Performance Report

IBM PC Server 704

Version 2.0
June 1997

IBM®

1 Introduction

About This Report

Who Should Read This Report

This report documents the performance of the new models of the IBM PC Server 704 that were announced worldwide in May 1997. The report is intended for Business Partners, customers, and IBM marketing and technical support representatives who are interested in performance results for the IBM PC Server 704, with up to four 200MHz[1] Intel** Pentium** Pro processors.

The previous IBM PC Server 704 Performance Report, Version 1.1, published in October 1996, provided performance results for Model 8650-4M0, which was announced worldwide in October 1996.

How This Report Is Organized

The IBM PC Server 704 system's performance was evaluated using Ziff-Davis' WebBench** Version 1.0 and NetBench** Version 5.0 benchmarks.

The Ziff-Davis benchmarks were also conducted on similarly configured Compaq** ProLiant** 5000 and Hewlett-Packard** NetServer** LX Pro systems,[2] and the results are presented for comparison.

NotesBench for Lotus** Domino** Server Release 4.51 was also recently conducted with the IBM PC Server 704 system. The audited results are presented here. The full NotesBench Disclosure Report is available on the World Wide Web at the following URL:

http://www.us.pc.ibm.com/techlink/srvperf.html

[1] MHz denotes the internal clock speed of the microprocessor; other factors also affect application performance.

[2] The system configurations measured were the same except that 4.51GB hard disks were used in the PC Server 704 vs. the 2GB hard disks used in the competitors' systems. The 4GB hard disks for these systems were not available at the time the measurements were conducted.

The remainder of this report is organized in the following sections:

- Section 2, “Executive Overview,” which provides a brief overview of the IBM PC Server 704 and presents highlights of all performance results, including an overview of recent NotesBench results
- Section 3, “Test Environment and Results,” which provides results, along with the measurement methodology and analysis
- Section 4, “Server Configurations,” which provides information about the server configurations used for the WebBench and NetBench measurements made with the IBM PC Server 704, the Compaq ProLiant 5000 and the Hewlett-Packard NetServer LX Pro systems
- Section 5, “Test Disclosure Information,” which describes the testbeds used for running the WebBench and NetBench benchmarks.

How to Obtain More Information

The IBM PC Server Performance Laboratory publishes white papers and performance reports, including audited disclosures for benchmarks such as TPC-C and NotesBench. These documents are available on the World Wide Web at the following URL:

http://www.us.pc.ibm.com/techlink/srvperf.html

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2 Executive Overview

IBM PC Server 704

Two new models of the IBM PC Server 704 system, a 4-way symmetric multiprocessing (SMP) server featuring the 200MHz Pentium Pro microprocessor and improved high-performance SCSI subsystems, were announced worldwide in May 1997. Both models are open-bay systems that can be easily configured to handle a wide variety of customer applications. Model 8650-6MM is a preconfigured, high-availability, fault-tolerant server that includes an IBM PC ServeRAID SCSI Adapter and a hot-swap, redundant power supply. Model 8650-5M0 ships in a basic configuration to support customized solutions.

Both IBM PC Server 704 models ship in a basic configuration without hard drives. It is intended that Business Partners or customers install the appropriate number and capacity of hard drives required. In addition, the number of processors, amount of memory, redundant power, and the preferred RAID and network adapters can be easily installed to meet customer requirements.

The IBM PC Server 704 system is intended for customers in large to medium-size businesses that need high-performance, multiprocessing servers that are scalable to four processors with high-availability, fault-tolerant features. The IBM PC Server 704 system features up to four Pentium Pro 200MHz processors, each with a 512KB L2 cache, and up to 2GB of system memory for compute-intensive requirements of high-end, database and application server environments. Typical enterprise installations include interconnected departmental database servers, large branch office database or application servers running Lotus Domino Server and other network applications. The IBM PC Server 704 provides the required high performance, multiprocessing capability, fault tolerance, and large amounts of internal data storage needed today or anticipated for the future. The IBM PC Server 704 can also function as a file server in network environments where there is a significant number of users requiring a large amount of file server resources.

