Cisco HyperSwitch ATM Family

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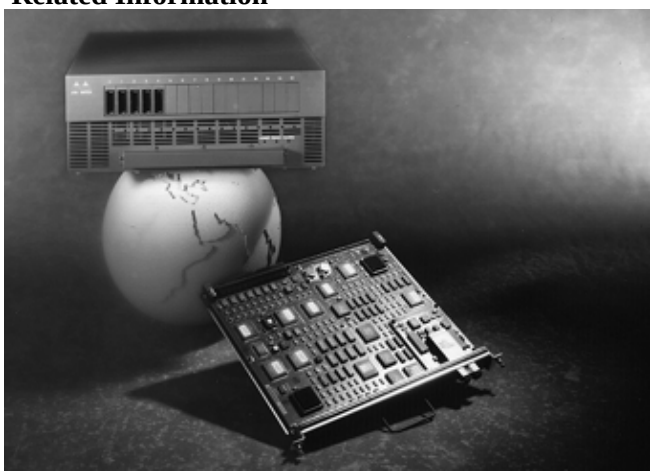


Introduction

The Cisco HyperSwitch Model A100 ATM Switch, targeted for use in building ATM campus backbone networks, is the industry's first switch to provide full, integrated support for ATM Forum User−Network Interface (UNI) V3.0 signaling. The Cisco HyperSwitch Model A100 is the first of a planned family of Cisco HyperSwitch products that will address the range of ATM switching applications, from the workgroup through WAN access and enterprise backbones.

Combined with the Cisco ATM Interface Processor (AIP), the 16−port Cisco HyperSwitch operates seamlessly with the Cisco 7000 family of high−end multiprotocol routers, enabling organizations to evolve their shared−media LAN internetworks into switched internetworks. The high bandwidth and scalability advantages of these switched, ATM−based internetworks provide users with a robust architecture capable of accommodating the emerging wave of complex, high−bandwidth network applications.

The Cisco HyperSwitch represents a key element of the CiscoFusion architecture, Cisco's comprehensive strategy for helping today's LAN internetworks to evolve into the switched internetworks of tomorrow. The

Cisco HyperSwitch was jointly developed by Cisco Systems and Nippon Electric Corporation (NEC), building on the combination of NEC's years of experience with ATM switching systems and Cisco's expertise in internetworking software.

Cisco has ported onto the Cisco HyperSwitch portions of Cisco IOS® Software. Cisco IOS Software offers a unique set of internetworking software capabilities that enable information−intensive companies to build scalable, high−performance enterprise networks that can incorporate the growing multitude of network protocols, platforms, and technologies. The first portion of Cisco IOS Software to be ported onto the Cisco HyperSwitch is the ATM signaling code, which also runs on the Cisco AIP, ensuring interoperability between the two devices. In the future, Cisco plans to integrate increasingly sophisticated ATM networking capabilities into Cisco IOS Software.

Supports up to 16 155−Mbps ATM interfaces.
Uses modular architecture to achieve flexibility and low entry costs.
Provides nonblocking, 2.4−Gbps output buffer type switch fabric with a minimum of 1000 virtual output cell buffers per port.
Supports all ATM adaptation layers (ATM adaptation Layer 1 [AAL1] through ATM adaptation Layer 5 [AAL5]) and traffic types.
Provides two priority levels for both cell loss and for cell delay.
Supports multicast traffic with no throughput degradation.

Cisco HyperSwitch Features. *The Cisco HyperSwitch supports any combination of from one to 16 ATM interface cards. The Cisco HyperSwitch uses a combination of input and output buffers connected by a nonblocking switch fabric, which offers full throughput multicast and broadcast support.*

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions.

