CHAPTER 1

Product Overview

This chapter provides an introduction to the Catalyst 8540 MSR, Catalyst 8510 MSR, and LightStream 1010 ATM switch routers.

Note This chapter provides hardware and software information for the Catalyst 8540 MSR, Catalyst 8510 MSR, and LightStream 1010 ATM switch routers. For descriptions of software features, refer to the *Guide to ATM Technology.*

This chapter includes the following sections:

- ATM Switch Router Hardware Overview
- Summary of Software Features

ATM Switch Router Hardware Overview

This section provides an overview of the hardware available for the Catalyst 8540 MSR, Catalyst 8510 MSR, and LightStream 1010 ATM switch routers and includes the following:

- ATM Switch Router Hardware (Catalyst 8540 MSR)
- ATM Switch Router Hardware (Catalyst 8510 MSR and LightStream 1010)

ATM Switch Router Hardware (Catalyst 8540 MSR)

The ATM switch router uses a 13-slot, modular chassis featuring dual, fault-tolerant, load-sharing AC or DC power supplies. Slots 4 and 8 are occupied by the dual, field-replaceable route processors, which perform central processing functions and provide redundancy. The route processors can also accommodate the network clock module, which features a stratum 3 oscillator and two building integrated timing supply (BITS) ports. Slots 5, 6, and 7 are occupied by either two or three switch processors, for a 20-Gbps non-EHSA or 20-Gbps EHSA switch fabric. The switch processors also accommodate the switch processor feature card.

The remaining slots hold either a full-width module, such as the new four-port OC-12 module, or the carrier module, which in turn accommodates one or two port adapters, such as the four-port OC-3 port adapters. Along with other available interfaces, the ATM switch router provides switched ATM connections to individual workstations, servers, LAN segments, or other ATM switches and routers using fiber-optic, unshielded twisted-pair (UTP), and coaxial cable.

Available Hardware Components (Catalyst 8540 MSR)

The Catalyst 8540 MSR features the following available hardware components:

- Optional switch feature card, supporting usage parameter control (UPC) and statistics
- Optional network clock module
- Full-width ATM router modules
- All Layer 3 interface modules available on the Catalyst 8540 CSR
- Full-width 1-port OC-48c single-mode intermediate reach *plus* 4-port OC-12 single-mode fiber interface modules
- Full-width 1-port OC-48c single-mode intermediate reach *plus* 4-port OC-12 multimode fiber interface modules
- Full-width 1-port OC-48c single-mode long reach *plus* 4-port OC-12 multimode fiber interface modules
- Full-width 2-port OC-48c single-mode intermediate reach interface modules
- Full-width 2-port OC-48c single-mode long reach interface modules
- Full-width 4-port OC-12 single-mode intermediate reach interface modules
- Full-width 4-port OC-12 multimode short reach interface modules
- Full-width 16-port OC-3 multimode short reach interface modules
- Support for the following Catalyst 8510 MSR and LightStream 1010 ATM switch router port adapters via the carrier module:
  - 1-port OC-12 port adapters (multimode, single-mode, and single-mode long reach)
  - 4-port OC-3 port adapters (multimode, single-mode, single-mode long reach, mixed, and UTP)
  - 4-port DS3/E3 port adapters
  - 4-port channelized E1 Frame Relay port adapters
  - 1-port channelized DS3 Frame Relay port adapters
  - 4-port T1/E1 port adapters
  - 4-port T1/E1 circuit emulation service (CES) port adapters

ATM Switch Router Hardware (Catalyst 8510 MSR and LightStream 1010)

The Catalyst 8510 MSR and LightStream 1010 ATM switch routers both use a five-slot, modular chassis featuring the option of dual, fault-tolerant, load-sharing AC or DC power supplies. A single, field-replaceable ATM switch processor module supports both the 5-Gbps shared memory and the fully nonblocking switch fabric. The processor also supports the feature card and high performance reduced instruction set computing (RISC) processor (CPU) that provides the central intelligence for the device. The remaining slots support up to four hot-swappable carrier modules. Each carrier module can hold up to two hot-swappable port adapters for a maximum of eight port adapters per switch, supporting a wide variety of desktop, backbone, and wide-area interfaces.

The ATM switch provides switched ATM connections to individual workstations, servers, LAN segments, or other ATM switches and routers using fiber-optic, unshielded twisted-pair (UTP), and coaxial cable.

Note The ATM switch processor and port adapters can be installed in the Catalyst 5500 switch chassis. In the Catalyst 5500 switch chassis the processor must be installed in slot number 13 and the port adapters in slot numbers 9 though 12. The examples in this guide assume that the ATM switch router is in its own chassis, with the processor in slot number 2 and the port adapters in slot numbers 0, 1, 3, and 4.

Processor and Feature Card Models (Catalyst 8510 MSR and LightStream 1010)

The Catalyst 8510 MSR and LightStream 1010 ATM switch routers are equipped with one of the following combinations of processor (CPU) and feature card:

- ASP-B with feature card per-class queuing (FC-PCQ) or feature card per-flow queuing (FC-PFQ)
- ASP-C with FC-PCQ or FC-PFQ
- Multiservice switch route processor (MSRP)

The Catalyst 8510 MSR is equipped with the MSRP.

