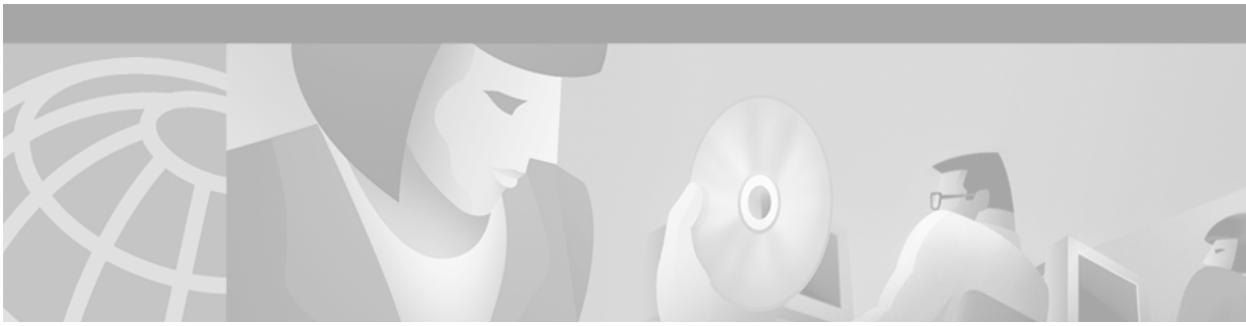

IP Overview

The Cisco IOS software supports a variety of routing protocols. The *Cisco IOS IP and IP Routing Configuration Guide* explains the following network protocols:

- IP
- IP Routing Protocols

The *Cisco IOS AppleTalk and Novell IPX Configuration Guide* explains the following network protocols:

- AppleTalk
- Novell IPX

The *Cisco IOS Apollo Domain, Banyan VINES, DECnet, ISO CLNS, and XNS Configuration Guide* explains the following network protocols:

- Apollo Domain
- Banyan VINES
- DECnet
- ISO CLNS
- XNS

Each Configuration Guide has an accompanying Command Reference.

This overview chapter provides a high-level description of IP. For configuration information, refer to the appropriate chapter in this publication.

IP

The Internet Protocol (IP) is a packet-based protocol used to exchange data over computer networks. IP handles addressing, fragmentation, reassembly, and protocol demultiplexing. It is the foundation on which all other IP protocols (collectively referred to as the IP Protocol suite) are built. A network-layer protocol, IP contains addressing and control information that allows data packets to be routed.

The Transmission Control Protocol (TCP) is built upon the IP layer. TCP is a connection-oriented protocol that specifies the format of data and acknowledgments used in the transfer of data. TCP also specifies the procedures that the networking devices use to ensure that the data arrives correctly. TCP allows multiple applications on a system to communicate concurrently because it handles all demultiplexing of the incoming traffic among the application programs.

IP addressing features such as Address Resolution Protocol (ARP), Next Hop Resolution Protocol (NHRP), and Network Address Translation (NAT) are described in the "Configuring IP Addressing" chapter. Dynamic Host Configuration Protocol (DHCP) is described in the "Configuring DHCP" chapter. IP services such as IP access lists, Internet Control Message Protocol (ICMP), Hot Standby Router Protocol (HSRP), IP accounting, and performance parameters are described in the "Configuring IP Services" chapter.

The Cisco implementation of IP provides most of the major services contained in the various protocol specifications. Cisco IOS software also provides the TCP and User Datagram Protocol (UDP) services called Echo and Discard, which are described in RFCs 862 and 863, respectively.

Cisco supports both TCP and UDP at the transport layer, for maximum flexibility in services. Cisco also supports all standards for IP broadcasts.

IP Routing Protocols

Cisco's implementation of each IP routing protocol is discussed at the beginning of the individual protocol chapters in this publication.

With any of the IP routing protocols, you must create the routing process, associate networks with the routing process, and customize the routing protocol for your particular network. You will need to perform some combination of the tasks in the respective chapters to configure one or more IP routing protocols.

