

Internetwork Performance Monitor

Internetwork Performance Monitor (IPM) is a network response time and availability troubleshooting application. This tool empowers network engineers to proactively troubleshoot network performance utilizing real-time and historical reports. IPM is available as one of the network management applications offered within the CiscoWorks Routed WAN Management Solution.

As enterprise networks continue to grow in size, scope, and strategic importance, network managers face numerous challenges in maintaining the performance and availability of their network.

Furthermore, as customers deploy new network applications and services, such as Voice over IP (VoIP) and streaming video, measurements of network performance must recognize different levels of service based on different types of network traffic.

To maintain network performance, network managers often spend too much time trying to identify the source of performance problems, and too little time solving them. This reactive approach to network performance management has become increasingly unwieldy. The network manager needs performance troubleshooting tools that can either identify

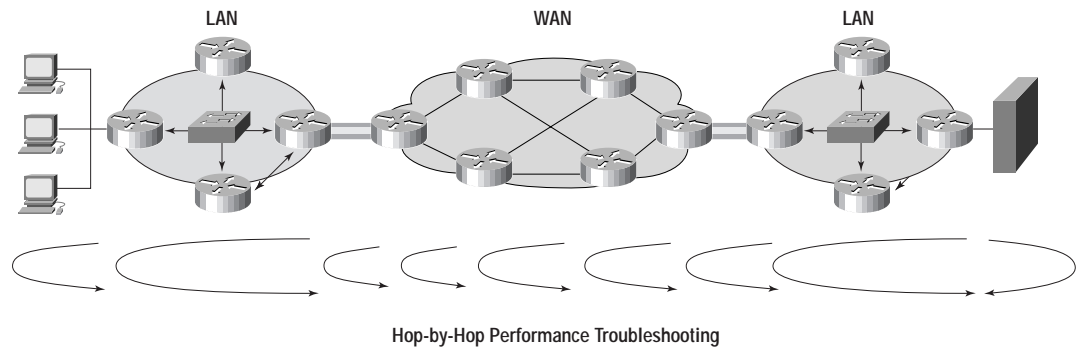
potential performance problems before they seriously impact users, or quickly identify the network devices that caused the performance problems once they have occurred. The ability to measure network response time, determine device availability, analyze response time patterns, and provide performance reports—both real-time and historical—are high priority requirements in today's enterprise networks.

IPM satisfies these requirements by performing proactive measurements of network response time and availability, including both real-time and historical analysis.

With IPM, network managers have the tool they need to identify performance problems, locate performance bottlenecks, diagnose latency and jitter, and identify performance trends in the network. IPM enables the network manager to perform path and hop performance analysis, thereby simplifying the identification of network devices that are contributing to network performance problems. IPM can determine the possible network paths used between two network devices and display the response time for each of the router hops in each path (see Figure 1).



Figure 1: IPM Performance Troubleshooting



Furthermore, IPM is an essential tool to facilitate the deployment of future network services. IPM provides network performance measurement for a wide range of network protocols, including those used for VoIP and quality of service (QoS) based on IP Precedence.

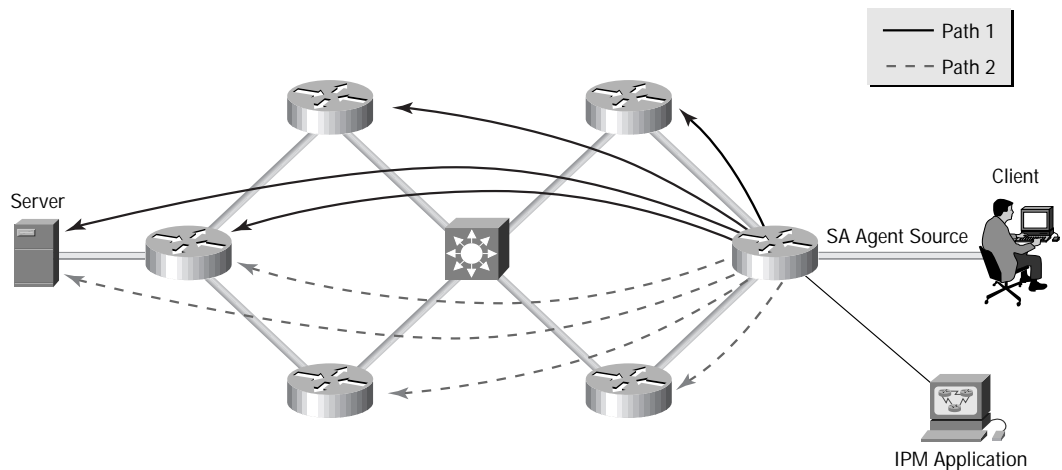
Use of Cisco IOS Technology to Measure Network Performance

IPM measures network performance based on the "synthetic traffic generation" technology within the Cisco IOS® software, which is known as the Service Assurance Agent (SA Agent). The use of synthetic traffic by IPM gives the network manager a high degree of flexibility in selecting the end points in a network between which network performance will be measured. This flexibility makes IPM a highly effective performance-troubleshooting tool.