ASP-B with FC-PCQ and ASP-C with FC-PCQ are functionally equivalent, offering the same features and performance. FC-PFQ, however, provides an enhanced feature set, including advanced traffic management. ASP-B and ASP-C, equipped with FC-PFQ, also provide identical functionality for ATM applications. However, ASP-C with FC-PFQ provides the additional capability for supporting both ATM and Layer 3 switching on the same platform. ASP-C with FC-PFQ and the MSRP, used in the Catalyst 8510 MSR, are identical.

For additional information, refer to the *Processor Installation Guide*.

Available Physical Interfaces (Catalyst 8510 MSR and LightStream 1010)

The ATM switch router features the following available hardware components:

- Full-width ATM router modules
- All Layer 3 interface modules available on the Catalyst 8510 CSR
- The ATM switch router supports the following port adapters:
  - 4-port channelized E1 Frame Relay port adapters
  - 1-port channelized DS3 Frame Relay port adapters
  - 1-port OC-12 port adapters (multimode, single-mode, and single-mode long reach)
  - 4-port OC-3 port adapters (multimode, single-mode, single-mode long reach, mixed, and UTP)
  - 2-port DS3/E3 port adapters
  - 4-port DS3/E3 port adapters
  - 4-port T1/E1 port adapters
  - 4-port T1/E1 circuit emulation service (CES) port adapters
  - 25-Mbps port adapters
  - 8-port T1/E1 inverse multiplexing over ATM (IMA) port adapters

Summary of Software Features

The following sections provide a brief overview of the software features of the ATM switch router and include the following:

The ATM switch router provides Enhanced High System Availability (EHSA) during hardware and software upgrades as well as fault resistance by means of the following features:

- Dual power supplies
- Dual route processors (CPUs)
- Switching fabric with optional spare switch processor
- Optional dual network clock modules

In the event one of the route processors becomes unavailable because of a failure or software upgrade, the secondary route processor takes over. To support switching fabric availability, an optional third switch processor, running in standby mode, takes over if one of the other switch processor cards fails. Additionally, the optional network clock modules are able to retain clock configuration should one of the modules fail.

System Availability (Catalyst 8540 MSR)

The ATM switch router provides Enhanced High System Availability (EHSA) during hardware and software upgrades as well as fault resistance with the following features:

- Dual power supplies
- Dual route processors (CPUs)
- Switching fabric with optional spare switch processor
- Optional dual network clock modules

In the event one of the route processors becomes unavailable due to failure or for software upgrade, the secondary route processor takes over with zero boot time. To support switching fabric availability, an optional third switch processor, running in standby mode, takes over if one of the other switch processor cards fails. Finally, the optional network clock modules are able to retain clock configuration should one of the modules fail.

ATM Addressing and Plug-and-Play Operation

The ATM switch router provides the following self-configuring features:

- Preconfigured ATM address prefixes and MAC address, permitting small-scale ATM internetworks to be deployed prior to obtaining officially-allocated ATM addresses
- Automatic reassignment of addresses when reconfiguration is necessary
- Automatic recognition of port adapter types and ATM interface type using ILMI
- Automatic IP address configuration features, such as BOOTP

Connections

The ATM switch router supports connections with the following characteristics:

- Full 8-bit virtual path identifier (VPI) and 16-bit virtual channel identifier (VCI) with configurable boundaries.
- 12-bit VPI support available on ATM Network-Network Interface (NNI) interfaces on the Catalyst 8510 MSR and LightStream 1010
- Up to 256,000 total virtual connections on the Catalyst 8540 MSR and up to 64,000 total virtual connections on the Catalyst 8510 MSR and LightStream 1010
- VC and virtual path (VP) switching, VP tunneling, and VC merging
- The following virtual connection types:
  - Permanent virtual channel (PVC) connections
  - Permanent virtual path (PVP) connections
  - Soft permanent virtual channel (soft PVC) and soft permanent virtual path (soft PVP) connections with route optimization
  - Switched virtual channel (SVC) and switched virtual path (SVP) connections
  - Virtual path (VP) tunneling with traffic shaping and QoS guarantees for multiple service categories (hierarchical VP tunnels)
  - Point-to-point ATM connections
  - Point-to-multipoint ATM connections
- F4 and F5 Operation, Administration, and Maintenance (OAM) segment-loopback and end-to-end remote deflect identification (RDI) and alarm indication signal (AIS)
- OAM-based ping of IP or ATM address on the Catalyst 8510 MSR and LightStream 1010
- Frame Relay to ATM interworking features on the channelized E1 port adapter:
  - PVCs and soft-VCs with Network Interworking
  - PVCs and soft-VCs with Service Interworking
  - Support for various LMIs

Resource Management

Resource management provides support for the following:

- Traffic categories:
  - Constant bit rate (CBR)
  - Real-time variable bit rate (VBR-RT)
  - Non-real time variable bit rate (VBR-NRT)
  - Available bit rate (ABR) + minimum cell rate (MCR)
  - Unspecified bit rate (UBR) + MCR

Note FC-PCQ-equipped systems only support MCR value 0 for ABR and UBR traffic categories.

