INTEGRATION NOTE

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Prepared By
Internet Solutions
Business Unit

Compaq Computer
Corporation

CONTENTS

Compaq ProLiant 850R Dedicated Windows NT Web-Hosting Server

This integration note has four key objectives: to document performance characteristics of the Compaq ProLiant 850R Web-hosting server for Microsoft Windows NT Server™; to determine the bottlenecks of the system; to provide a methodology for their discovery; and to describe the tools available for monitoring and maintaining the server.

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EXECUTIVE SUMMARY

Performance analysis helps Internet Service Providers (ISPs) serve their customers effectively. By analyzing hardware performance with a load simulator, an ISP can characterize hardware requirements for its clients. This paper describes the methodology and results of performance testing on the Compaq ProLiant 850R dedicated Windows NT Web-hosting server. The paper also describes the tools that are available to monitor and manage Compaq servers: Carbon Copy, Compaq Insight Manager (CIM), and the Integrated Remote Console.

Microsoft Web Capacity Analysis Toolkit (WebCat) 3.2 was used to investigate the performance of the system under test (SUT). The test bed consisted of a ProLiant 850R Web-hosting server, eight client machines to generate load on the server, and a ninth machine for monitoring. Two Netelligent 5606 100-megabit switches provided the test bed's bandwidth.

The following loads were generated during testing:

- 100% static HTML

- 10% ISAPI (90% static HTML)

- 90% ISAPI (10% static HTML)

- 10% CGI (90% static HTML)

- 90% CGI (10% static HTML)

Test conditions included not only various file mixes but also hardware configurations in which one and two processors were used. Utilization of the system processor approached 100% in most cases. In the testing performed, adding a second processor improved performance.

When the Webstone file set was used (under 1 MB), varying memory size from 32 MB through 128 MB made a negligible difference in performance, since all the content resided in memory. On the other hand, when a large file set (approximately 100 MB) was used, varying memory size from 32 MB through 128 MB made a significant difference in performance. An 85% gain in performance was observed on the server under test.

Network interface controller (NIC) affinities between first and second processors were also tested. Under Static load the SUT performed 6.9% better when the NIC was assigned to the first processor. ISAPI 90% also demonstrated a 4.1% performance gain when the NIC was managed by the first processor. CGI 90%, however, demonstrated a 4.8% improvement when the NIC was managed by the second processor.

Several management tools are available for the ProLiant 850R and other Compaq servers. CIM can detect potential failure before it occurs, enabling the service provider to replace suspect components while the system is still under warranty. CIM also provides facilities with which to perform maintenance and recovery remotely. Carbon Copy lets administrators dial in to the server and operate it remotely. The Integrated Remote Console software that ships with the ProLiant 850R also provides remote access to the server.

The 3U ProLiant 850R rack-mountable, Web-hosting server is a low-cost, high-performance multiprocessor server that is easy to configure and manage. Use of the Windows NT Performance Monitor (Perfmon), CIM, and the methodology described in this paper can help identify and

prevent potential bottlenecks that will degrade performance. Other tools, including Carbon Copy and Remote Insight Manager, can be used to provide the remote notification and monitoring essential to preventing interruptions in service.

INTRODUCTION

Performance issues are critical to the selection and configuration of the ProLiant 850R server in order to meet the wide range of Web-hosting needs. Through good performance analysis, service providers can select appropriate hardware and software for their customers' needs, make configuration adjustments to achieve maximum throughput, identify the bottlenecks in a system, and improve their understanding of the Web-hosting customer's requirements. Simulated load can be helpful in the process of forecasting performance, identifying bottlenecks, and creating system optimization profiles, all of which are useful for sizing and planning. In this study the Webstone file mix was selected as a characterization of a typical Web site. However, performance may vary in relation to the size and content of the Web site.

In the attempt to provide the above type of analysis, the ProLiant 850R server was tested with various hardware and software configurations. Simulated traffic was generated against the server for each configuration, and the results were monitored with various tools available via value-added packages either sold separately or included with their products by Microsoft and Compaq. Configurations were optimized during testing based on system utilization reported by the monitoring tools.

Other tools are available to monitor the system's health, provide performance notifications, and perform remote management. They are Carbon Copy, Compaq Insight Manager (CIM), and the Integrated Remote Console.

SYSTEM UNDER TEST (SUT)

This section describes the system under test.

Hardware Configuration

The base ProLiant 850R server (PN 298800-001) was configured as follows:

- Single Pentium Pro 200-MHz processor and 256K L2 cache

- Integrated 10/100 TX Ethernet

- 3 PCI slots, 1 shared with ISA

- 2 serial ports/1 parallel port

- System Management 3.30

- Integrated Remote Console (IRC)

- PCI video with 1 MB DRAM

- Wide-Ultra SCSI

- IDE CD-ROM

- Dual-channel enhanced IDE support

- 64 MB EDO DIMM error-correcting memory

- SmartStart 3.30

- ROM Version 02/24/1997, Family 386P4, Type 03

The following options were used in some but not all test configurations:

- 200-MHz 256K cache Processor Kits: **PN 273733-B21**

- 4.3-GB Wide-Ultra SCSI drive: **PN 272573-001**

- 64 MB EDO DIMM error-correcting memory: **PN 225483-001**

The ProLiant 850R dedicated Web-hosting server was set up using Compaq SmartStart 3.30. SmartStart is shipped with all ProLiant servers. The default settings provided by SmartStart were taken for all NVRAM settings and hard drive geometries. For more on SmartStart see the Compaq Web site at **www.compaq.com**.

Software Configuration

The software components of the SUT included CGI, ISAPI, Carbon Copy, CIM Agents, Microsoft Internet Information Server (MS-IIS) 3.0, Windows NT Server 4.0, and various Compaq and Microsoft drivers and supplementary programs associated with these programs.

Windows NT Installation Guidelines

SmartStart 3.30 was used to install Windows NT Server 4.0. The SmartStart-assisted process helped insure that the installation was fully optimized for the Compaq ProLiant 850R server. The 850R Web-hosting server was assigned a static Internet Protocol (IP) address for the installation of the Windows NT 4.0 server software. MS-IIS 2.0 was installed, then upgraded to MS-IIS 3.0 through application of Service Pack 3. Service Pack 3 also contains a patch to the TCPIP.SYS file that significantly improves TCP/IP performance. Application of Service Pack 3 is **highly recommended** by Compaq. After the SmartStart and service pack installation, no additional tuning steps were necessary.