Standard features include:

- One to four 200MHz Pentium Pro processors, each with an integrated 512KB L2 write-back cache
- Two processor cards with two ZIF sockets standard (a second, third and fourth processor can be easily installed)
- Up to 2GB of ECC system memory (256MB of ECC memory standard)
- Advanced architecture: dual 132MB/second, I2O-ready PCI buses and an EISA bus for compatibility
- Ten adapter slots (six PCI slots and four EISA slots) for adding 32-bit adapters
- High-performance (7200 rpm) 2.14GB[3], 4.51GB and 9.1GB Wide Ultra SCSI S.M.A.R.T. hot-swap hard drive options (optional or standard PC ServeRAID SCSI Adapter for high-performance RAID 0, 1 and 5)
- Twelve hot-swap hard drive bays and three open 5.25 half-high bays
- Two 420W worldwide power supplies standard (a third 420W hot-swap, redundant power supply is available as an option or standard in the preconfigured model)
- Two serial ports (56Kbps) and one parallel port (peak transfer rate of 2MB/sec) that supports devices using ECP/EPP protocols adhering to the IEEE 1284 standard.
- Standard 8X-speed, bootable CD-ROM drive; 1.44MB diskette drive; keyboard and mouse
- ServerGuide*, the fastest way to set up and configure your IBM PC Server
- IBM NetFinity*, for robust, local and remote systems management
- Single-processor edition of Lotus Domino Server 4.50 (includes Notes) for more efficient business communications on the Internet or your intranet

[3] When referring to hard disk capacity, GB stands for one thousand million bytes. Total user-accessible capacity may vary depending on operating environments.

Performance Highlights

NotesBench

The IBM PC Server 704 system **demonstrated leadership performance as a Domino 4.51 server** in recently conducted measurements. The IBM PC Server 704 supported the highest number of Mail and MailDB users published to date on an Intel-based, PC server platform.

Configured with two 200MHz Pentium Pro processors and 768MB of memory, the IBM PC Server 704 was measured using NotesBench 4.51 for Lotus Domino Release 4.51 with Microsoft Windows NT Server Version 4.0 with Service Pack 3.[4] The following table summarizes the results[5].

Test Script	Maximum Users	NotesMark (tpm)	Response Time (sec)	$/User	$/NotesMark
Mail-Only	2,850	3,761	0.624	$15.18	$11.51
MailDB	2,050	4,697	1.599	$21.11	$9.21

WebBench 1.0

Ziff-Davis' WebBench 1.0 was used to measure the IBM PC Server 704 system's performance as a Web server running Microsoft Internet Information Server 2.0 on Windows NT Server 4.0.

In a non-RAID configuration, the IBM PC Server 704 system delivered:

- **Better overall throughput** to network clients across all workloads than the Compaq ProLiant 5000 and the HP NetServer LX Pro systems

[4] The NotesBench Disclosure Report for the IBM PC Server 704 was audited in June 1997 by KMDS Technical Associates and was approved for publication. Highlights from the report are presented here.

[5] The price/performance ratio is based on an actual price quote for the product from a U.S. reseller. IBM's Estimated Reseller Prices are available from IBM or your IBM reseller upon request. IBM resellers set their own prices.

In a non-RAID configuration, the IBM PC Server 704 system serviced:

- **More requests per second** than the Compaq ProLiant 5000 and the HP NetServer LX Pro systems at the peak of 12 WebBench clients and across all other workloads

In a RAID-5 configuration, the IBM PC Server 704 system delivered:

- **Better overall throughput** to network clients across all workloads than the Compaq ProLiant 5000 and the HP NetServer LX Pro systems

In a RAID-5 configuration, the IBM PC Server 704 system serviced:

- **More requests per second** than the Compaq ProLiant 5000 and HP NetServer LX Pro systems at the peak of 12 WebBench clients and across all other workloads

NetBench 5.0

Ziff-Davis' NetBench Version 5.0 Disk Mix for Windows for Workgroup Clients was used to measure the IBM PC Server 704 system's performance as a single-processor, file server running Novell** NetWare** 4.11 in a 100Mbps Ethernet environment.

