgium	0800 71429	Norway	800 11376
Denmark	800 17309	Poland	00800 3111206
Finland	0800 113153	Portugal	0800 831416
France	0800 917959	South Africa	0800 995014
Germany	0800 1821502	Spain	900 983125
Hungary	00800 12813	Sweden	020 795482
Ireland	1800 553117	Switzerland	0800 55 3072
Israel	1800 9453794	U.K.	0800 966197
Italy	1678 79489		
Latin America			
Argentina	AT&T +800 666 5065	Mexico	01 800 CARE (01 800 2273)
Brazil	0800 13 3266	Peru	AT&T +800 666 5065
Chile	1230 020 0645	Puerto Rico	800 666 5065
Colombia	98012 2127	Venezuela	AT&T +800 666 5065
North America	1 800 NET 3Com (1 800 638 3266) Enterprise Customers: 1 800 876-3266		

Returning Products for Repair

Before you send a product directly to 3Com for repair, you must first obtain an authorization number. Products sent to 3Com without authorization numbers will be returned to the sender unopened, at the sender's expense.

To obtain an authorization number, call or fax:

Country	Telephone Number	Fax Number
Asia, Pacific Rim	+ 65 543 6500	+ 65 543 6348
Europe, South Africa, and Middle East	+ 31 30 6029900	+ 31 30 6029999
Latin America	1 408 326 2927	1 408 326 3355
From the following countries, you may call the toll-free numbers; select option 2 and then option 2:		
Austria	0800 297468	
Belgium	0800 71429	
Denmark	800 17309	
Finland	0800 113153	
France	0800 917959	
Germany	0800 1821502	
Hungary	00800 12813	
Ireland	1800553117	
Israel	1800 9453794	
Italy	1678 79489	
Netherlands	0800 0227788	
Norway	800 11376	
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