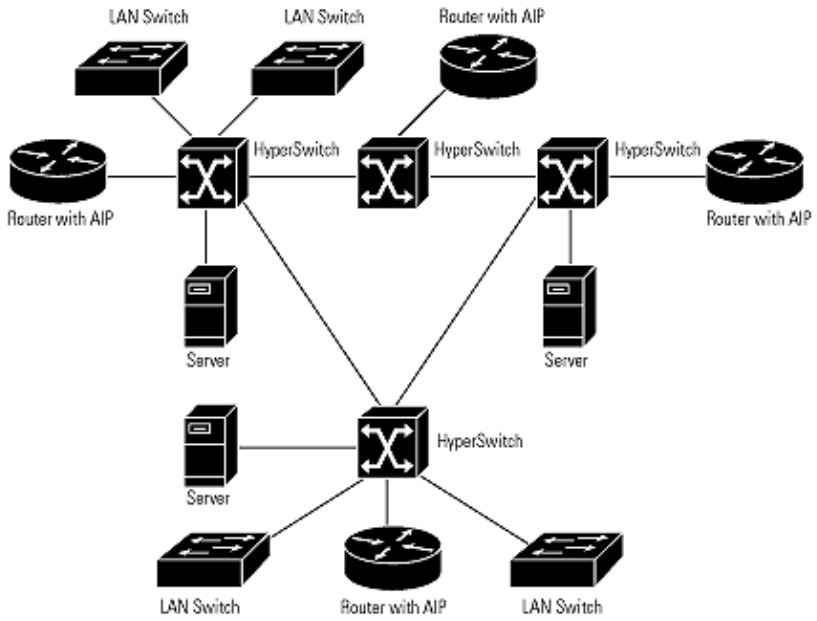
Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

ATM and the New Internetwork Paradigm

ATM networks offer a number of significant advantages, including scalable bandwidth, virtual networking, and integrated traffic support. ATM technology's connection−oriented, self−routing communications help facilitate high switch throughputs, helping to minimize network delays. High−speed ATM networks will be required to meet the increasing bandwidth requirements of such complex applications as image processing, video conferencing, and switched virtual LANs.

Switched internetworks based on ATM technology represent a paradigm shift away from shared−media LANs in campus and enterprise networking applications. The foundation of the switched internetwork is an ATM backbone, which interconnects multilayer LAN switches. These multilayer switches switching packets at Layer 2 (L2) or Layer 3 (L3), as described in the CiscoFusion architecture will support virtual LAN protocols across the ATM backbone, providing enterprise networks with much greater flexibility and broader management capabilities than shared−media LANs. In addition, ATM's potential to handle all types of traffic, including voice, video, and data, provides ATM backbones with significant advantages compared with backbones based on other technologies.



ATM Building or Campus Backbone. *Switched internetworks based on ATM technology represent a paradigm shift away from shared−media LANs in campus and enterprise networking applications. The Cisco HyperSwitch is designed for constructing ATM campus backbone networks that connect a number of ATM routers, multilayer switches, and high−performance servers into a router cluster.*

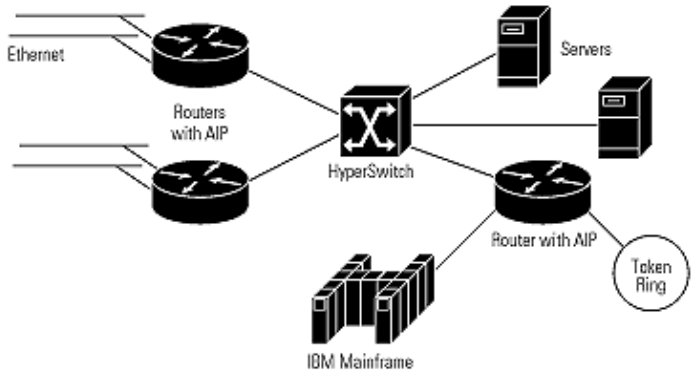
Network Architecture

The Cisco HyperSwitch is designed primarily for constructing ATM campus backbone networks that connect a number of ATM routers, multilayer switches, and high−performance servers into a router cluster. ATM routers such as the Cisco 7000 with the Cisco AIP module allow existing LANs to be interconnected across ATM backbones while paving the way for new applications such as virtual LAN internetworking. The AIP for the Cisco 7000 family of multiprotocol routers is the first of a set of native ATM interfaces that will support the full range of Cisco routers.

A router cluster can scale to many gigabits of bandwidth and millions of packets per second, enabling customers to alleviate the congestion on their current backbone networks by migrating from their existing backbone technologies. While the AIP module provides for transparent internetworking of current LAN and WAN protocols across the ATM backbone, high−speed servers can also be directly connected to the Cisco HyperSwitch, linking with desktop clients on multilayer switches through virtual LAN protocols.