- Quality of service (QoS) guarantees with traffic policing and intelligent packet discard
- Connection admission control (CAC)
- Congestion control and traffic pacing

Note Some newer port adapters do not support traffic pacing.

- ABR with explicit forward congestion indication (EFCI) and relative rate (RR) marking

Note Relative rate marking of ABR traffic is not supported on the Catalyst 8540 MSR.

Signalling and Routing

The following signalling and routing features are supported:

- User-Network Interface (UNI) 3.0, 3.1, and 4.0
- Integrated Local Management Interface 4.0
- ATM network service access point (NSAP) and E.164 addressing
- Interim Interswitch Signalling Protocol (IISP) routing protocol
- Single-level and full hierarchical Private Network-Network Interface (PNNI) routing protocol, including PNNI complex node support
- Closed user groups (CUGs) for ATM virtual private networks (VPNs)
- ATM signalling and ILMI access lists with support for time of day-based policies
- ATM anycast

ATM Internetworking Services (Catalyst 8540 MSR)

The following internetworking services are provided:

- LAN emulation configuration server (LECS), LAN emulation server (LES), and broadcast-and-unknown server (BUS) for Ethernet emulated LANs (ELANs)
- Cisco Simple Server Redundancy Protocol (SSRP) for LANE
- RFC 1577 classical IP over ATM and Address Resolution Protocol (ARP) server and client
- Tag switching for Open Shortest Path First (OSPF), Routing Information Protocol (RIP), and Enhanced Interior Gateway Routing Protocol (EIGRP) routing of IP packets
- ATM Circuit Emulation Service (CES) as defined by ATM Forum CES 1.0
- RFC 1483 multiprotocol encapsulation over ATM

ATM Internetworking Services (Catalyst 8510 MSR and LightStream 1010)

The following internetworking services are provided:

- LAN emulation configuration server (LECS), LAN emulation server (LES), and broadcast and unknown server (BUS) for Ethernet and Token Ring emulated LANs (ELANs)
- Cisco Simple Server Redundancy Protocol (SSRP) for LANE
- RFC 1577 classical IP over ATM and Address Resolution Protocol (ARP) server and client
- Tag switching for Open Shortest Path First (OSPF) routing of IP packets
- ATM Circuit Emulation Service (CES) as defined by ATM Forum CES 1.0
- RFC 1483 multiprotocol encapsulation over ATM

Network Clocking

Any interface on the ATM switch router can be synchronized to an internal source (system clock) or to an external source, such as another network. Synchronous residual time stamp (SRTS), and adaptive clocking modes are supported for CES.

With the optional network clock module on the Catalyst 8540 MSR, the ATM switch router can be synchronized to a BITS source or to the module's own stratum 3 clock.

Management and Monitoring

The following features provide support for managing the ATM switch router:

- Text-based command-line interface (CLI) for configuration and troubleshooting
- Simple Network Management Protocol (SNMP) agent provides dynamic status, statistics, and configuration information
- Configuration and system image files saved in NVRAM and Flash memory
- Boot from network or from Flash memory
- Upload and download system images using Trivial File Transfer Protocol (TFTP)

- Update hardware controller microcode independently of system image on channelized E1 port adapter
- In-band device network management using IP over ATM
- In-band device network management using LAN emulation client, RFC 1577 client, and RFC 1483 client
- Out-of-band device network management using Ethernet and console ports
- ATM forum and enterprise Management Information Bases (MIBs) including, but not limited to, the following:
  - AToM MIB RFC1695
  - SVC MIB
  - ILMI MIB
  - PNNIv1.0 MIB
  - ATM Signaling and Diagnostic MIB
  - ATM RMON MIB
  - ATM Accounting MIB
- Port, VC, and VP snooping for monitoring and troubleshooting
- ATM accounting
  - Remote and local periodic collection of records
  - Accounting records for PVC/PVPs
  - 5-second peak interval transmit and receive cell counter for PVC/PVP only
- Online diagnostics that detect and report hardware failures in the Catalyst 8540 MSR during system bootup and operation

Available Network Management Applications

The CiscoWorks 2000 family of network management software provides tools for managing your ATM switch router. CiscoWorks 2000 includes the following packages:

- CWSI Resource Manager Essentials—a suite of web-based network management tools that allow you to collect the monitoring, fault, and availability information needed to track devices.
- CWSI Campus—a suite of network management applications that allow you to configure, monitor, and manage a switched internetwork.

The functionality provided by the CWSI Campus suite of applications includes the following:

- Automatically discover and display a map of your enterprise or campus network
- Display and configure emulated LANs
- Configure PNNI
- Obtain end-station user information
- Display and configure device information
- Monitor traffic