Under a high-end workload in a non-RAID environment, the IBM PC Server 704 system provided network clients with **better throughput** than both the Compaq ProLiant 5000 and the Hewlett-Packard NetServer LX Pro systems.

3 Test Environments and Results

NotesBench

Performance measurements were made using NotesBench for Lotus Domino Server Release 4.51 with the IBM PC Server 704, running Lotus Domino Server Release 4.51 on Microsoft Windows NT Server Version 4.0 with Service Pack 3.

NotesBench generates a transactions-per-minute (tpm) throughput metric, called a NotesMark, for each test, along with a value for the maximum capacity (number of users) supported, and the average response time. The price/performance results are derived using a total system cost of $43,272, which was provided by an IBM PC Server Business Partner.

Results Summary

The following table provides the results for the IBM PC Server 704, configured with two processors, 768MB of memory and ten 4.51GB Wide Ultra SCSI hard disks, running two NotesBench workloads: Mail-only and Mail and Shared Database (MailDB).

Test Script	Maximum Users	NotesMark (tpm)	Response Time (sec)	$/User	$/NotesMark
Mail-Only	2,850	3,761	0.624	$15.18	$11.51
MailDB	2,050	4,697	1.599	$21.11	$9.21

Competitive Results

The IBM PC Server 704 system **demonstrated leadership performance as a Domino 4.51 server** in recently conducted measurements. The IBM PC Server 704 supported the highest number of Mail and MailDB users published to date on an Intel-based, PC server platform.

The table below summarizes some of the published results for the Mail and MailDB tests, including those for the IBM PC Server 704. All systems used Microsoft Windows NT Server 3.51 or 4.0, except for the Sun Microsystems server, which used Solaris 2.5.1. Of the systems shown, only the IBM PC Server 704 ran the Domino Server; the competitive systems ran Notes 4.x.

All competitive results shown are based on the tests conducted by the respective companies. IBM did not test or in any way verify the test results obtained by these companies. The configuration of the server under test as well as the test environment may vary. Readers are encouraged to contact the companies or their Web site for a copy of the audited disclosure report, which provides details concerning the server configuration and methodology used to obtain the published results.

	Maximum Users	NotesMark (tpm)	$/User	$/NotesMark
	Mail / MailDB	**Mail / MailDB**	**Mail / MailDB**	**Mail / MailDB**
IBM PC Server 704 (2 - 200MHz Pentium Pro Processors, 768MB Memory) June 1997	**2,850 / 2,050**	**3,761 / 4,697**	**$15.18 / $21.11**	**$11.51 / $9.21**
Compaq ProLiant 5000 (2 - 200MHz Pentium Pro Processors, 640MB Memory) Jan. 1997	2,112 / 1,769	2,697 / 3,612	$21.79 / $26.02	$17.07 / $12.74
Sun Ultra Enterprise 2 Model 2200 Server (2 - 200MHz UltraSPARC-I Processors, 512MB Memory) Sept. 1996	1,925 / 1,700	2,563 / 3,967	$29.48 / $33.38	$22.14 / $14.30
Hewlett-Packard NetServer LX Pro (2 - 166MHz Pentium Pro Processors, 512MB Memory) July 1996	1,750 / 1,550	2,327 / 3,603	$29.02 / $32.76	$21.82 / $14.09

Measurement Methodology

The IBM PC Server 704 system under test was configured with two 200MHz Pentium Pro processors (512KB of L2 write-back cache per processor); 768MB of memory; ten 4.51GB Wide Ultra SCSI hot-swap disk drives configured as a RAID-0 array, using an IBM PC ServeRAID SCSI Adapter; and an IBM 10/100 PCI Ethernet Adapter.

For these tests, a single 100Mbps Ethernet LAN segment was used. The system under test, the destination servers, and the driver systems were connected to the LAN by two Bay Networks BayStack 201 100BaseT Hubs. An IBM PC 350 computer was used as the source driver (parent) system; 14 IBM PC 350 computers were used as the client driver (child) systems. Three IBM PC Server 720 systems were used as destination servers. Destination mail addresses were distributed across these three destination servers.