As network backbones increase in size, multiple switches can be interconnected to increase the scale and port density of the backbone. ATM routing protocols, such as the Private Network−to−Node Interface (P−NNI) protocol currently being developed by the ATM Forum, will be used to facilitate the construction of these large−scale ATM backbone networks.

Reliable backup network configurations are possible with the Cisco HyperSwitch through the use of redundant connections. Cisco ATM routers also can support dual−homed connections and route around failed links, thus providing the same level of reliability on ATM backbones that can be achieved today using router backbones.



Multiple−Switch Backbone Network. *By interconnecting multiple Cisco HyperSwitches, network backbone scale and port density can be increased. ATM routing protocols, such as the P−NNI protocol, will be used to build large−scale ATM backbone networks.*

Switch Overview

The Cisco HyperSwitch supports up to 16 ATM ports and features a total nonblocking throughput of 2.4 Gbps. Each port is able to operate at rates of up to 155 Mbps. The Cisco HyperSwitch uses a combination of input and output buffers connected by a nonblocking switch fabric. Multicast and broadcast support are built into the fabric and can be implemented without any reduction in throughput. In addition, the Cisco HyperSwitch's integrated support for ATM signaling precludes the need for an external signaling server.

The Cisco HyperSwitch supports any combination of from 1 to 16 ATM interface cards, enabling users to easily and economically deploy the precise number of interfaces and interface types that they require. Interface cards can be added and changed in the field, offering additional versatility to organizations with large, geographically dispersed internetworks.

Broad Interface Support

The Cisco HyperSwitch supports a wide range of LAN and WAN ATM interfaces. All interfaces conform to the relevant standards, including those of the ATM Forum, European Telecommunication Standards Institute (ETSI), T1S1.5, and the International Telecommunication Union Telecommunication Standardization Sector (ITU−T).

Because the Cisco HyperSwitch has been designed for backbone deployment, it will be able to support such WAN interfaces as DS3/E3 and single−mode fiber SONET/Synchronous Digital Hierarchy (SDH). This capability will allow seamless connectivity between ATM campus backbones and ATM public and private WANs. In addition, the Cisco HyperSwitch can be used in workgroups to support power users with direct ATM desktop interfaces. In order to facilitate such deployment, the Cisco HyperSwitch will support the emerging ATM Forum copper (unshielded twisted pair Category 5 [UTP−5]) interfaces.

Interfaces

- Complies fully with ATM Forum, ITU−T, and ETSI specifications.
- Can be used as either a backbone, workgroup, or WAN access switch.
- Interface types:

- ♦ SONET/SDH Synchronous transport signal Level 3, concatenated (STS3c)/Synchronous Transport Module level 1 (STM1) 155−Mbps multimode fiber.
- ♦ Transparent Asynchronous Transmitter/Receiver Interface (TAXI) 100−Mbps multimode fiber.
- ♦ SONET/SDH STS3c/STM1 155−Mbps single−mode fiber.
- ♦ DS3 over coaxial cable.
- ♦ E3 over coaxial cable.
- ♦ STS3c/STM1 over UTP−5.
- ♦ STS−1 (55 Mbps) over unshielded twisted pair Category 3 cable (UTP−3).

PHYSICAL LAYER	DATA RATE	MODE	CONNECTOR
STS3c/STM1	155 Mbps	Multimode fiber	SC
TAXI 4B/5B	100 Mbps	Multimode fiber	MIC (FDDI style)
STS3c/STM1	155 Mbps	Single−mode fiber	SC
STS3c/STM1	155 Mbps	UTP−5	RJ−45
DS3	45 Mbps	Coaxial cable	BNC
E3	34 Mbps	Coaxial cable	BNC

Broad Interface Support. *The Cisco HyperSwitch supports a wide range of LAN and WAN interfaces. The switch will support such WAN interfaces as DS3/E3 and single−mode fiber SONET/SDH, providing connectivity between campus backbones and public and private WANs.*

Switch Management

The Cisco HyperSwitch is configured through a local management console connected through a serial port. Simple Network Management Protocol (SNMP) and Telnet access across the ATM ports is also possible for remote monitoring and configuration of switch parameters. Front−panel LEDs allow for rapid diagnosis of line alarms and faults. Future software enhancements will allow for SNMP configuration and full monitoring of traffic flows through the switch, while switch management will be integrated into the CiscoWorks network management system.