Additional Software Components

In addition to the programs already mentioned, the following software was used in testing:

- Compaq Performance Counters (available at **www.compaq.com**)

- Compaq SSD Version 1.21C (installed by SmartStart)

- Compaq Windows NT Agents for Insight Manager (installed by SmartStart)

- Compaq Survey (installed by SmartStart)

> *New Server Support*
>
> *While the ProLiant 850R system as shipped contains the latest driver and ROM support at the time of shipment, new releases of the Windows NT Agents, ROMs, and SSD may subsequently become available from Compaq. The latest server support can be obtained from the Compaq Web site at* **www.compaq.com**.

TESTING ENVIRONMENT

Test Bed

Microsoft Web Capacity Analysis Toolkit (WebCat) 3.2 was used to investigate the performance of the SUT. WebCat is script-driven and can be configured to simulate loads similar to those generated by other test tools. Comparison tests were run against Ziff Davis WebBench 1.1 using similar file mixes to verify that the results were comparable. Of the available tools, WebCat can simulate similar load with fewer client machines, making it an economical tool for service providers who want to perform additional tests to simulate specific client needs. WebCat is publicly available as part of the Microsoft Resource Kit for Windows NT 4.0 Supplement One. For a complete description of the WebCat tool see the resource kit.

WebCat has three components: the server, the controller, and the client. The server is designed to simulate Web site content of different sizes and types. This includes CGI content, ISAPI content, and static HTML content. The controller initiates and monitors the WebCat session. The client simulates a Web browser by repeatedly sending requests to the Web server.

In addition to the ProLiant 850R Web-hosting server, the test bed consisted of eight client machines whose purpose was to generate load on the server. The client units were ProLiant 5000R servers. Each was equipped with dual Pentium Pro 166/512K-cache processors, 64 MB RAM, one Netelligent 10/100-megabit PCI network interface controller (NIC), and a single 4.3-GB hard drive. A ninth identical unit was used for online monitoring of server performance. The WebCat controller, Compaq Insight Agents, and the Windows NT Performance Monitor (Perfmon) were all set to perform monitoring and logging on the SUT during test sessions. The Management console was configured to trap and send threshold-based utilization alerts on processor, NIC, and environment variables. All logging of server status was directed to disk rather than displayed on screen in order to minimize the resource consumption associated with active monitoring.

Two Netelligent 5606 100-megabit switches provided the test bed's bandwidth. Switches can provide improved bandwidth by reducing the number of collisions. (See **www.compaq.com** for complete information on the Netelligent 5606.) Each of the 5606 switches had six ports, and each port had one configured segment between client and server. The switches provided local areas of IP resolution, thus isolating IP traffic and reducing bandwidth consumption. Also, the full-duplex operation supported by the Netelligent 5606 helped increase capacity and reduce collisions. During testing, a 14% improvement in overall performance was noted after previously installed repeaters were replaced with 5606 switches. Both switches and NIC were set to operate in full-duplex mode at 100 megabits per second. Testing was performed with one LAN segment originating from the server. Figure 1 illustrates the network topology.
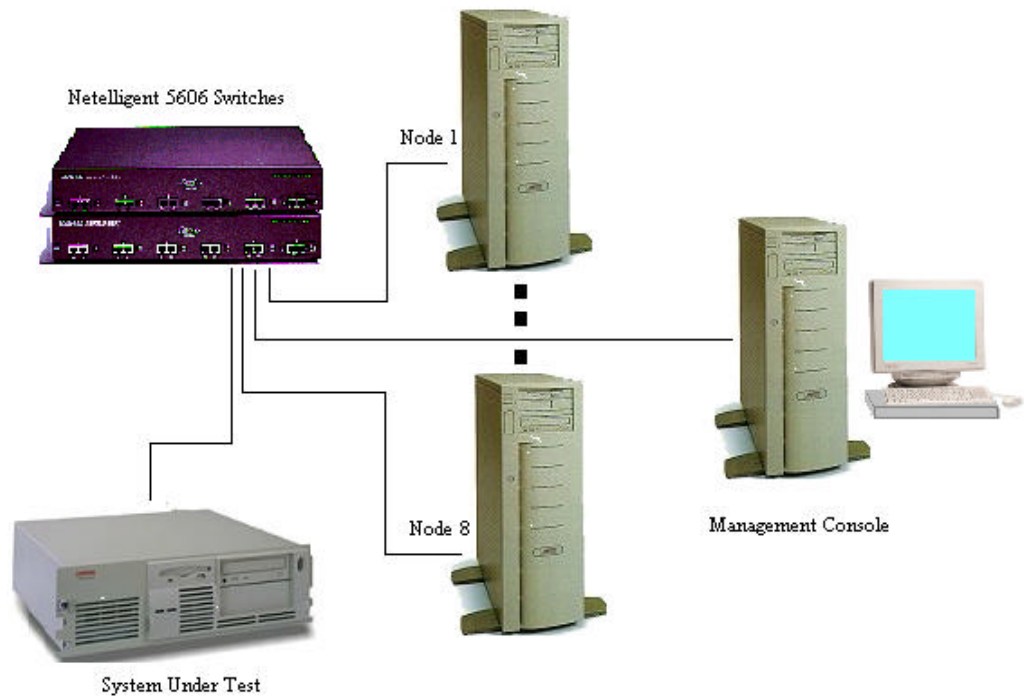
Figure 1. Network topology

Profiling mixes

WebCat 3.2 lets the user select up to 100 different files and file sizes to be requested by simulated client machines in specified percentages. The user can select the file mix that best represents the anticipated load. For this testing, the Webstone file mix, an industry-standard file mix that represents the loads experienced by existing Web servers, was used.

Tests were run on the ProLiant 850R Web-hosting server to simulate various types of loads based on industry data concerning common Web server usage. The loads simulated were as follows:

- 100% static HTML

- 10% ISAPI (90% static HTML)

- 90% ISAPI (10% static HTML)

- 10% CGI (90% static HTML)

- 90% CGI (10% static HTML)

Simulation of the loads was accomplished through manipulation of the WebCat configuration files. Different loads represented different types of requests generated by clients. The static HTML file sizes ranged from 256 bytes through 128K bytes. For ISAPI and CGI traffic, a request that generated a procedure call was sent to the server. The Web server generated a random number and returned the result to the client.

Webstone File Distribution and Mix

The Webstone file distributions and mixes used for testing are illustrated by the following tables:

File Distribution (%)	File Size (bytes)	File Type
1	256	Static HTML
1	512	Static HTML
2	1K	Static HTML
1	2K	Static HTML
1	4K	Static HTML
1	8K	Static HTML
0	16K	Static HTML
2	32K	Static HTML
0	64K	Static HTML
1	128K	Static HTML
90	----	CGI / ISAPI

Table 1. 90% CGI / ISAPI.

