CHAPTER 1

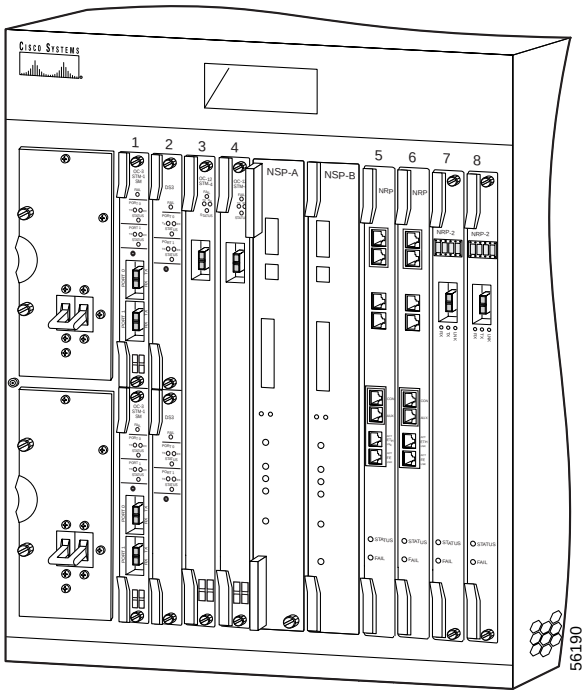
Product Overview

The Cisco 6400 carrier-class broadband aggregator is a high-performance, scalable service gateway that enables the selection and delivery of broadband network services, virtual private networks (VPNs), and voice- and entertainment-driven traffic over the full suite of access media. The Cisco 6400 combines the richness of Cisco IOS software, ATM switching and routing capabilities, and value-added service selection in a modular, scalable, redundant, Network Equipment Building Systems (NEBS) certified and ETSI form factor.

The Cisco 6400 consists of a fault-tolerant midrange ATM switching core and multiple fault-tolerant routing engines. The ATM switch, based on Catalyst 8500 + Per-Flow Queuing (PFQ) technology, provides the necessary ATM switching and traffic management capabilities, while the router modules enable the service provider to offer scalable Layer 3 services. ATM interfaces connect the Cisco 6400 to dial access servers, digital subscriber line access multiplexers (DSLAMs), and Cisco IP DSL switches, and ATM and packet interfaces connect to the network core. The Cisco 6400 is designed for use in high-availability environments such as operating companies' central offices (directly or via co-location), Internet service provider (ISP) offices, and corporate premises. As such, it includes switch, router, and line card redundancy, as well as 12-inch packaging (key for central office deployment).

The Cisco 6400 can reside within the operating company's infrastructure (directly or via co-location) to aggregate access media (DSL, cable, wireless, and dial), serving as the intelligent equal access point that allows a multitude of operating companies and service providers access to the end users. In addition, the Cisco 6400 can reside at the network edge between the operating companies and ISP or corporation, providing the aggregation of sessions and tunnels as well as service and network selection capabilities required in the delivery of advanced broadband services.