Connection Support

The Cisco HyperSwitch supports virtual channel connections (VCCs) and virtual path connections (VPCs). Both types of connections can also be configured as either point−to−point or point−to−multipoint. Each port supports a maximum of 4096 point−to−point connections, while the switch itself can support up to 1024 point−to−multipoint connections. The full eight bits (for UNI cells) or 12 bits (for Network−to−Network Interface [NNI] cells) of the virtual path identifier (VPI) field are supported for VPC.

Each connection through the Cisco HyperSwitch can be labeled as either high priority (requiring low cell delay variation) or low priority (tolerant of cell delay variation). High−priority connections will typically be used for voice or video traffic, while low−priority connections will usually handle data traffic. Connections can be either permanent virtual connections (PVCs) or switched virtual connections (SVCs). PVCs are set up through the serial port, with parameters stored in nonvolatile memory for retention following a power failure or reset. By comparison, SVCs are set up by ATM end stations using ATM signaling protocols to communicate with the switch.

Connection Types
Supports both permanent and switched virtual circuits.
Supports virtual channel (VC), virtual path (VP), point−to−point, and point−to−multipoint connections.

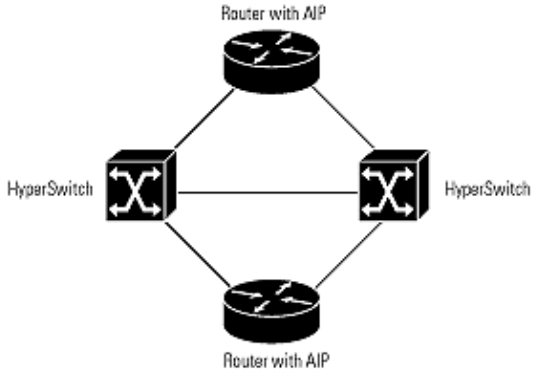
Eliminates single points of failure through fully integrated support for ATM Forum V3.0 Q.2931 UNI signaling.
Supports up to 4096 ATM point−to−point connections per interface and 1024 point−to−multipoint connections per switch.
Allows construction of multiswitch networks via NNI standard support.

Additional Features
Allows downloading of new software images using Flash EPROM support.
Provides configuration and PVC setup through a local management console.
Enables remote monitoring across ATM interfaces using SNMP.
Supports SNMP configuration and ATM management standards.
Fits into any standard 19−inch equipment rack using either tabletop or rack mounting.

ATM Signaling

The Cisco HyperSwitch supports signaling protocols that conform to the ATM Forum UNI version 3.0 specification. Future releases will support the pending ATM Forum UNI version 3.1 signaling protocol based on ITU−T recommendations Q.2931 and Q.2110. The signaling will support point−to−point connection setup using any of the address formats defined by the ATM Forum, including E.164 or network service access point (NSAP)−encoded ATM private network addresses. A built−in segmentation and reassembly (SAR) function in the switch allows it to support ATM signaling and network management functions. Either AAL5 or AAL (layer 3/4) 3/4 can be used for carrying signaling requests.

In addition to supporting UNI signaling, the Cisco HyperSwitch supports NNI functionality, enabling signaling requests to be routed in a multiswitch network. In the first release, the switch will support a prefix−based static routing protocol. As the P−NNI standards are developed, the Cisco IOS Software will be enhanced to support them. Because of built−in signaling support, the switch does not require a separate connection management system thus lowering system costs and enhancing overall reliability.



