

Access Server and Router Product Overview

Computer networks that use different protocols on a variety of local-area network (LAN) media over a variety of wide-area network (WAN) technologies must be able to communicate with other networks. Additionally, dial-in users must be able to access the same network services that local users can access. The Cisco Internetwork Operating System (Cisco IOS) software provides these capabilities. The Cisco IOS software runs on internetworking products purchased directly from Cisco Systems, Inc. and from many Cisco partners.

This chapter describes the capabilities of the Cisco IOS software implemented on router and access server platforms. It contains the following sections:

- Cisco IOS Software Benefits
- Configuring Cisco IOS Software
- Supported Media
- Supported Network Protocols
- Supported Routing Protocols
- Supported Terminal Services

We provide various documents about your Cisco access server or router.

- Refer to the *Documentation Roadmap* for information about the interrelationship among the various documents.
- For the latest information about the software, including new features added since the documentation was printed and additional caveats about using the software, refer to the release note that accompanies the software.
- Refer to the “Platform Support” appendix in the *Configuration Fundamentals Command Reference* for platform information.
- Refer to the *Cisco IOS Software Command Summary* for summarized command information.
- Refer to the *Cisco Access Connection Guide* for information about connecting to network hosts using an access server or router.
- Refer to the *System Error Messages* publication for information about system software, internal hardware, and communication line error messages.
- Refer to the *Cisco Management Information Base (MIB) User Quick Reference* for information about MIBs.
- Refer to the *Debug Command Reference* for information about debug commands.

Cisco IOS Software Benefits

The Cisco IOS software supports users and applications throughout the enterprise and provides security and data integrity for the internetwork. The Cisco IOS software manages resources cost effectively by controlling and unifying complex, distributed network information. It also functions as a flexible vehicle for adding new services, features, and applications to the internetwork.

The Cisco IOS software provides several internetwork benefits, which are described in the following sections:

- Scalability
- Reliable, Adaptive Routing
- Remote Access and Protocol Translation Functionality
- WAN Optimization
- Management and Security

Scalability

Scalability provides the flexibility required to address all of the key issues facing internetworks as organizations evolve. The Cisco IOS software utilizes scalable routing protocols to avoid needless congestion, overcome inherent protocol limitations, and bypass many of the obstacles that result from the complex scope and geographical dispersion of an internetwork.

The Cisco IOS software reduces network costs by efficiently using network bandwidth and resources while eliminating the need for static routes. Advanced Cisco IOS features such as route filtering, protocol termination and translation, smart broadcasts, and helper address services combine to create a flexible, scalable infrastructure that can keep pace with evolving network requirements.

Reliable, Adaptive Routing

The Cisco IOS software is reliable and adaptive because it identifies the best network paths and routes traffic around network failures.

Policy-based Cisco IOS features such as route filtering and route redistribution save network resources by preventing data from being unnecessarily broadcast to nodes that do not need it. Priority output queuing and custom queuing grant priority to important sessions when network bandwidth is scarce. Load balancing uses every available path across the internetwork to preserve valuable bandwidth and improve network performance. The Cisco IOS software also provides the most effective and efficient scaling available for network applications that require transparent or source-route bridging algorithms.

Increasingly, internetworks are incorporating new technologies such as Asynchronous Transfer Mode (ATM) and LAN switching. With CiscoFusion, Cisco's scalable architecture for switched internetworks, the Cisco IOS software provides the framework for a new technology called multilayer switching, which fuses the ease of switching solutions with the power of routed solutions.

By distributing routing intelligence and switching functions to create "virtual LANs," the CiscoFusion multilayer switching capabilities increase bandwidth while simplifying moves, additions, and changes across the enterprise. CiscoFusion extends the power and flexibility of the Cisco IOS software beyond internetwork routers to include the ATM and LAN switches that are increasingly being deployed throughout today's internetworks.

Remote Access and Protocol Translation Functionality

Depending on the product you purchased, your Cisco device connects terminals, modems, microcomputers, and networks over serial lines to local-area networks (LANs) or wide-area networks (WANs). Cisco products provide network access to terminals, printers, workstations, and other networks.

On LANs, terminal services support TCP/IP on UNIX machines with Telnet and rlogin connections, IBM machines with TN3270 connections, and Digital machines with LAT connections. You can use the router or access server's protocol translation services to make connections between hosts and resources running different protocols including router and access server connections to X.25 machines using X.25 PAD.