Determining a Routing Process

Choosing a routing protocol is a complex task. When choosing a routing protocol, consider at least the following:

- Internetwork size and complexity
- Support for variable-length subnet masks (VLSMs). Enhanced Interior Gateway Routing Protocol (Enhanced IGRP), Intermediate System-to-Intermediate System (IS-IS), static routes, and Open Shortest Path First (OSPF) support VLSM.
- Internetwork traffic levels
- Security needs
- Reliability needs
- Internetwork delay characteristics
- Organizational policies
- Organizational acceptance of change

The chapters in this publication describe the configuration tasks associated with each supported routing protocol or service. This publication does not provide in-depth information on how to choose routing protocols; you must choose routing protocols that best suit your needs.

Interior and Exterior Gateway Protocols

IP routing protocols are divided into two classes: Interior Gateway Protocols (IGPs) and Exterior Gateway Protocols (EGPs). The IGPs and EGPs that Cisco supports are listed in the following sections.

Note Many routing protocol specifications refer to routers as *gateways*, so the word *gateway* often appears as part of routing protocol names. However, a router usually is defined as a Layer 3 internetworking device, whereas a protocol translation gateway usually is defined as a Layer 7 internetworking device. The reader should understand that regardless of whether a routing protocol name contains the word "gateway," routing protocol activities occur at Layer 3 of the Open System Interconnection (OSI) reference model.

Interior Gateway Protocols

Interior protocols are used for routing networks that are under a common network administration. All IP interior gateway protocols must be specified with a list of associated networks before routing activities can begin. A routing process listens to updates from other routers on these networks and broadcasts its own routing information on those same networks. Cisco IOS software supports the following interior routing protocols:

- On-Demand Routing (ODR)
- Routing Information Protocol (RIP)
- Internet Gateway Routing Protocol (IGRP)
- OSPF
- IP Enhanced IGRP
- Integrated IS-IS

Exterior Gateway Protocols

Exterior protocols are used to exchange routing information between networks that do not share a common administration. IP Exterior Gateway Protocols require the following three sets of information before routing can begin:

- A list of neighbor (or peer) routers with which to exchange routing information
- A list of networks to advertise as directly reachable
- The autonomous system number of the local router

The supported exterior gateway protocol is Border Gateway Protocol (BGP).

Multicast BGP (MBGP) adds capabilities to BGP to enable multicast routing policy throughout the Internet and to connect multicast topologies within and between BGP autonomous systems. That is, MBGP is an enhanced BGP that carries IP multicast routes. BGP carries two sets of routes, one set for unicast routing and one set for multicast routing. The routes associated with multicast routing are used by Protocol-Independent Multicast (PIM) to build data distribution trees.

Multiple Routing Protocols

You can configure multiple routing protocols in a single router to connect networks that use different routing protocols. You can, for example, run RIP on one subnetted network and IGRP on another subnetted network, and exchange routing information between them in a controlled fashion. The available routing protocols were not designed to interoperate, so each protocol collects different types of information and reacts to topology changes in its own way.

For example, RIP uses a hop-count metric and IGRP uses a five-element vector of metric information. If routing information is being exchanged between different networks that use different routing protocols, you can use many configuration options to filter the exchange of routing information.

The Cisco IOS software can handle simultaneous operation of up to 30 dynamic IP routing processes. The combination of routing processes on a router consists of the following protocols (with the limits noted):

- Up to 30 IGRP routing processes
- Up to 30 OSPF routing processes
- One RIP routing process
- One IS-IS process
- One BGP routing process

IP Multicast Routing

IP multicast routing provides an alternative to unicast and broadcast transmission. It allows a host to send packets to a subset of all hosts, known as *group transmission*. IP multicast runs on top of the other IP routing protocols.

In addition to IP multicast routing itself, other multicast features are available, each discussed in a separate chapter, as follows:

- Multicast Source Discovery Protocol (MSDP) is a mechanism for the router to discover multicast sources in other Protocol-Independent Multicast (PIM) domains.
- Pragmatic General Multicast (PGM) is a reliable multicast transport protocol for applications that require ordered, duplicate-free, multicast data delivery from multiple sources to multiple receivers. The PGM Router Assist feature allows Cisco routers to support the optimal operation of PGM, which runs on the host of a customer.
- Unidirectional Link Routing (UDLR) provides a way to forward multicast packets over a physical unidirectional interface, such as a satellite link.
- The “Using IP Multicast Tools” chapter includes the Multicast Routing Monitor (MRM) feature, a management diagnostic tool that provides network fault detection and isolation in a large multicast routing infrastructure.