To ensure that all results were reproducible, each test was run at least two times, and the results were compared for consistency.

Measurement Analysis

A detailed analysis of the measurements for the Mail-only and MailDB tests is provided in the NotesBench Disclosure Report for the IBM PC Server 704, published in June 1997. In addition, details of the benchmarked configuration are provided in the report, which is available on the World Wide Web at **http://www.us.pc.ibm.com/techlink/srvperf.html**.

The test results demonstrate that an IBM PC Server 704 configured as described within the report can support 2,850 Mail-only users and 2,050 MailDB users with a response time well below what the test criteria permit.

These results are based on running the IBM PC Server 704 as a dedicated Domino server; the addition of other application workloads will affect the number of users supported as well as the response time. Achieving optimum performance in a customer environment is highly dependent upon selecting adequate processor power, memory and disk storage as well as balancing the configuration of that hardware and appropriately tuning the operating system and the Lotus Domino Server software[6].

[6] Additional scalability and high availability may be achieved when using up to six Domino servers in a clustered configuration. This feature is available in the advanced server because of Domino Server.

WebBench 1.0

Ziff-Davis' WebBench 1.0 system test suite NT_SIMPLE_CGI20_V1.TST was used to measure the IBM PC Server 704 system's performance as a Web server running Microsoft Internet Information Server 2.0 on Microsoft Windows NT Server 4.0. This system test suite performs both static HTML page requests and dynamic Common Gateway Interface (CGI) scripts requests, which are the two primary functions of an enterprise Web server.

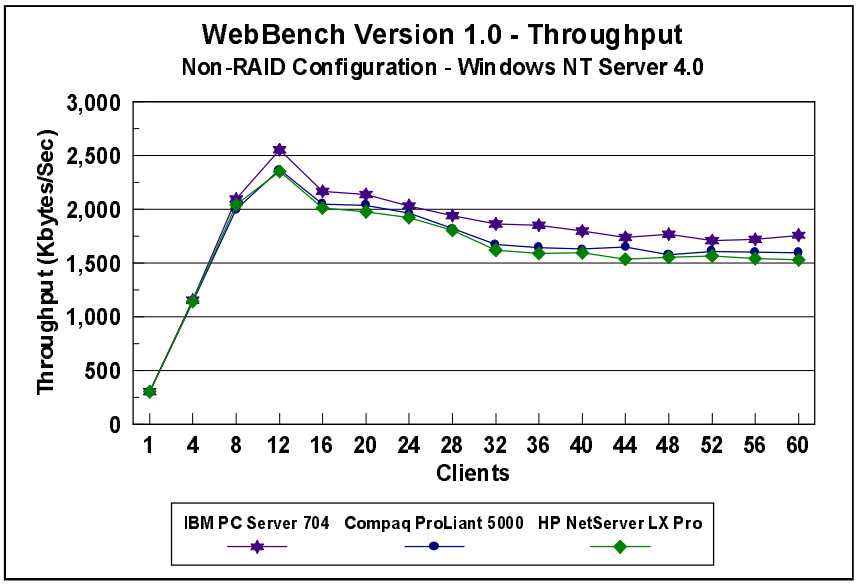
Results Summary

The IBM PC Server 704 demonstrated better overall performance as a Web server than similarly configured Compaq ProLiant 5000 and Hewlett-Packard NetServer LX Pro systems.