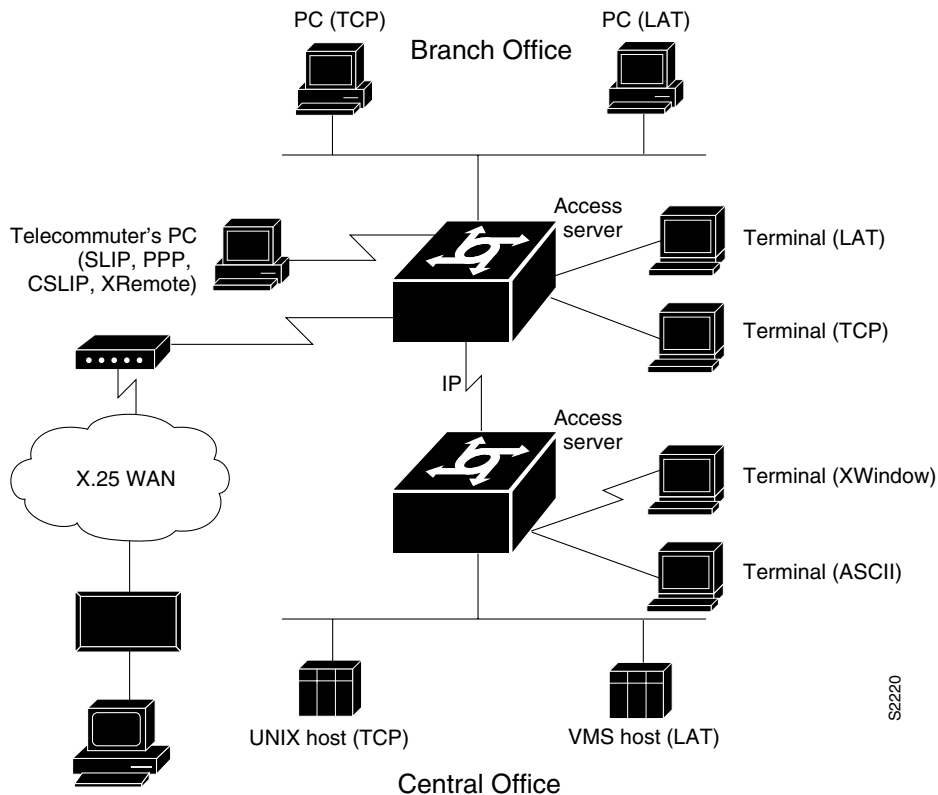
Access servers provide remote configuration through Telnet and Digital Equipment Corporation's Maintenance Operation Protocol (MOP) connections to virtual ports.

The Cisco IOS software supports four types of server operation:

- Remote node services—Connect devices over a telephone network using AppleTalk Remote Access (ARA), Serial Line Internet Protocol (SLIP), compressed SLIP (CSLIP), Point-to-Point Protocol (PPP), and XRemote (NCD's X Windows terminal protocol). See Figure 2.
- Terminal services—Connect asynchronous devices to a LAN or WAN through network and terminal-emulation software including Telnet, rlogin, Digital's Local Area Transport (LAT) protocol, and IBM TN3270. See Figure 2.
- Protocol translation services—Convert one virtual terminal protocol into another protocol. See Figure 2.
- Asynchronous remote access routing—Enables full-featured Internet Protocol (IP), Novell Internet Packet Exchange (IPX), and AppleTalk routing over asynchronous interfaces.

Figure 2 illustrates these types of server functionality available on access servers: remote node service is demonstrated by the remote PC connection running SLIP, CSLIP, PPP, or XRemote; terminal service is shown between the terminals and hosts running the same protocol (LAT-to-LAT or TCP-to-TCP); protocol translation is shown between the terminals and hosts running unlike protocols (LAT-to-TCP or TCP-to-LAT); asynchronous IP routing is shown by the PC running SLIP or PPP, and between the two access servers.

Figure 2 Remote Access Functionality



WAN Optimization

Because most network costs are expended on WAN switching and bandwidth requirements, a cost-effective internetwork must optimize all WAN-related operations. Optimization increases network throughput while reducing delay time. It also reduces costs by eliminating unnecessary traffic and selecting the most economical WAN links available.

The Cisco IOS software seamlessly accommodates circuit-switched WAN services such as Integrated Services Digital Network (ISDN), switched T1, and dial-up telephone lines. Cisco IOS software innovations such as dial-on-demand access and dial backup capabilities provide cost-effective alternatives to point-to-point switched leased lines. Support for advanced, packet-switched services such as X.25, Frame Relay, Switched Multimegabit Data Service (SMDS), and ATM extends the internetwork across the broad range of WAN interface alternatives now available.

In addition to remote node WAN connectivity with ARA, SLIP, PPP, or XRemote, other WAN services include dial-on-demand routing (DDR) of IP and IPX, X.25, Frame Relay, and SMDS.

Management and Security

The Cisco IOS software provides an array of network management and security capabilities designed to meet the needs of today's large, complex internetworks. Integrated management simplifies administrative procedures and shortens the time required to diagnose and fix problems. Automated operations reduce hands-on tasks and make it possible to manage large, geographically dispersed internetworks with a small staff of experts located at a central site.

The Cisco IOS software provides several important management features that are built into every Cisco router and access server. These management features include configuration services, which lower the cost of installing, upgrading, and reconfiguring routers and access servers, as well as comprehensive monitoring and diagnostic services. In addition, the Cisco IOS software provides valuable information and services for router management applications developed by Cisco and its partners. The Cisco applications, known collectively as CiscoWorks, offer administrators a wide-ranging suite of operational, design, and management capabilities that increase productivity and reduce costs.

The Cisco IOS management services are matched by their security capabilities. The Cisco IOS software includes a diverse tool kit for partitioning resources and prohibiting access to sensitive or confidential information and processes. Multidimensional filters prevent users from knowing that other users or resources are even on the network. Encrypted passwords, dial-in authentication, multilevel configuration permissions, and accounting and logging features provide protection from—and information about—unauthorized access attempts.

Configuring Cisco IOS Software

The following sections describe the two software tools that you can use to configure your access server or router via the Cisco IOS software:

- Using Cisco Configuration Builder
- Using the Command Interpreter

Using Cisco Configuration Builder

The Cisco Configuration Builder allows you to create configuration files for multiple routers or access servers without knowing the command-line language or syntax. It is a Microsoft Windows-based application that runs on an IBM PC or compatible computer.

To use Configuration Builder, refer to the *Cisco Configuration Builder Getting Started Guide*.

If you do not have the platform required to run Configuration Builder, configure your Cisco device using the command interpreter, as described in the next section.

Using the Command Interpreter

You can build most straightforward configurations and create a configuration file using the **setup** command facility. This facility is described in the “Using Setup for Configuration Changes” chapter in the *Configuration Fundamentals Configuration Guide*.

Before configuring your router or access server, you must determine the following:

- Which network protocols you are supporting (for example, AppleTalk, IP, Novell IPX, and so on)
- The addressing plan for each network protocol
- Which WAN protocols you will run on each interface (for example, Frame Relay, HDLC, SMDS, X.25, and so on)
- Which routing protocol you will use for each network protocol

The Cisco IOS software provides a user interface called a command interpreter, or EXEC, that allows you to configure and manage the router or access server. The user interface also provides context-sensitive help. The command interpreter has several command modes, each of which provides a group of related commands that you can use to configure the routing device and display its status. Some commands are available to all users; others can be executed only after the user enters

an enabling password. Context-sensitive help gives information about command syntax. The command interpreter and its help feature are described in the “Understanding the User Interface” chapter of the *Configuration Fundamentals Configuration Guide*.

You use the command interpreter (also known as the command-line parser) to configure interfaces, terminal sessions, and asynchronous communications lines. Interfaces are connections to network media, such as Ethernet, Token Ring, and serial media. You configure them to run routing and networking protocols. You configure terminal sessions and modems connected to the router or access server so that other network users can log in to the network over asynchronous lines. Configuring terminal sessions and asynchronous communications lines is discussed in the “Configuring Terminal Lines and Modem Support” chapter of the *Access Services Configuration Guide*. Configuring interfaces is described in the “Configuring Interfaces” chapter of the *Configuration Fundamentals Configuration Guide*; the routing, bridging, and IBM protocols you can configure on these interfaces are described in their protocol-specific configuration guides.

You also can configure and manage the router or access server itself, performing such tasks as naming the device, setting the time, configuring SNMP, and setting security. These tasks are described in the “Managing the System” chapter of the *Configuration Fundamentals Configuration Guide*.

The basic process to set up your access server or router follows:

- Step 1** Attach an RS-232 ASCII terminal to the system console port located at the rear of the router.
- Step 2** Configure the terminal to operate at 9600 baud, 8 data bits, no parity, 2 stop bits.
- Step 3** Power up the router. The **setup** command facility runs automatically for initial startup.
- Step 4** Perform general system configuration.
- Step 5** Configure your system for by referring to the appropriate part in the documentation.

To enhance the configuration, perform the protocol-specific tasks described in the appropriate chapters of the Cisco IOS software configuration guides.

Supported Media

Our routers and access servers support the following industry-standard networking media:

- Asynchronous serial
- Channelized T1, E1
- Ethernet—IEEE 802.3 and Type II
- Fiber Distributed Data Interface (FDDI)—single and dual mode
- High-Speed Serial Interface (HSSI)—supports T1, E1, T3, E3, and SONET rates
- ISDN Basic Rate Interface (BRI) and Multiport BRI (MBRI)
- ISDN Primary Rate Interface (PRI)
- Synchronous serial—V.35, RS-232, RS-449, RS-530, X.21, and G.703
- Token Ring—IEEE 802.5

These media are described briefly in the “Configuring Interfaces” chapter of the *Configuration Fundamentals Configuration Guide*.

Supported Network Protocols

The Cisco IOS software supports many networking protocols, as well as their associated routing protocols. These protocols are based on both open standards and proprietary protocols from a variety of vendors. The Cisco IOS software also supports a wide set of bridging and IBM connectivity solutions.

The Cisco IOS software can receive and forward packets concurrently from any combination of the following:

- WAN protocols
 - Asynchronous Transfer Mode (ATM)
 - Frame Relay
 - High-Level Data Link Control (HDLC)
 - Integrated Services Digital Networks (ISDN)
 - Point-to-Point Protocol (PPP)
 - Serial Line Internet Protocol (SLIP)—for asynchronous lines only
 - Switched Multimegabit Data Service (SMDS)
 - X.25 and its derivatives, including Link Access Procedure, Balanced (LAPB) and Defense Data Network (DDN) X.25

These protocols are described in the *Wide-Area Networking Configuration Guide*.

- Network protocols
 - Apollo Domain
 - AppleTalk (Phase 1 and Phase 2)
 - Banyan VINES
 - DECnet Phase IV, Phase IV Prime, and Phase V
 - Internet Protocol (IP)
 - ISO Connectionless Network Services (CLNS) and Connection Mode Network Services (CMNS)
 - Novell IPX
 - Xerox Network Systems (XNS) and two variations developed by Ungermann-Bass and 3Com

These protocols are described in the *Network Protocols Configuration Guide, Part 1* and the *Network Protocols Configuration Guide, Part 2*.

- Bridging types
 - Transparent bridging and source-route transparent (SRT) bridging
 - Source-route bridging (SRB) and remote source-route bridging (RSRB)
 - Source-route translational bridging (SR/TLB)
- Support for IBM networking
 - Serial tunnel (STUN)
 - Block Serial Tunnel (BSTUN) support for the Binary Synchronous Communications (BSC) data link protocol.

- Logical Link Control, type 2 (LLC2) and Synchronous Data Link Control (SDLC)
- SDLLC—A software feature that translates between LLC2 and Synchronous Data Link Control (SDLC)
- Qualified Logical Link Control (QLLC) conversion
- IBM Channel Attach

These bridging and IBM networking topics are described in the *Bridging and IBM Networking Configuration Guide*.

Supported Routing Protocols

The Cisco IOS software supports the following IP routing protocols:

- Interior Gateway Protocols
 - Internet Gateway Routing Protocol (IGRP)
 - Enhanced IGRP
 - Open Shortest Path First (OSPF)
 - Routing Information Protocol (RIP) and RIP Version 2
 - Intermediate System-to-Intermediate System (IS-IS)
- Exterior Gateway Protocols
 - Border Gateway Protocol (BGP)
 - Exterior Gateway Protocol (EGP)
- Router Discovery Protocols
 - ICMP Router Discovery Protocol (IRDP)
 - Hot Standby Router Protocol (HSRP)

The “Configuring IP Routing Protocols” chapter in the *Network Protocols Configuration Guide, Part 1* describes these protocols in detail.

The Cisco IOS software supports the following AppleTalk routing protocols:

- AppleTalk Enhanced IGRP
- AppleTalk Update-based Routing Protocol (AURP)
- Routing Table Maintenance Protocol (RTMP)

The “Configuring AppleTalk” chapter in the *Network Protocols Configuration Guide, Part 1* describes these protocols in detail.

The Cisco IOS software supports the following Novell IPX routing protocols:

- IPX Enhanced IGRP
- NetWare Link Services Protocol (NLSP)
- Routing Information Protocol (RIP)

The “Configuring Novell IPX” chapter in the *Network Protocols Configuration Guide, Part 1* describes these protocols in detail.

Routing protocols for Apollo Domain, Banyan VINES, DECnet, ISO CLNS, and XNS are described in the *Network Protocols Configuration Guide, Part 2*.

Supported Terminal Services

The Cisco IOS software supports the following terminal services used to dial in to a port on an access server or router:

- Telnet and rlogin
- LAT—Local Area Transport (LAT) protocol, Digital's proprietary terminal connection protocol used with Digital minicomputers.
- TN3270—IBM 3278 terminal emulation provides TN3270-based connectivity to IBM hosts over serial lines.
- ARA—AppleTalk Remote Access (ARA) provides access to Macintosh computers on remote AppleTalk networks over standard telephone lines.
- SLIP and PPP connections to a single PC—Serial Line IP (SLIP) and Point-to-Point Protocol (PPP) are inexpensive tools to connect a workstation to a network using asynchronous dial-up modems.
- XRemote—XRemote is a terminal facility developed by Network Computing Devices Inc., that allows for remote X Window operations.
- X.25 (Cisco 2500 only)—X.25 specification permits cost-effective, as-needed access to major public networks in the United States and Europe.
- NASI—NetWare Asynchronous Services Interface enables NASI clients to connect to asynchronous resources attached to your router.