File Distribution (%)	File Size (bytes)	File Type
5	256	Static HTML
5	512	Static HTML
8	1K	Static HTML
23	2K	Static HTML
19	4K	Static HTML
15	8K	Static HTML
9	16K	Static HTML
4	32K	Static HTML
1	64K	Static HTML
1	128K	Static HTML
10	----	CGI / ISAPI

Table 2. 10% CGI / ISAPI.

| File Distribution (%)	File Size (bytes)	File Type
7	256	Static HTML
7	512	Static HTML
10	1K	Static HTML
26	2K	Static HTML
17	4K	Static HTML
13	8K	Static HTML
12	16K	Static HTML
6	32K	Static HTML
1	64K	Static HTML
1	128K	Static HTML

Table 3. 100% Static HTML.

RESULTS

Before testing, it was assumed that the best throughput would be achieved for static HTML content, followed by ISAPI, then CGI. This assumption, which proved true, was based on the fact that a static HTML file request is a simple file request such as that submitted to a file server in a common network environment. Both ISAPI and static HTML spawn a thread for every request. In the case of ISAPI, a custom DLL is loaded once in memory and remains there. Thread overhead is much less processor-intensive than the startup and cleanup of a process performed by a CGI program.
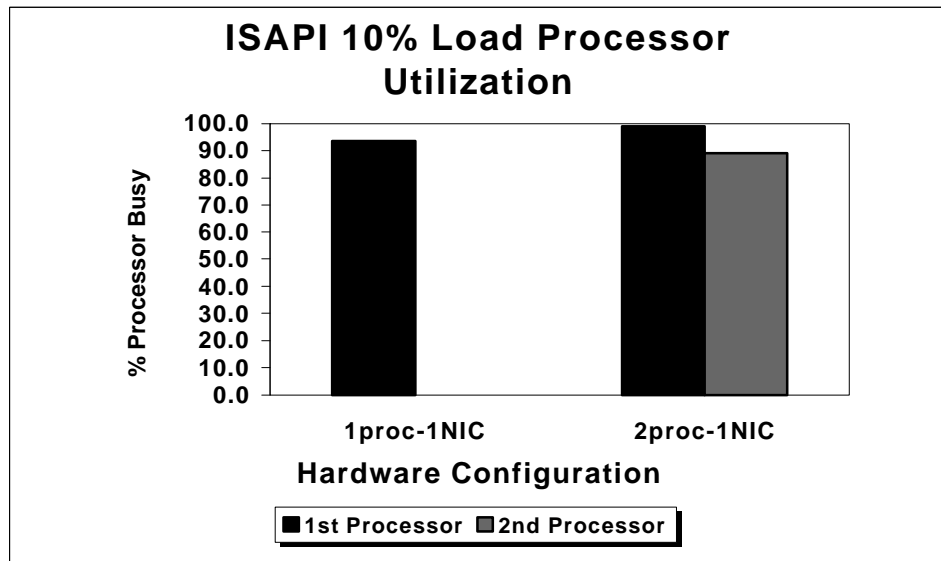
In testing the ProLiant 850R Web-hosting server, effort was made in all cases to cause the bottleneck to be the processor by providing sufficient load and eliminating unrelated bottlenecks. With each transaction mix (100% static HTML, 10% ISAPI, etc), multiple runs of varying client thread count were executed in order to determine the peak performance level of the SUT. Pages per second, processor utilization, and network throughput were the three factors considered in determining peak performance. At peak, three performance samples were taken and averaged to produce the performance statistics reported here.

Processor Utilization

Processor utilization for the various file mixtures is shown by the following graphs:

Static Load Processor Utilization

% Processor Busy

Hardware Configuration

■ **1st Processor** ▨ **2nd Processor**
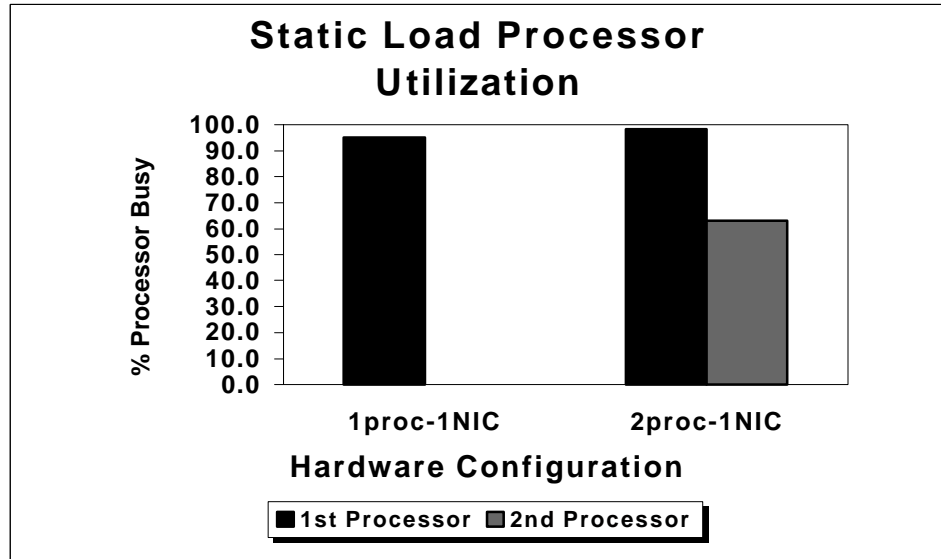
Graph 1. Static Load Processor Utilization