Non-RAID Configuration - Throughput

The PC Server 704 system delivered:

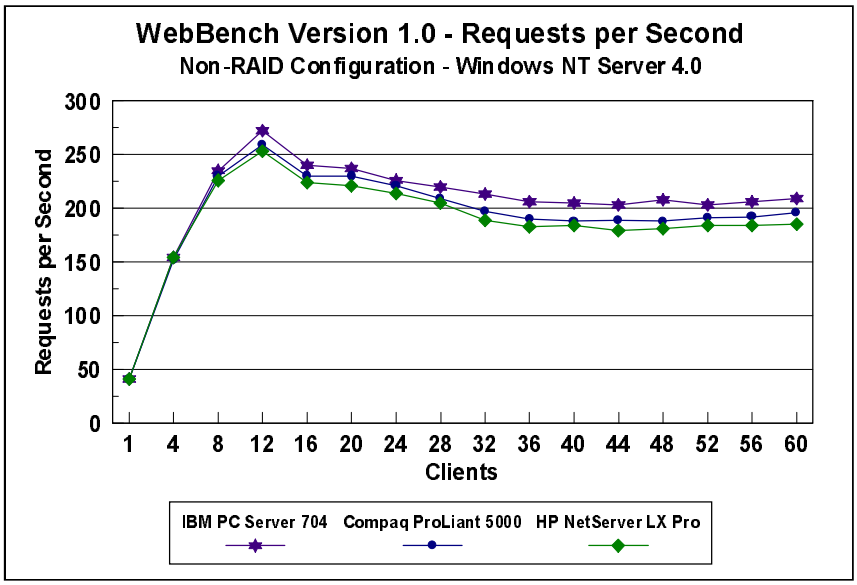
- **Better overall throughput** to network clients across all workloads than the Compaq ProLiant 5000 and the HP NetServer LX Pro systems



Non-RAID Configuration - Requests per Second

The IBM PC Server 704 system serviced:

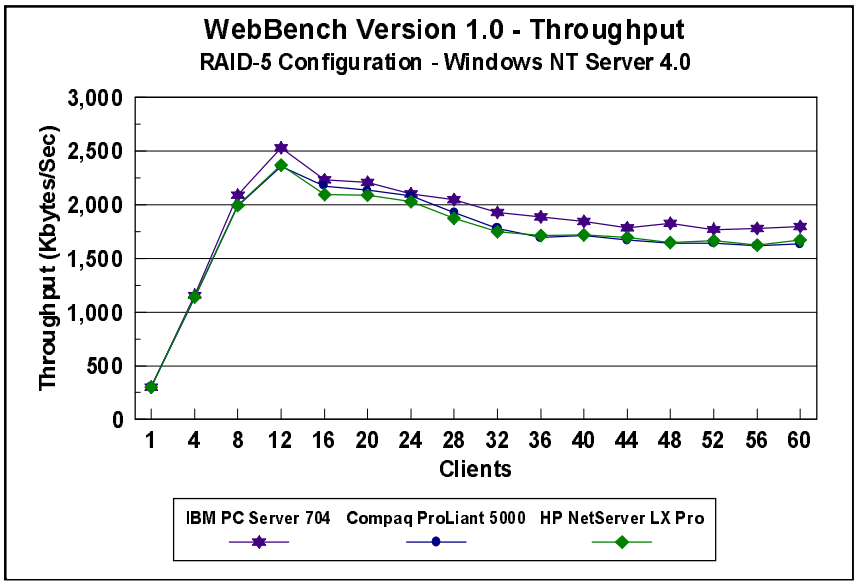
- **More requests per second** than the Compaq ProLiant 5000 and the HP NetServer LX Pro systems at the peak of 12 WebBench clients and across all other workloads



RAID-5 Array Configuration - Throughput

The IBM PC Server 704 system delivered:

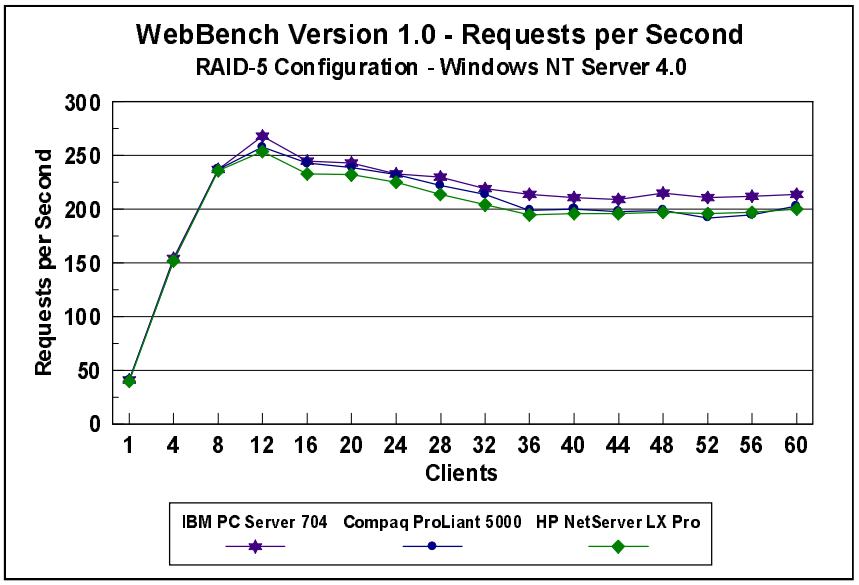
- **Better overall throughput** to network clients across all workloads than the Compaq ProLiant 5000 and the HP NetServer LX Pro systems at the peak of 12 WebBench clients and across all other workloads



RAID-5 Array Configuration - Requests per Second

The IBM PC Server 704 system serviced:

- **More requests per second** than the Compaq ProLiant 5000 and HP NetServer LX Pro systems at the peak of 12 WebBench clients and across all other workloads



Measurement Methodology

The system test suite was performed using four 100Mbps Ethernet network segments with a total of 60 IBM PC 750 systems as client workstations attached to the server. Two kinds of performance data were collected:

- Static HTML pages requests, which demonstrates server throughput as each of the 60 clients, simulating an actual Web browser, fetched predesigned HTML pages using the HTTP protocol from the server. The HTML pages of different sizes (from 0.25KB to 128KB) were spread out in the home and 10 other directories (one of which has subdirectories two levels deep) in the server. The unit of this throughput measurement is bytes per second (shown here as Kbytes per second), indicating the number of bytes of HTML pages per second that were moved to the clients.
- Dynamic Common Gateway Interface requests, which demonstrates the number of requests per second completed by the server.

Each workstation ran Windows NT Workstation 4.0 and executed the WebBench 1.0 NT_SIMPLE_CGI20_V1.TST workload, which includes HTML pages requests and Common Gateway Interface (CGI) requests, two of the primary functions of a web server. Each client randomly issued these requests to the web server according to a workload file that specifies each request a client makes and how frequently the client makes that request. The workload file associates a request percentage with each HTTP request and CGI request. The request percentage tells the client the number of requests it issues during a mix and what the percentage of requests should be for that particular mix. If all clients requested the same file at the same time, the results could be adversely affected; therefore, each client's request access patterns are randomized.

Clients were added incrementally to each mix as follows: 1, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60.

The NT_SIMPLE_CGI20_V1.TST test suite contains a total of 15 mixes. Each mix uses 30 seconds as ramp-up time, 30 seconds as ramp-down time, during which periods measurements were not done. Each mix ran for 300 seconds.

After the 15 mixes in the test suite were finished, WebBench created two graphs: one that plots the requests per second against each mix and another that plots the throughput against each mix. Also supplied is the amount of time how it took the clients to

connect to the server and receive data from the server, and the number of connections per second made by each client.

Measurement Analysis

In a typical two-tier Internet/intranet environment, the Web browser is usually the user front end that makes requests to the Web server. The Web server functions either as a large HTML document store directly returning the HTML documents to the browser or as a back-end logic unit building a dynamic HTML document based on calculation of input fields from the Web browser. In a three-tier Internet/Intranet environment, the Web server usually functions as middleware directing Web browser requests to the appropriate business unit (e.g., database) to retrieve information for the user.

WebBench is designed to benchmark a Web server in a two-tier Internet/intranet environment. In calculating the scores, WebBench counts only completed requests. A completed request consists of four steps:

- The client connects to the server.
- The client issues an HTTP request (either HTML or CGI) to the server.
- The server responds to the request. This response usually results in the server sending to the client an HTML file associated with the URL specified by the client.
- The client disconnects from the server.

In a single mix, the request begins with each client connecting to the server and ends with the client disconnecting from the server, followed immediately by another repeating the process. The cycle continues until the mix is completed.

Because each WebBench client generally stresses the server as much as several actual users do, the test suites can be run with a relatively small number of clients and still provide an accurate measure of a server's performance.

To get a valid measure of the server's performance, the requests-per-second score and the throughput score should reach a point where they flatten out. This "flattening out" indicates that the server has been saturated, or fully loaded. In our test, adding clients increased the total requests-per-second and throughput scores. The curves increased very sharply from 1 to 8 clients, peaked at 12 clients, and then flattened out, indicating that the server had reached its saturation point. Ideally, the curves after saturation point should remain at the same level where the server's

resources (CPU, memory subsystem, disk subsystem) are used optimally. However, due to heavy network traffic and the need to balance each client request load, the curve may dip slightly, reducing the server load.

Our data shows that the saturation point occurred at 12 clients for all three servers. The scores at the saturation point, which are repeatable, indicate how well the server performs. The curves after 12 clients dipped and varied sometimes widely for each run for the reason mentioned above.

File-sharing mode/application server mode is a parameter in NT that allows the server's memory manager policy to be tuned to favor either the file cache or the process' working set. In file-sharing mode, the server does not trim file cache as often as it does in application server mode, and it allocates more memory resources to file cache. Because the system is configured with 512MB memory, the system was tuned in file-sharing mode, which did not provide a higher score at the saturation point, but rather a smoother curve than was achieved in application server mode after the saturation point.

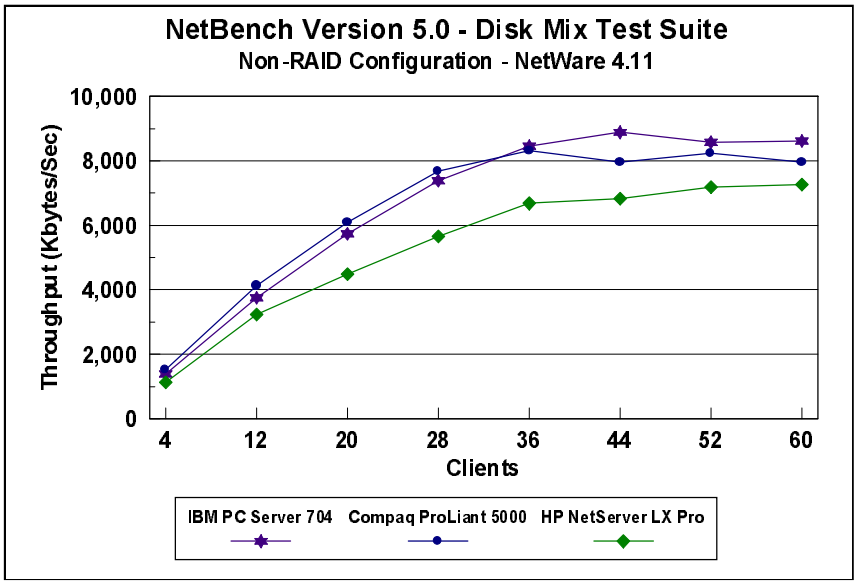
NetBench 5.0

For these measurements, NetBench 5.0 system test suite DM_4GB_TST was used. The results for NetBench 5.0 in a Windows environment should not be compared with results from NetBench 3.01 or 3.0, which used DOS-only clients.

The Disk Mix test results are shown as the number of kilobytes (Kbytes) per second obtained by the server under test.

Results Summary

Under a high-end workload in a non-RAID environment, the IBM PC Server 704 system provided network clients with **better throughput** than both the Compaq ProLiant 5000 and the Hewlett-Packard NetServer LX Pro systems.



Measurement Methodology

The Disk Mix test suite was performed using two 100Mbps Ethernet network segments with a total of 60 IBM PC 350 systems as client workstations attached to the server. Each workstation ran Windows for Workgroups Version 3.11 and executed the NetBench 5.0 Disk Mix workload, which is based on leading Windows applications such as Lotus 1-2-3** