

# Cisco Internetwork Operating System (Cisco IOS)

Document ID: 13178

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## Introduction

Information is a strategic asset that can make or break a company's fortunes in today's global economy. Computer internetworks are the electronic highways upon which that information travels and they unify the world to create new and better ways of doing business.

With so much at stake, an organization's internetwork must have the ability to increase the overall productivity of its people and resources. To do this, it can maximize the availability of applications while it minimizes the total cost of ownership. This means providing users with continual access to a flexible and reliable network. It also means keeping in check the expenses that an organization must absorb over time in order to develop and maintain its information systems and services.

No company in the world can match Cisco Systems when it comes to maximizing an internetwork's applications availability and minimizing its total cost of ownership. Over the last decade, our proven technology and wide range of scalable solutions have enabled us to set the pace in the internetworking industry. More than anything else, Cisco owes its leadership position to Cisco's unique and robust Internetwork Operating System® (IOS). Cisco IOS is value-added software that resides at the heart of all Cisco internetworking solutions.

The Cisco IOS is Cisco's key to help make information-intensive companies all over the world more productive. And ultimately, that is the greatest benefit that any internetwork can provide.

## 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.

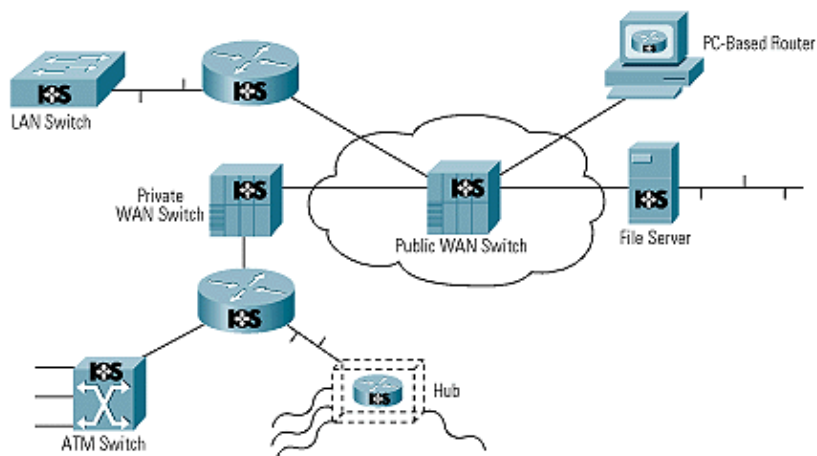
## Cisco's IOS: The Unifying Thread

Just as a personal computer improves individual productivity, an efficient internetwork improves the productivity of large groups of people. And in the same way that a local area network (LAN) relies on a software-driven network operating system (NOS) to function, an internetwork depends on a sophisticated operating system (also implemented in software) to effectively connect users all over the world.

An internetwork's intelligence lies in its operating system. Network hardware inevitably changes every few years with the introduction of new generations of processors, switching, and memory components. But the internetwork's software is the unifying thread that connects otherwise disparate networks and provides a scalable migration path as needs evolve.

Just as enterprises invest in LAN network operating systems that can evolve as new hardware and applications are introduced, the Cisco IOS is a strategic investment that enables organizations to safeguard the future of their internetworks. Cisco IOS supports inevitable change and migration through its ability to integrate all evolving classes of network platforms. This includes routers, ATM switches, LAN and WAN switches, file servers, intelligent hubs, personal computers and any other devices that have a strategic impact on an organization's internetwork. By powering Cisco platforms and those delivered by technology partners who incorporate Cisco IOS into their products, Cisco IOS enables companies to build and enhance a single, integrated, cost-effective information systems infrastructure.

**Multiplatform IOS: Cisco's IOS enables an enterprise to build an integrated, cost-effective infrastructure using platforms from both Cisco and its partners.**



## The Internetwork Foundation

Today's multifaceted enterprise internetworks typically consist of four distinct sectors, each with its own specific mission:

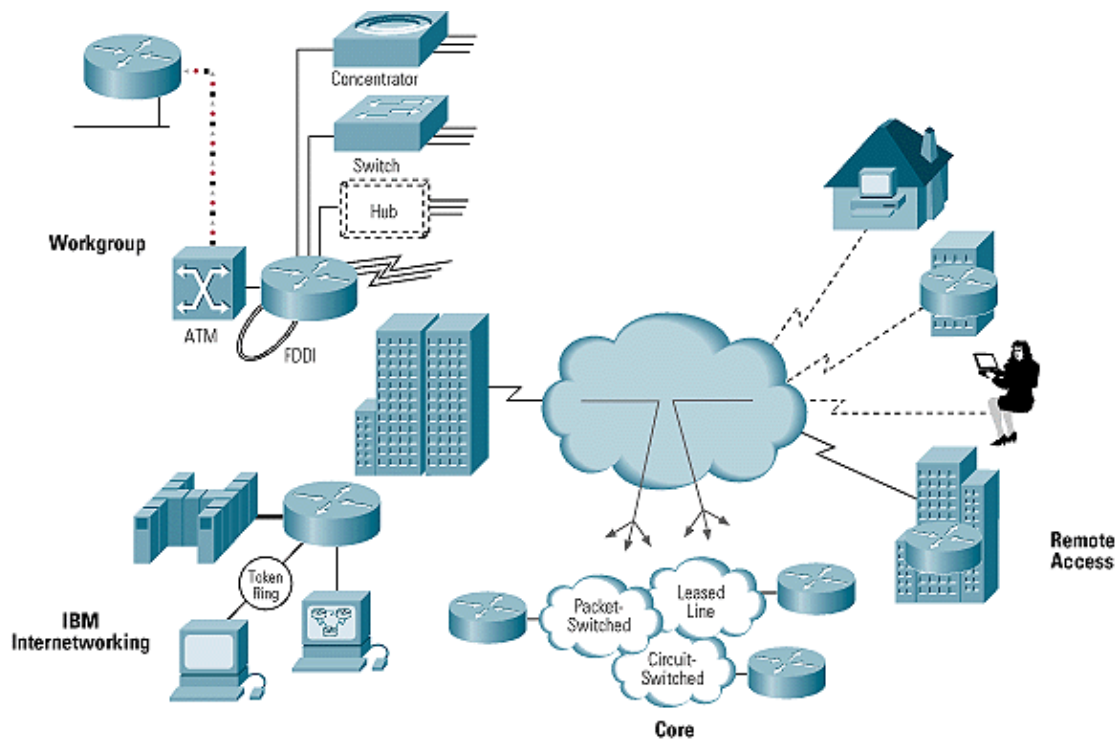
- **The core** of the internetwork provides broad, reliable wide-area connections among all worldwide

locations. Its focus is on cost-effective and efficient use of expensive WAN resources.

- **The workgroup** sector provides groups of end users with scalable bandwidth capable of meeting increasing application demands.
- **The remote access** sector serves remote locations, telecommuters, and mobile users with cost-effective, easily managed connectivity solutions.
- **The IBM internetworking** sector lowers costs and provides a safe and secure migration path for IBM SNA network applications.

The Cisco IOS spans the requirements of all these internetworking sectors to create a single, unified infrastructure that provides lower costs, higher applications availability, and improved internetwork management.

**Enterprise Networks Today: The enterprise of today and tomorrow has requirements that span all four internetworking sectors: workgroup, IBM internetworking, core, and remote access.**

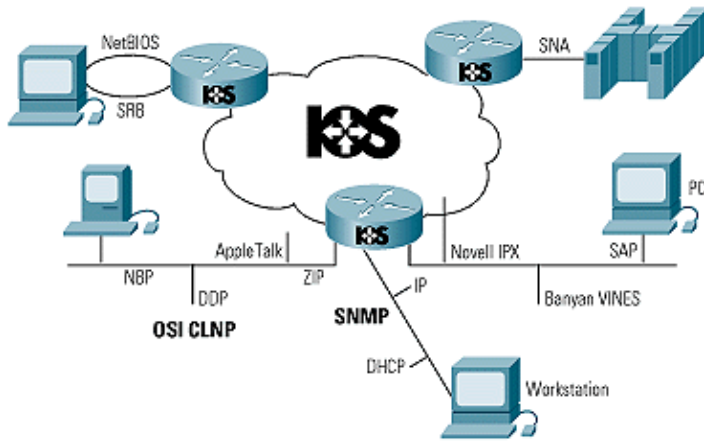


## The IOS: Cisco's Advantage

Cisco IOS is the key differentiator that separates Cisco's internetworking solutions from other alternatives in the industry. Its value-added intelligence supports users and applications throughout the entire enterprise and provides security and data integrity for the internetwork. The IOS cost-effectively manages resources by controlling and unifying complex, distributed network intelligence. Also, it functions as a flexible vehicle that can add new services, features, and applications to the internetwork.

In the applications support arena, the Cisco IOS provides interoperability with more standards-based physical and logical protocol interfaces than any other internetwork supplier in the industry. From twisted pair to optical fiber, LAN to campus to WAN media, UNIX to Novell NetWare to IBM SNA, no other internetwork architecture can match the wide-ranging protocol support of the IOS.

**IOS Interfaces: Cisco's IOS supports the industry's largest set of formal and de facto standard interfaces.**



## Four Cornerstones of the IOS

The value-added intelligence of the IOS is embodied in four types of internetwork services:

- Reliable adaptive routing services
- WAN optimization services
- Management and security services
- Scalability services

**Four IOS Cornerstones: The value-added intelligence of the IOS is embodied in four types of services: reliable adaptive routing, WAN optimization, management and security, and scalability services.**



### Reliable Adaptive Routing Services

The Cisco IOS has continually set the pace in the industry for providing innovative, robust routing intelligence. Its reliable adaptive routing capabilities enhance productivity and applications availability by finding performance-optimal paths and quickly routing traffic around any network failures. Reliable adaptive routing 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. And the IOS provides the most effective and efficient scaling available for network applications that require transparent or source–route bridging algorithms.

Increasingly, internetworks are incorporating such new technologies as ATM and LAN switching, which operate at Layer 2 and below of the OSI networking model. While switching devices based on these technologies provide higher bandwidth than existing shared–media hubs, they fail to offer the scalability, stability, and security of their more intelligent shared–media counterparts.

Through CiscoFusion", Cisco's scalable architecture for switched internetworks, the IOS provides the framework for a new technology called *multilayer switching*, which operates up to OSI Layer 3 or higher.

By distributing routing intelligence and switching functions to create "virtual LANs," CiscoFusion's multilayer switching increases bandwidth while simplifying moves, adds, 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 Services**

Because the large majority of network costs are expended on wide–area network (WAN) switching and utilization functions, an effective internetwork must optimize all WAN–related operations. Optimization promotes applications availability by increasing network throughput while reducing delay time. It also minimizes ownership costs by eliminating unnecessary traffic and intelligently selecting the most economical WAN links available.

The Cisco IOS provides the highest level of WAN support in the industry, seamlessly accommodating circuit–switched services such as ISDN, switched T1, and dial–up telephone lines. IOS innovations such as dial–on–demand access and dial backup capabilities provide cost–effective alternatives to expensive point–to–point switched leased lines. And 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 Services**

The Cisco IOS 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 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 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 drive down costs.

The IOS's management services are matched by its security capabilities. No organization today can ignore the need to protect valuable information and applications supported on its internetwork. The Cisco IOS includes a diverse toolkit 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 Services

Scalability services provide the high degree of flexibility that is necessary to address all of the key issues facing today's internetworks as organizations change and their needs evolve. The IOS'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. These techniques, important in all networks, are especially essential in IBM SNA internetworking environments.

The IOS also helps to cut costs by reducing network bandwidth and processing overhead, offloading 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.

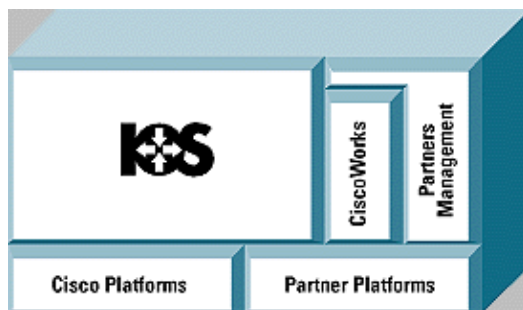
## Cisco's IOS: A Strategic Investment

Reliable adaptive routing capabilities. WAN optimization services. Management and security features. And scalability services. These are the four principal types of services that the IOS provides, the four cornerstones essential to building a strategic internetwork foundation.

The IOS supports the broadest range of applications by virtue of a full portfolio of standards-based interfaces. Thus, users with very diverse needs and applications (from finance, to sales, to engineering) can be served by a single, integrated network infrastructure. Wherever a user needs to be (in a workgroup, in the data center, in a remote office, or telecommuting across a distance) the IOS provides the network resources to increase that user's productivity.

In a world where hardware platforms are constantly evolving, software intelligence is the value-added differentiator that ultimately determines the efficiency and effectiveness of any internetwork. The software-driven Cisco IOS supports the evolution of all of today's strategic network platforms, whether provided by Cisco or one of our technology partners. Because of these attributes, the IOS is the key that has enabled Cisco to set the pace and establish leadership standards in today's internetworking industry.

**Cisco's IOS Mission: The IOS supports the evolution of all of today's strategic network platforms**



For more information on the Cisco IOS, call us today toll-free at 800 553-NETS (6387) or contact your local Cisco sales office. Find out how we can maximize the applications availability of your internetwork while reducing your total cost of ownership. And we do it with the Cisco Internetwork Operating System — your strategic investment for the Information Age.

## Related Information

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Updated: Feb 02, 2006

Document ID: 13178

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