Furthermore, utilizing the SA Agent technology in Cisco routers enables their use as the platform for measuring network performance in addition to their traditional traffic routing function. As a result, users can leverage the financial investment that they have already made in their Cisco routers.

IPM takes advantage of Cisco IOS SA Agent technology by configuring network performance agents, called "collectors", in the router. These "collectors", as part of their configuration, include a "source" router, a "target" device and an "operation" type. Figure 2 depicts how the Cisco router, acting as an IPM source device, measures network performance to a target device across the network.

Figure 2: Cisco IOS/SA Agent Source Device





The definition of an IPM operation includes the protocol type, the measurement interval, the packet size, and the IP precedence value. IPM can measure performance based on a variety of network protocols, including:

- Internet Control Message Protocol (ICMP) Echo
- IP Path Echo
- 3270 Ping
- Systems Network Architecture (SNA)
- User Datagram Protocol (UDP) Echo
- UDP Jitter
- Transmission Control Protocol (TCP) Connect
- Domain Name System (DNS)
- Dynamic Host Configuration Protocol (DHCP)
- HTTP (for static URLs)
- DLSw

Furthermore, for networks that have deployed QoS based on IP Precedence values, IPM can measure performance for any of these protocols across any of the six values of IP Precedence. As a result, IPM provides an accurate representation of network performance by measuring the performance of "synthetic" traffic that closely resembles "real user" traffic. Furthermore, IPM enables performance measurement of differentiated services (for example, voice, video and data) in an enterprise network.

Once an IPM collector is configured and deployed in the source router, IPM will continuously collect performance information, based on the parameters of the collector that has been defined, for the following performance metrics:

- Latency
- Jitter (for UDP jitter operation type only)
- Availability
- Errors
- Packet loss

Troubleshooting Network Response Time and Availability Problems

IPM enables the network engineer to proactively manage network response time problems. IPM facilitates notification of the network engineer when network response time degrades or a monitored link becomes unavailable, and helps pinpoint the device or link causing the problem.

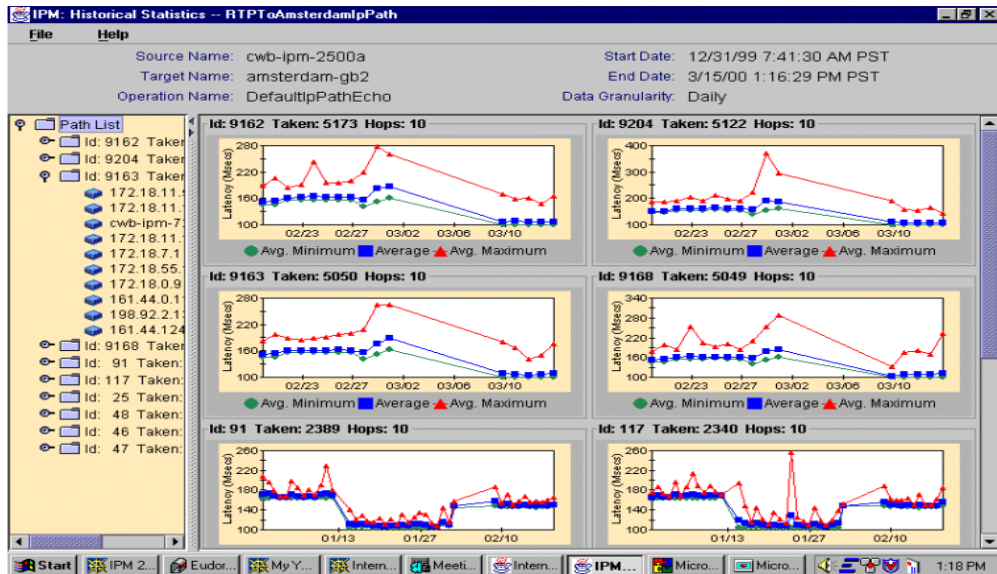
IPM enables performance measurements to be taken automatically for an entire path or for each hop (i.e. link or device) within a path. Network managers can quickly and easily narrow down the source of a performance problem to a single hop in the network. As a result, rapid problem diagnostic capabilities lead to higher network availability by allowing network managers to alleviate performance bottlenecks quickly.

IPM provides the following performance troubleshooting features:

- Identification and performance analysis of all paths between two devices in a network
- Performance analysis of each hop in the path between two networked devices
- Real-time and historical graphical reports of response time between two network devices
- Proactive notification with a SNMP trap when response time exceeds predefined thresholds
- Proactive notification with a SNMP trap when a link becomes unavailable



Figure 3: IPM Path and Hop Performance Report



Troubleshooting Network Response Time Threshold Violations

IPM enables the continuous monitoring of response time between network device pairs using Cisco IOS SA Agent technology. IPM configures the SA Agent on a router to send notification using SNMP trap or NMVT alert whenever response time thresholds are exceeded or network availability has been lost between the router and any other network device. The thresholds that IPM configures on the router can be tuned to the appropriate level of sensitivity based on the following configuration parameters:

- Rising thresholds—Notification occurs when the response time value rises above a specified level
- Falling thresholds—Notification occurs when the response time value falls below a specified level
- Immediate thresholds—Notification occurs when one sample violates the threshold
- Intermittent threshold—Notification occurs based on the threshold being satisfied a specified percentage of the time
- Average threshold—Notification is based on the threshold being exceeded on average. In this case, notifications are not issued until a specified number of samples has been taken
- Consecutive threshold—Notification is based on the sampled response time violating the threshold a specified number of consecutive times

Troubleshooting Network Performance for VoIP

When VoIP has been deployed in the enterprise network, IPM can be used for performance troubleshooting to allow rapid identification and isolation of performance problems and, thereby, ensure continuous voice service in the network. IPM can identify and isolate specific network paths where the latency and jitter measurements of the network have risen above performance levels necessary to support high quality telephony services.



IPM is capable of providing detailed jitter analysis between the source and target devices in an IPM collector. This detailed analysis includes both positive and negative jitter, as well as forward and reverse jitter between the source and target. Figure 4 shows an example of the jitter performance analysis provided by IPM to analyze the quality of VoIP performance.

Figure 4: IPM Jitter Analysis



SNA/IP Network Performance

IPM also provides a performance monitoring solution for SNA and IP internetworks, particularly those in which SNA traffic is transported over IP through a router network to a front-end processor (FEP), or to a Cisco Channel Interface Processor (CIP) or Channel Port Adapter (CPA) in a router. In these environments, IPM can measure the IP response time from a source workstation through the router network over which the SNA traffic is being routed.

In addition, IPM can measure the path of native SNA traffic either from the last router in the network directly to the mainframe or from the last router in the network through the FEP to the mainframe. Using these features combined, network operators can obtain complete path performance management.

IPM provides the following SNA features:

- Measures response time for network links between Cisco routers and the mainframe
- Supports multiple session types
 - System Services Control Point (SSCP)
 - Logical Unit (LU) 0
 - LU 2
- Notifies network managers of threshold violations through NMVT alerts



Improved User Interface, Reporting and Integration

IPM offers several major enhancements with respect to the user interface, performance reporting, application integration, and data export.

The enhanced user interface provides a simple, easy-to-navigate interface for both configuration and reporting. The number of keystrokes and mouse clicks needed to configure the IPM source devices, target devices, operations, and collectors has been significantly reduced.

IPM provides new Web-based interfaces to all IPM functions. Now all IPM performance reports can be accessed from any Web browser client on the user network. Configuration of IPM is still performed using a separate Java client.

IPM also supports both real-time and historical reporting of network performance. Historical reports can specify the time range to be reported, and can easily be displayed with user-selected time intervals, including hourly, daily, weekly, or monthly.

In the area of application integration, IPM supports source and target device input from the CiscoWorks2000 device inventory information, thereby greatly reducing the amount of time necessary to configure source and target devices within IPM. In addition, IPM supports offline configuration of sources, targets, and operations using imported seed files.

IPM allows for export of performance statistics in CSV format, thereby making these performance statistics available to spreadsheet programs and allowing for more customized performance analysis.

Server, Client, and Web Browser Requirements

The server, client and web browser system requirements can be found in the Product Overview documents for the Routed WAN and LAN Management solutions and on Cisco's main on-line documentation site, under each CiscoWorks solution. Please refer to these and other Product Installation documentation for more detailed information on setting up and configuring these solutions.

Cisco Router Requirements

IPM requires that the router used as the source device for a performance measurement operation be running a version of Cisco IOS software that supports the SA Agent feature. The SA Agent is available in the IP Plus, Desktop Plus, IBM and Enterprise feature sets of certain versions of Cisco IOS. The following list of Cisco IOS versions summarizes those versions that support the SA Agent.

Minimum Cisco IOS Software Releases

To run IPM, you need to have at least one of the following Cisco IOS software releases on your router:

- Release 11.2(18)
- Release 11.3(6)
- Release 12.0(5)
- Release 12.0(5)T
- Release 12.1(1)
- Release 12.1(2)T
- Release 12.2(1)
- Release 12.2(2)T

Recommended Cisco IOS Software Releases

The recommended Cisco IOS software releases are as follows:

- Release 11.3(11) or later
- Release 12.0(7)T or later
- Release 12.1(3) or later

Each Cisco router that supports the SA Agent is capable of supporting a minimum of 200 concurrent performance measurement operations. However, the actual number of operations supported in a particular router will depend on several factors, including the router buffer size and amount of DRAM available.

Certain Cisco routers do not support the SA Agent feature of Cisco IOS, as follow: Cisco 12000 series (GSR), Cisco 1000 series, Cisco 700 series. These devices can, nevertheless, participate in IPM performance measurement as a target device.

Mainframe Requirements

These requirements apply only if you are using the SNA response time components of IPM.

Hardware

- Disk space: five cylinders of 3380 DASD

Software

- OS/390 2.4 or later
- VTAM 4.4 or later



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(0303R) 203046/ETMG 03/03