Figure 1-1 Cisco 6400 Carrier-Class Broadband Aggregator

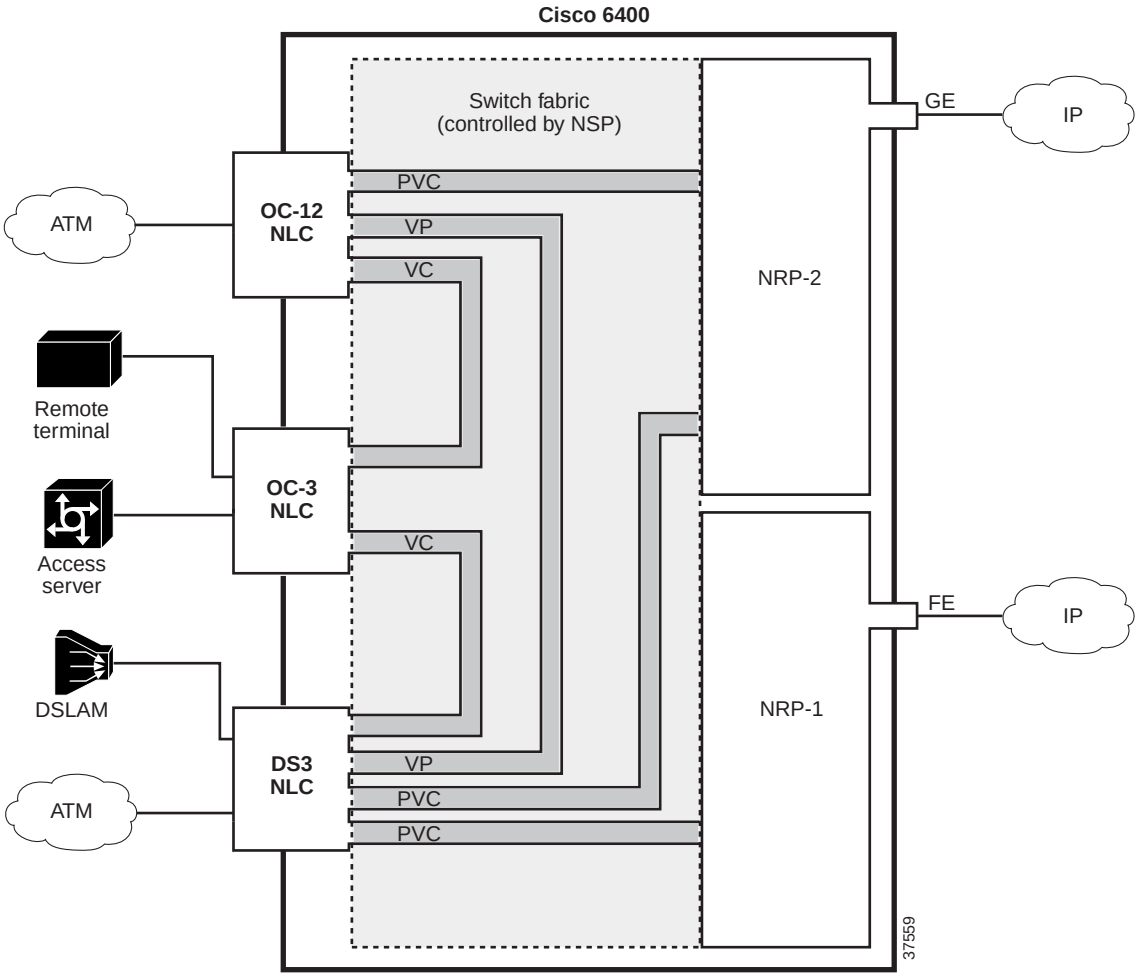


Cisco 6400 System

The Cisco 6400 uses a ten-slot, modular chassis featuring the option of half-height and full-height card and slot redundancy, along with dual, fault-tolerant, load-sharing AC or DC power supplies. The two central slots (slot 0A and 0B) in the Cisco 6400 are dedicated to redundant, field-replaceable NSP modules that support the 5-Gbps shared memory, fully nonblocking switch fabric. The NSP also supports the feature card and high-performance reduced instruction set computing (RISC) processor that provides the central intelligence for the device. The NSP supports a variety of backbone and wide-area interfaces.

The remaining slots support up to eight node route processors (NRPs), full-height node line cards (NLCs), or carrier modules for half-height NLCs. NRPs and NLCs can be configured for redundant operation. As a result, you can have multiple redundant pairs of NRPs and NLCs, or any combination of nonredundant NRPs and NLCs. The NRPs are fully functional router modules capable of terminating PPP sessions delivered over OC-12, OC-3, or DS3 node line cards.

Figure 1-2 Simple Schematic of Cisco 6400 Internal and External Connectivity



Node Switch Processor

The Cisco 6400 NSP provides ATM switching functionality. The NSP uses permanent virtual circuits (PVCs) or permanent virtual paths (PVP) to direct ATM cells between the NRP and ATM interface. The NSP also controls and monitors the Cisco 6400 system, including component NLCs and NRPs.

Node Route Processor

The Cisco 6400 supports three node route processors, designated as NRP-1, NRP-2, and NRP-2SV (see Table 1-1 for major differences):

- NRP-1—Incorporates a 100-Mbps Fast Ethernet interface for connecting into an IP network and has processing capability for OC-3 rate of user traffic.
- NRP-2 and NRP-2SV—Provides a Gigabit Ethernet interface and sufficient processing capability for handling OC-12 rate of user traffic.

The Cisco 6400 can contain multiple NRP modules, configured to operate independently or as 1+1 redundant pairs. The NRP receives traffic from NLC interface ports through the NSP ATM switch, reassembles the ATM cells into packets, processes (for example, routes or bridges) the packets, and then does one of the following:

- Segments the packets into ATM cells and sends them back to the NSP for transmission out of another NLC interface
- Sends the traffic out the Fast Ethernet (NRP-1) or Gigabit Ethernet (NRP-2) interface

Table 1-1 Differences Between NRP-1 and NRP-2 or NRP-2SV

Feature or Capability	NRP-1	NRP-2 and NRP-2SV[1]
Session scalability	Hardware supports as many as 2000 sessions per NRP-1.	Hardware supports as many as 16,000 sessions per NRP-2.
Physical interfaces	Faceplate interfaces: • Console port • Auxiliary port • Ethernet port • Fast Ethernet port Backplane interfaces: • 155-Mbps ATM interface • Backplane Ethernet (BPE)	Faceplate interfaces: • Gigabit Ethernet interface Backplane interfaces: • 622-Mbps ATM interface • PAM mailbox serial interface[2]
Location of startup configurations and crash information	NRP-1 memory (built-in or internal Flash)	PCMCIA[3] disk on NSP.
Message logging	Messages are logged on the NRP-1 as a local message.	NRP-2 messages are logged on both the NSP and NRP-2. NRP-2 messages on the NSP include the NRP-2 slot number.
Console line access	Direct external connection to NRP-1 console port or auxiliary port.	Indirect external connection via the NSP. NSP contains a virtual communication server to access NRP-2 console.
ROMMON[4]	ROMMON not upgradable; NRP-1 ROM state information stored locally on NRP-1.	ROMMON is upgradable; NRP-2 ROM state information is stored on the NSP PCMCIA disk.
SNMP[5]	Standard SNMP services.	Standard SNMP services, or the NSP can be used as the proxy forwarder.
LED display	None.	On faceplate.

1. Differences between the NRP-2 and NRP-2SV vary by software release. See the release notes for your specific software images.
2. The PAM mailbox serial interface is used for internal system communication. Do not attempt to configure serial interfaces on the Cisco 6400.
3. PCMCIA = Personal Computer Memory Card International Association
4. ROMMON = ROM monitor
5. SNMP = Simple Network Management Protocol

Node Line Card

NLCs provide ATM interfaces for the Cisco 6400 system and are controlled by the NSP. The three types of NLC available for the Cisco 6400 each offer a different interface type, as shown in Table 1-2.

Table 1-2 Supported Cisco 6400 NLCs

NLC	Bandwidth	Cable	Height	Number of Ports
OC-12/STM-4	622 Mbps	SONET[1] single-mode fiber-optic cable	Full-height	1
OC-3/STM-1 SM	155 Mbps	SONET single-mode fiber-optic cable	Half-height[2]	2
OC-3/STM-1 MM	155 Mbps	SONET multimode fiber-optic cable	Half-height	2
DS3	45 Mbps	Coaxial cable	Half-height	2

1. SONET = Synchronous Optical Network
2. Half-height NLCs require carrier modules, each of which hold two half-height NLCs with covers for empty slots.

Redundancy and SONET Automatic Protection Switching

Redundancy for both the NSP and NRP is based on enhanced high system availability (EHSA). If the NRP fails, no virtual connections from the NSP need to be reconfigured. The NRP blades also support online insertion and removal (OIR). When operating in nonredundant mode, the NRPs appear as separate network management and routing entities and can be accessed through individual management ports.

SONET automatic protection switching (APS) provides a mechanism to support redundant transmission circuits between SONET devices. Automatic switchover from the primary or working circuit to the backup or protection circuit happens when the working circuit fails or degrades. The Cisco 6400 supports 1+1, linear, unidirectional, nonreverting APS operation on its redundant OC-3 and OC-12 NLC interfaces. SONET APS does not apply to DS3 NLCs.

Network Management—Cisco 6400 SCM

The Cisco 6400 Service Connection Manager (SCM) software provides simplified ATM and Layer 2 and Layer 3 IP services to access servers and DSLAMs through network and service management of the Cisco 6400 carrier-class broadband aggregator.

The Cisco 6400 SCM assists you in making network connections by eliminating the need to have technical knowledge of SNMP and Cisco IOS commands required to establish these connections. It also streamlines the deployment process for the Cisco 6400 aggregator. The Cisco 6400 SCM provides a service-oriented management view of the Cisco 6400 aggregator's inbound and outbound connections.

The Cisco 6400 SCM is based on the common Cisco Element Management Framework (CEMF), which is a Sun Solaris UNIX-based element management foundation for many Cisco service provider products. The Cisco 6400 SCM Element Manager software adds custom windows and modeling behavior to the standard CEMF to improve management of the Cisco 6400 aggregator hardware.

For more information, see the Cisco 6400 SCM documentation on Cisco.com at http://www.cisco.com/en/US/products/sw/netmgtsw/ps4865/