ISAPI 10% Load Processor Utilization

% Processor Busy

Hardware Configuration

■ **1st Processor** ▨ **2nd Processor**

Graph 2. ISAPI 10% Load Processor Utilization

10
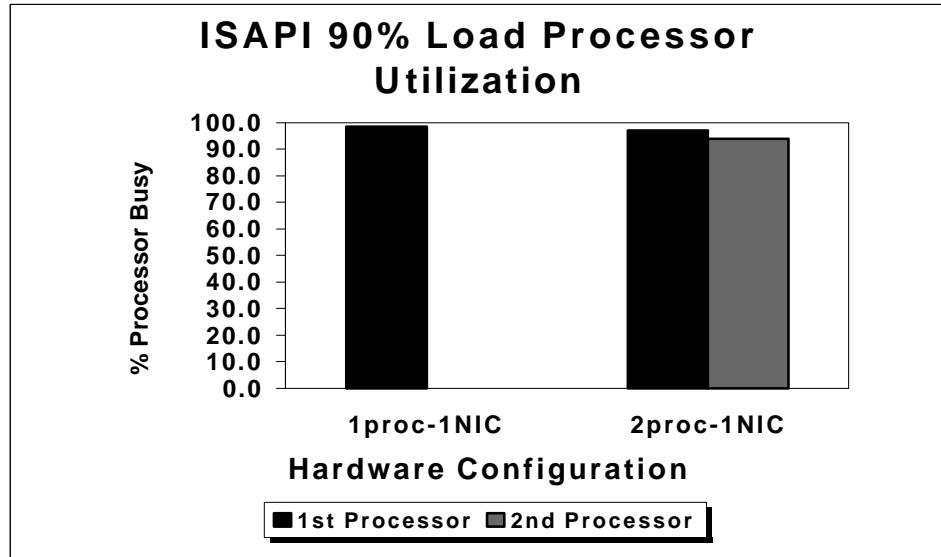
Graph 3. ISAPI 90% Load Processor Utilization

Graph 4. CGI 10% Load Processor Utilization

CGI 90% Load Processor Utilization
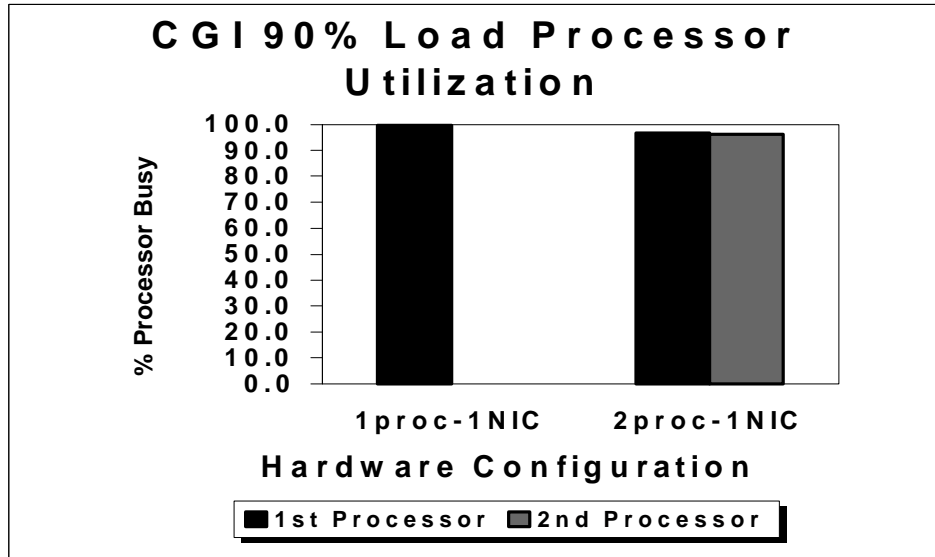
Graph 5. CGI 90% Load Processor Utilization

SUT Performance

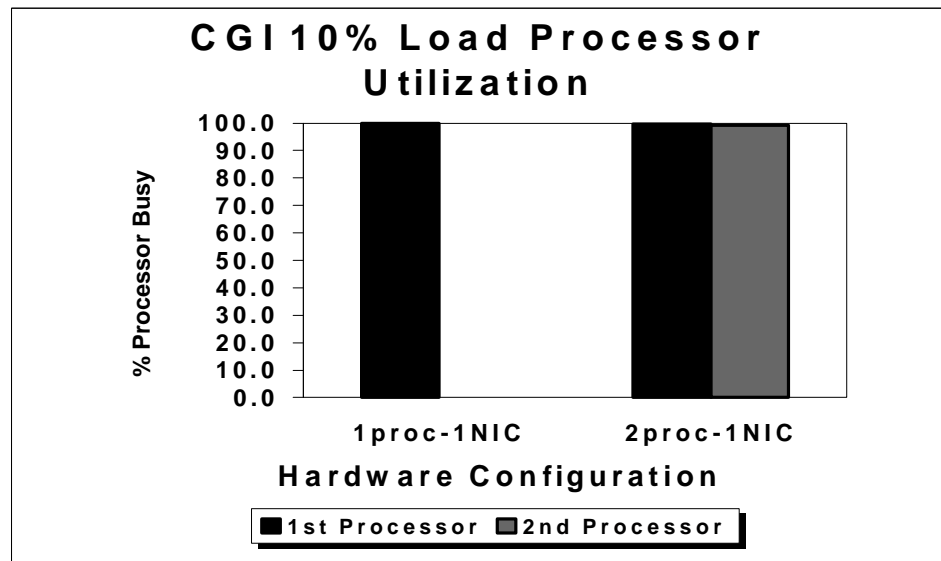Test conditions included not only varying file mixes but also hardware configurations with one and two processors. Adding a second processor often improved performance. A detailed summary of test results with reference to the next two graphs follows below.

Average NIC Throughput
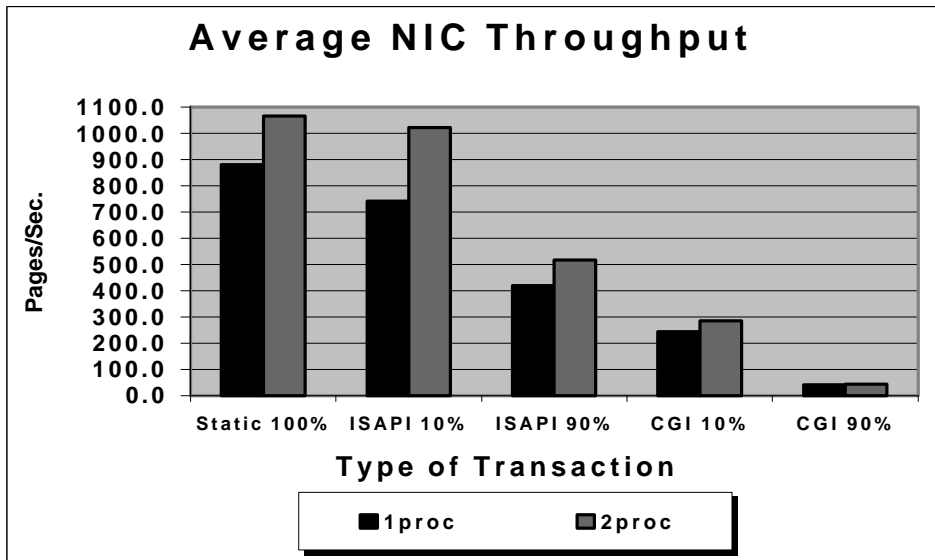
Graph 6. Average NIC Throughput (Pages/Sec.)

Graph 7. Average NIC Throughput (Megabits/Sec.)

100% Static HTML

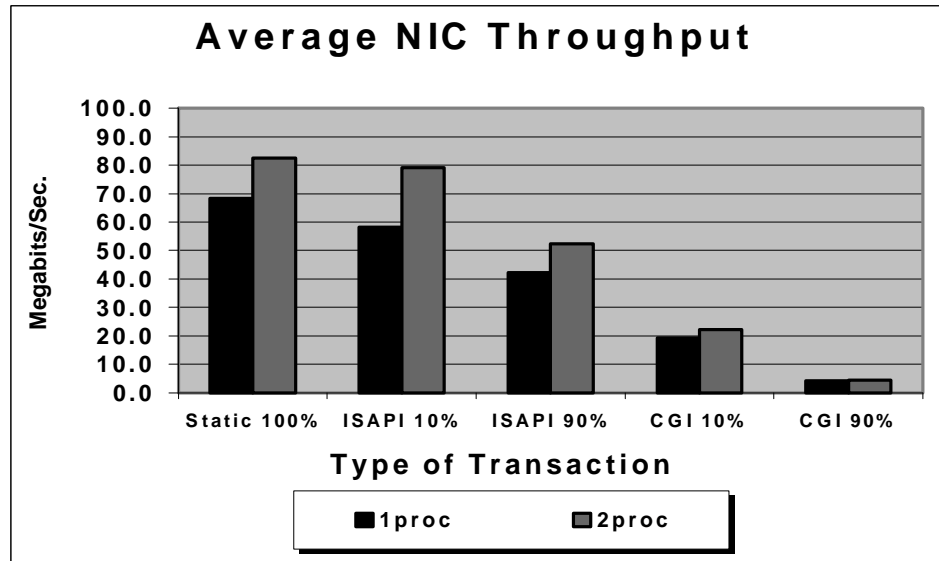The server with one processor provided throughput of 68.2 megabits per second (Mbps) or 882.5 pages per second (Pps). The server with two processors provided throughput of 82.5 Mbps or 1066 Pps. The percent gain from a single-processor to a dual-processor configuration was 21% for both Mbps and Pps. See Graphs 6 and 7 above.

10% ISAPI

The server with one processor provided throughput of 58.1 Mbps or 743 Pps. The server with two processors provided throughput of 79.1 Mbps or 1022 Pps. The percent gain from a single-processor to a dual-processor configuration was 36.1% for both Mbps and Pps. See Graphs 6 and 7 above.

90% ISAPI

The server with one processor provided throughput of 42.3 Mbps or 420 Pps. The server with two processors provided throughput of 52.4 Mbps or 518 Pps. The percent gain from a single-processor to a dual-processor configuration was 23.9% for both Mbps and Pps. See Graphs 6 and 7 above.

10% CGI

The server with one processor provided throughput of 19.2 Mbps or 243.4 Pps. The server with two processors provided throughput of 22.2 Mbps or 286.3 Pps. The percent gain from a single-processor to a dual-processor configuration was 15.6%. See Graphs 6 and 7 above.

90% CGI

The server with one processor provided throughput of 4.1 Mbps or 39.5 Pps. The server with two processors provided throughput of 4.4 Mbps or 42.8 Pps. The percent gain from a single-processor to a dual-processor configuration was 7.3%. See Graphs 6 and 7 above.

Memory Configuration Results

In testing, when the Webstone file set was used (under 1 MB), varying memory size from 32 MB through 128 MB made a negligible difference in performance, since all the content resided in memory. When all content served fits into memory, there is no need to repetitively access it from disk. This speeds up processing, since there is a higher overhead associated with accessing disk (milliseconds) than there is with accessing memory (nanoseconds).

In contrast, when a large file set (approximately 100 MB) was used, varying memory size from 32 MB through 128 MB made a significant difference in performance. As memory was reduced, the entire file set finally exceeded the caching capacity of available memory. This resulted in paging and increased disk I/O. The minimum memory available was observed to drop from 10 MB to 353K while disk transfers per second increased from 31 to 109. These measurements coincided with a drop in throughput from 97 Mbps to 3.8 Mbps, *a difference of 85%.* Where the Web content exceeds available memory, the cache hit ratio and the I/O rates on the drive should be monitored on the server to insure that performance is not degraded by a lack of system resources. See Graph 8.
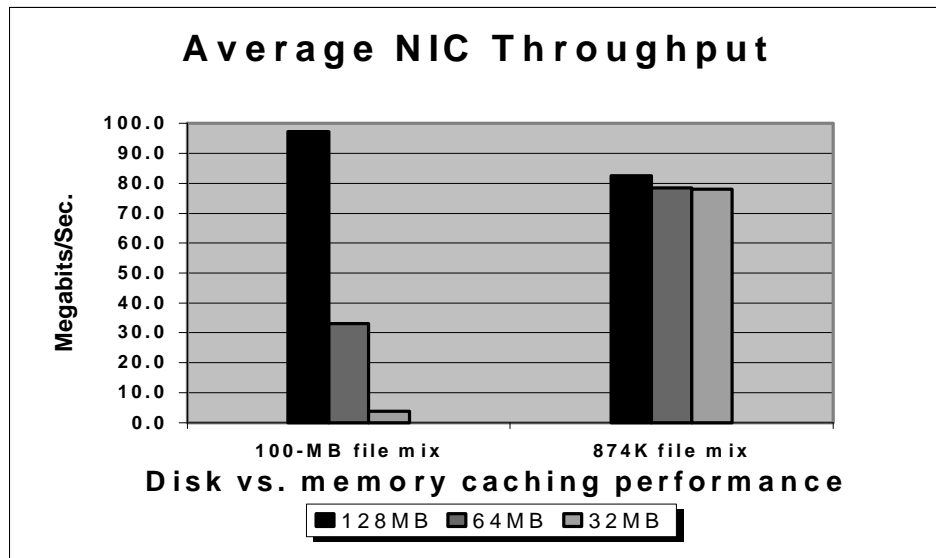

Graph 8. Average NIC Throughput

Processor and Network Configurations versus Performance

A single network adapter was configured for the first processor, then for the second processor in separate tests. Assigning the NIC to a particular processor caused the interrupts and deferred program calls (DPCs) associated with the NIC to be assigned to the processor as well. After each change in configuration, the server was subjected to tests of Static, ISAPI 90, and CGI 90 loads. The results revealed that under Static load the SUT performed 6.9% better when the NIC was assigned to the first processor. ISAPI 90% also demonstrated a 4.1% performance gain when the NIC was managed by the first processor. CGI 90%, on the other hand, demonstrated a 4.8% improvement when the NIC was managed by the second processor. Distributing the NIC load between both processors produced results similar to those achieved by assigning the NIC to the second processor. NIC-to-processor assignments are performed through a Windows NT registry parameter. The server registry entry used was:

\system\currentcontrolset\services\ndis\parameters\processoraffinitymask.

Setting the value to 0x00000001 assigns the NIC to the first processor, setting the value to 0x00000000 distributes the NIC assignment between both processors, and setting the value to 0xffffffff assigns the NIC to the second processor. See Graph 9.
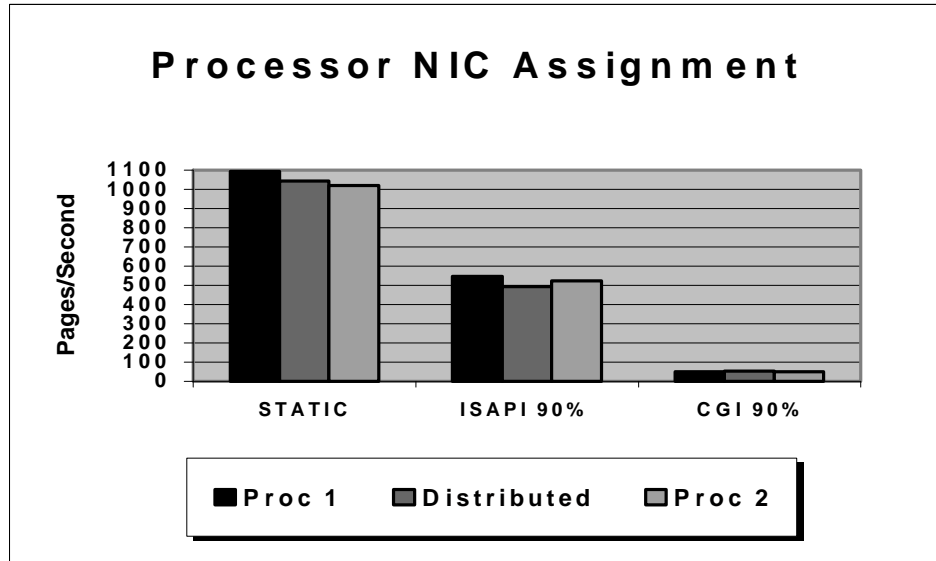
Graph 9. Processor NIC Assignment

In environments where low-speed (10-megabit) NICs are in use, NIC bottlenecks may occur and should be monitored. If such bottlenecks exist, adding an additional 10-megabit NIC or upgrading the LAN and associated NIC to 100-megabit speeds will probably increase performance. The Windows NT network monitoring tool and agent provides access to the communication protocols. This access helps identify potential problems affecting the wire, the protocols, or the application that in turn affect network performance

PERFORMANCE MONITORING AND TUNING

Maintaining a server in top condition can be just as important as selecting the right hardware. Tools that permit monitoring of the system are useful when performance is being observed while configuration changes are made. This section describes several such tools. The Windows NT Performance Monitor and Network Monitor provide information on hardware utilization of resources such as processor, network, memory and disk.

Monitoring Tools

A processor bottleneck occurs when one or more processes occupy nearly all of the processor time. A bottleneck is happening when process threads must wait in queue for processor time. Adding additional components such as memory, disks, network peripherals, or greater bandwidth to the computer will not overcome typical processor performance problems. Items that should be monitored include: processor queue length, total processor time, privileged time, processor utilization, and DPCs.

A server's effective performance is determined by the individual capacity of each network segment and by the ability of the server to respond to requests. The effective bandwidth varies depending upon the transmission capacity of the link, server configuration, and server workload. It is important to observe both the low and high extremes of server performance in order to guard

against under-utilization of the network infrastructure as well as against saturation of the network. The item that should be monitored is the number of NIC bytes received and transmitted.

A reduction in disk-to-memory cache hit ratios can affect system performance. Web-hosting servers take advantage of the performance gains provided by the cache. It is important to provide enough physical memory to allow the operating system to maintain the cache at an optimal size. Items to monitor include: disk transfers, read transfers, cache faults per second, and memory page reads per second.

In optimizing the performance of the ProLiant 850R, the following parameters were monitored to eliminate system bottlenecks: processor utilization, DPCs queued, NetFlex-3 transmits bytes/sec., NetFlex-3-receives bytes/sec., memory consumption, and disk utilization. Figure 2 below is the system upgrade path flow chart resulting from performance analysis of the ProLiant 850R.
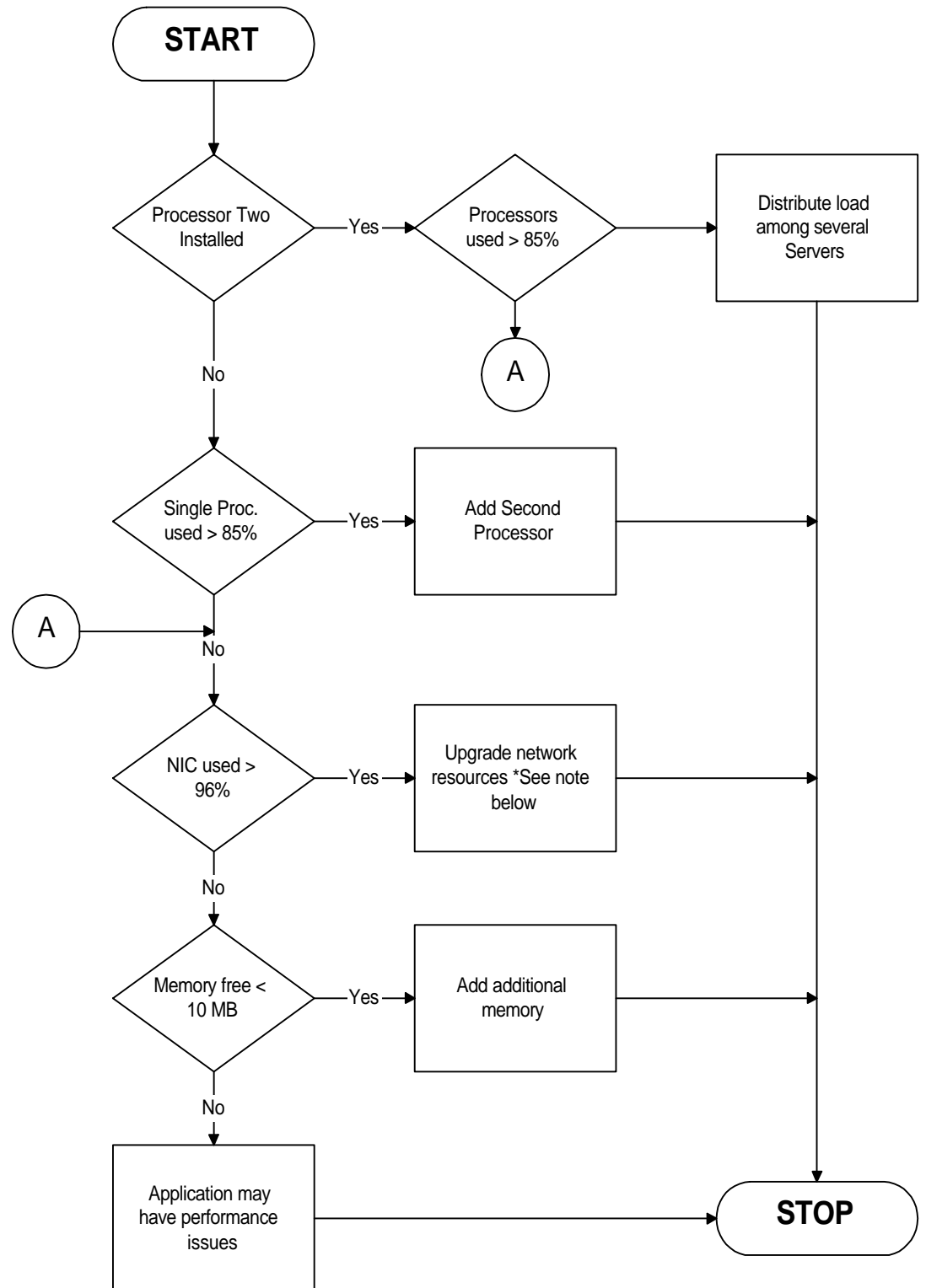
Figure 2. Upgrade Path

Note: When the available bandwidth has been exceeded, the logical course is to upgrade the network to a higher bandwidth or create a multiple-segment network.

SYSTEMS MANAGEMENT

Compaq Insight Manager (CIM) can detect potential failure before it occurs, enabling the service provider to replace suspect components while the system is still under warranty. CIM also provides facilities with which to perform maintenance and recovery remotely. Carbon Copy lets administrators dial in to the server and operate it remotely. The Integrated Remote Console software that ships standard with the ProLiant 850R also provides remote access to the server. More discussion of each tool follows.

Compaq Insight Manager

CIM has two main components: the agent software that runs on the managed node, and the 32-bit Windows application that runs on a management console or PC.

The CIM agents collect and transmit information about the Compaq server resources. They also send alerts (traps).

The CIM management software is a Windows NT application that monitors multiple Compaq servers and clients and displays their information. It also receives, logs, and forwards alerts. Licensing of the management software is on a per-console basis.

CIM uses the industry-standard Simple Network Management Protocol (SNMP) for communication between the agents and the management console. Both in-band and out-of-band communications between servers and clients are possible. If the in-band communication path is broken, CIM's asynchronous management feature can run SNMP over dial-up connections using Point-to-Point Protocol (PPP). This lets CIM administrators communicate with a server and perform management functions on a backup basis even when the network is down.

Besides monitoring and alert handling, CIM's features include security provision and automatic data collection. The management application can dial up and manage servers on demand, or be set for automatic data collection. The agent running on the server can be configured to establish a dial-up connection dynamically and deliver an SNMP trap packet. Such connections use PPP, which has built-in security, and are terminated by inactivity on the line.

The information that CIM monitors and documents includes the following:

- **Configuration.** Online documentation concerning processors, memory, mass storage controllers, security, fault management, and additional boards installed.

- **Mass Storage.** Information on controllers and the operational status of storage subsystems.

- **Network Interface Controllers.** Information about the NICs that are installed.

- **Utilization.** Statistics on the CPU and EISA bus utilization of the server.

- **Expansion Boards.** Resource usage associated with each expansion board.

- **System Boards.** System name, ROM version, hours in service, serial number, bus type, memory, and processor information.

- **Recovery.** Information on automatic server recovery (ASR), critical error log, power-on message, correctable memory log, environment, UPS, redundant power supply, remote Insight Management, communication settings, and device software.

Finally, CIM lets administrators set alarm thresholds on certain data items in the following categories: mass storage, NIC, utilization, system board, and recovery. If a threshold is exceeded,

CIM will issue an alert so the administrator can take action to avoid an actual failure of the component.

Carbon Copy

Carbon Copy 32 for Windows is a remote control and file transfer software package that runs under Windows 95 or Windows NT. With Carbon Copy, a PC running Windows can control another PC. Because Carbon Copy allows the user to operate the remote PC as if it were local, the user can make use of utilities such as the Windows NT Performance Monitor and Network Monitor to diagnose a system at any given moment. Carbon Copy 32 has full 32-bit compatibility that allows it to exploit Windows 95 features such as long file names, TAPI, faster remote control performance with disk caching, and easy toolbar. The Multi-wait feature allows the software to wait for calls in multiple modes. Enhanced file transfer security lets the user hide selected directories from other users during transfer.

Integrated Remote Console

The Integrated Remote Console management software provides users with direct access to the server through dial-up. The actions that can then be performed include: cycling the power down unconditionally; resetting all features and internal peripherals; viewing complete boot sequence and operating system load information following an automatic server recovery event; and managing access to the utility itself.

CONCLUSION

The 3U ProLiant 850R rack-mountable, Web-hosting server provides a low-cost, high-performance multiprocessor server that is easy to configure and manage. This Web-hosting server with two processors, as tested, can provide 82.5 Mbps of static data at 1066.5 Pps utilizing an aggregate bandwidth of 55 T1s. This level of execution outperforms the bandwidth available to a majority of ISPs. See Graph 10.
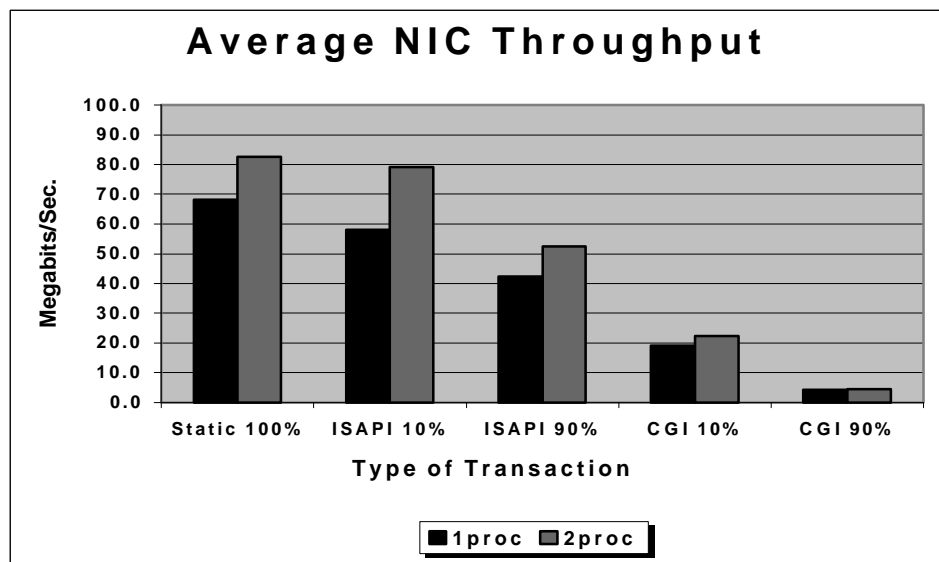
Graph 10. Average NIC Throughput

As a base configured platform (one P6/200, 128 MB RAM, 4.3-GB hard drive, and one 10/100-megabit NIC), the ProLiant 850R server delivers outstanding performance. As with most such

equipment, an adequate level of maintenance and monitoring must be established in order to ensure continued efficient operation. Use of tools such as Perfmon and CIM following the methodology described in this paper will help identify potential bottlenecks and prevent the resulting degradation to performance that may occur. Carbon Copy and Remote Insight Manager are also useful sources for the remote notification and monitoring functionality essential in ISP environments to the diagnosis of problems and prevention of interruptions in service.

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PN 281862-001

GLOSSARY

Application Program Interface (API)

A set of routines that an application program uses to request and carry out lower-level services performed by another component, such as the computer's operating system or a service running on a network computer.

Backbone

The part of a network used as the primary path for transporting traffic between network segments. It provides a high-speed line or series of connections that form a major pathway.

Bandwidth

In communications, the difference between the highest and lowest frequencies in a given range. Bandwidth determines how much information can be sent through a connection.

Bit

A single digit number in base-2.

bps

Bits per second. A measurement of how fast data is moved from one place to another. A 100-Mbps switch can move data at rates close to 100 million bits per second.

Byte

Eight bits that represent a single character.

Client

A software program that is used to contact and obtain data from a server software program on another computer, often across a great distance.

Common Gateway Interface (CGI)

A standard for sharing data between browsers and servers. CGI allows applications such as database query to be run over the Internet. The primary advantage of CGI is that it is common. This interface can be run on all popular Web servers and can be written in all common scripting languages such as Perl and Visual Basic. CGI applications are compiled as stand-alone executables. Each CGI request generates a separate process. CGI was created for a UNIX environment, where processes are the basic unit of operation.

CSMA/CD

Carrier sense multiple access with collision detection. A channel access mechanism in which devices that want to transmit first check the channel for a carrier. If no carrier is sensed for some period of time, devices can transmit. If two devices transmit at once, a collision occurs and is detected by all colliding devices, which then delay their retransmissions for a random length of time. CSMA/CD access is used by Ethernet and IEEE 802.3

Ethernet

A baseband LAN specification network that operates at 10 and/or 100 Mbps using CSMA/CD to run over coaxial and/or twisted pair cable.

Full Duplex

Capability for simultaneous data transmission between a sending station and a receiving station. Compare with Half Duplex

Half Duplex

Capability for data transmission in only one direction at a time between a sending station and a receiving station. Compare with Full Duplex.

Host

Any computer on a network that is a repository for services available to other computers on the network.

Hypertext Markup Language (HTML)

A markup language used to create hypertext documents that are portable from one platform to another. HTML files are simple ASCII text files with codes embedded (indicated by markup tags) to indicate formatting of documents on the World Wide Web.

HTTP

Hypertext transfer protocol. The protocol for moving hypertext files across the Internet.

IEEE 802.3

IEEE LAN protocol that specifies an implementation of the physical layer and MAC sublayer of the link layer. IEEE 802.3 uses CSMA/CD access at a variety of speeds over a variety of physical media.

Internet

The vast collection of inter-connected networks that use the TCP/IP protocols and that evolved from the ARPANET of the late 1960s.

Internet Server Application Programming Interface (ISAPI)

A new dynamic interface that was designed to optimize performance of applications that generate dynamic pages on intranet and Internet servers running Windows NT 3.51 or later. This interface is compiled as a dynamic link library (DLL) that is loaded into the HTTP service and resides in memory when the service starts. ISAPI applications are actually extensions of the HTTP service. A waiting thread processes a client request. When the request is completed, the thread returns to a thread pool until another request arrives. ISAPI differs from CGI in that no further processing time or memory is required when initiating a request.

IP Number

Internet Protocol number. Sometimes called a dotted quad. A unique number consisting of 4 parts separated by dots, for example, 192.22.22.11. Every machine that is on the Internet has a unique IP number.

ISP

Internet service provider. An institution that provides access to the Internet in some form, usually for money.

LAN

Local area network. A computer network limited to the immediate area, usually the same building or floor of a building.

MAC Sublayer

Media Access Control sublayer. As defined by the IEEE, the MAC is the lower portion of the OSI reference model data link layer. The MAC sublayer is concerned with media access issues, such as whether token passing or contention will be used.

Megabyte

One million bytes.

Network

A network is formed whenever two or more computers are connected together so that they can share resources.

Repeater

A device that regenerates and propagates electrical signals between two devices or segments.

Static Web Pages

Standard Web pages that are created in advance and stored for later delivery to clients.

Switch

In the context of Frame or LAN switching, a switch is a device that filters, forwards and floods frames based on the frames' destination address. The switch learns the addresses associated with each switch port and builds tables based on this information to be used for the switching decision.

T1

Bell System terminology referring to a digital carrier facility used for transmission of data through the telephone hierarchy. The rate of transmission is 1.544 Mbps.

U

A unit of measurement used to represent the height of rack-mountable equipment. One U is equivalent to 1.7 inches.