C H A P T E R 1

Router Product Overview

Computer networks that run different protocols on a variety of LAN media over a variety of WAN technologies must be able to communicate. The Cisco Systems Internetwork Operating System (IOS) software provides this capability. The IOS software runs on internetworking platforms purchased directly from Cisco Systems and from many Cisco partners.

This chapter describes the capabilities of the IOS as implemented on router platforms. It contains the following sections:

- IOS Software Benefits
- Supported Network Protocols
- Supported IP Routing Protocols
- Supported Media
- Supported Platforms
- Configuring the Router

We provide various documents about your 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.

IOS Software Benefits

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

The IOS software provides four types of internetwork benefits:

- Reliable, Adaptive Routing
- WAN Optimization
- Management and Security
- Scalability

Reliable, Adaptive Routing

The IOS software is reliable and adaptive because it identifies the best paths and routes traffic around network failures. It also reduces costs by efficiently using network bandwidth and resources while eliminating needless management of static routes.

Policy-based IOS features such as route filtering and routing information translatability save network resources by preventing data from being unnecessarily broadcast to nodes that do not require it. Priority output queuing and custom queuing grant priority to important sessions when network bandwidth is saturated. Load balancing makes use of all available paths across the internetwork, preserving valuable bandwidth and improving performance. The 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 ATM and LAN switching. Through CiscoFusion, Cisco's scalable architecture for switched internetworks, the 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," CiscoFusion's multilayer switching increases bandwidth while simplifying moves, additions, and changes across the enterprise. This extends the power and flexibility of the IOS beyond internetwork routers to include the ATM and LAN switches that are increasingly being deployed throughout today's internetworks.

WAN Optimization

Because most network costs are expended on wide-area network (WAN) switching and usage functions, an effective internetwork must optimize all WAN-related operations. Optimization increases network throughput while reducing delay time. It also minimizes costs by eliminating unnecessary traffic and intelligently selecting the most economical WAN links available.

The IOS software seamlessly accommodates circuit-switched services such as ISDN, switched T1, and dial-up telephone lines. 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, SMDS, and ATM extends the internetwork across the broad range of WAN interface alternatives now available.

Management and Security

The 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 IOS software provides several important management features that are built into every Cisco router. These include configuration services that lower the cost of installing, upgrading, and reconfiguring routers, as well as comprehensive monitoring and diagnostic services. In addition, the IOS software provides valuable information and services to 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 IOS management services are matched by their security capabilities. The IOS software includes a diverse tool kit for partitioning resources and prohibiting access to sensitive or confidential information or 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.

Scalability

Scalability provides the flexibility required to address all of the key issues facing internetworks as organizations evolve. The IOS software's scalable routing protocols help avoid needless congestion, overcome inherent protocol limitations, and bypass many of the obstacles that can arise because of the scope and geographical dispersion of an internetwork.

The IOS software also helps to cut costs by reducing network bandwidth and processing overhead, off-loading servers and conserving resources, and easing system configuration tasks. Advanced IOS features such as 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.

Supported Network Protocols

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 IOS software also supports a wide set of bridging and IBM connectivity solutions.

The 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
  - Switched Multimegabit Data Service (SMDS)
  - X.25 and its derivatives, including LAPB and DDN X.25
- 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
- — XNS and two variations developed by Ungermann-Bass and 3Com
- 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)
  - — 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 protocols, bridging, and IBM networking topics are described in separate chapters of this manual. For background information, refer to the *Internetworking Technology Overview* publication.

Supported IP Routing Protocols

The 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)
  - — 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 later in this manual describes these protocols in detail.

Supported Media

Our routers support the following industry-standard networking media:

- Asynchronous serial
- Channelized T1
- Ethernet—IEEE 802.3 and Type II
- FDDI—single and dual mode
- High-Speed Serial Interface (HSSI)—Supports T1, 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 this manual. For additional information, refer to the *Internetworking Technology Overview.*

Supported Platforms

The IOS software runs on a variety of Cisco internetworking devices and partners' platforms. For details on the supported platforms, refer to the *Cisco Systems Products Catalogue*.

Configuring the Router

There are two alternative mechanisms for configuring a router:

- Using Cisco Configuration Builder
- Using the Command Interpreter

Using Cisco Configuration Builder

Cisco's Configuration Builder lets you create configuration files for multiple routers without knowing the router 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 to run Configuration Builder, configure your router using the command interpreter as described in the next section.

Using the Command Interpreter

You can build most straightforward router configurations and create a configuration file using the **setup** facility. This facility is described in the *Router Products Getting Started Guide*.

In order to configure your router, you must decide the following:

- What network protocols you are supporting (for example, AppleTalk, IP, Novell IPX, and so on)
- Your addressing plan for each network protocol

- What WAN protocols you will run on each interface (for example, Frame Relay, HDLC, SMDS, X.25, and so on)

- What routing protocol you will use for each network protocol

The *Router Products Getting Started Guide* contains worksheets to help you plan your router configuration.

To enhance the configuration, perform the protocol-specific tasks described in the appropriate chapters of this manual.

The router software provides a user interface called a command interpreter, or EXEC, that lets you configure and manage the router. This 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 router and display its status. Some commands are available to all users, while 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 this manual.

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 different routing protocols and other networking protocols. You configure terminal sessions and modems connected to the router so that other network users can log in to the router. Configuring terminal sessions and asynchronous communications lines is discussed in the "Configuring Terminal Lines and Modem Support" chapter of this manual. Configuring interfaces is described in the "Configuring Interfaces" chapter of this manual; the routing, bridging, and IBM protocols you can configure on these interfaces are described in the protocol-specific chapters of this manual.

You also can configure and manage the router itself, performing such tasks as naming the router, setting the router's time, configuring SNMP, and setting security. These tasks are described in the "Managing the System" chapter of this manual.