Redundant Network Design. *Redundant connections enable the Cisco HyperSwitch to provide reliable network configurations. Cisco ATM routers also can support dual−homed connections and route around failed links providing the same level of reliability currently offered by today's conventional router backbones.*

Traffic Management and Performance

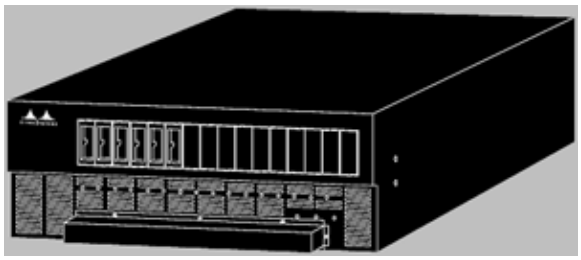
The Cisco HyperSwitch supports two levels of priority for both cell loss and cell delay variation (called jitter). Each connection can be marked as either high or low priority with respect to cell delay variation. The switch fabric maintains separate logical queues for each priority class and guarantees that high−priority queues will be served first, thus reducing cell delay variation due to buffering delays. This capability is ideal for time−sensitive traffic such as voice or video.

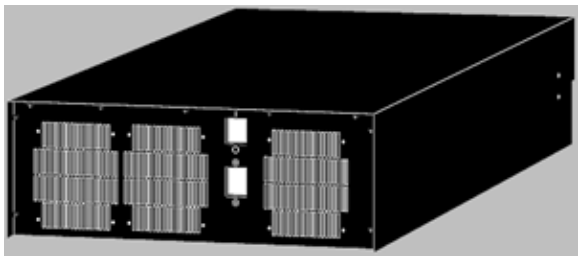
Cell loss priority is controlled by the Cell Loss Priority (CLP) bit in the cell header. Once cell buffers fill beyond a set threshold, cells with the CLP bit set will be discarded. The switch supports a minimum of 1000 cells of virtual output buffering per port, ensuring low loss rates for highly bursty or "best effort"−type LAN traffic. Interface cards also implement traffic policing to monitor the peak transmission rates of connections. Once a set peak rate is exceeded, the interface discards excess cells, precluding specific connections from monopolizing the switch's bandwidth. Because of these mechanisms, the delay through the switch is constrained to between 20 microseconds and 5 milliseconds, depending upon traffic flows. Higher−priority cells will experience a shorter latency and jitter than lower−priority cells.

The Cisco Advantage

All of the world's largest multiprotocol data networks have been built with Cisco routers. The experience that Cisco has gained helping to construct these global internetworks has delivered real competitive benefits to customers across all industry segments. Strategic global partnerships with other industry leaders and the industry's most comprehensive internetwork support infrastructure complete the Cisco advantage.

As an active member of the ATM Forum and the first company to introduce ATM routing and switching products that conform to Forum specifications for connection setup Cisco has been one of the key companies responsible for developing and advancing the state of ATM technology. Cisco HyperSwitch and Cisco AIP module, linked by Cisco IOS Software to provide a seamless and scalable enterprise network, enable Cisco to offer the industry's most comprehensive evolution path to switched internetworks. Using the common software infrastructure of the Cisco IOS Software, customers can build networks using virtually any technology from LAN concentration and multiprotocol routing to LAN and ATM switching. Cisco's technology protects existing network equipment investments while providing a smooth migration path and scalable connectivity to accommodate future internetworking needs.





Specifications

Dimensions

- Width: 17.1 in (435 mm)
- Depth: 16.9 in (430 mm)
- Height: 6.3 in (160 mm)
- Weight: 33.1 lbs (15 kg)

Immunity

- International Electrotechnical Commission (IEC) 801−2
- IEC 801−3
- IEC 801−4
- IEC 801−5
- IEC 801−6

Regulatory Approvals

- Safety
    - ♦ Underwriters Laboratories (UL) 1950
    - ♦ Canadian Standards Association (CSA) 22.2 − 950
    - ♦ European Norm (EN) 60950
    - ♦ EN 41003
    - ♦ Standards Australia (AS) 3260
    - ♦ AS T001
    - ♦ FDA, class 1 laser
    - ♦ EN 60825 single−mode, class 1 laser
- EMI/radio frequency interference (RFI)
    - ♦ Federal Communications Commission (FCC) Part 15, class A
    - ♦ VDE 0878 parts 3 and 30, class B
    - ♦ EN 55022 (CISPR 22, class A and class B)
    - ♦ Voluntary Control Council for Interference (VCCI) class I and class II
    - ♦ NFC 98020

Related Information

- **Technical Support & Documentation − Cisco Systems**

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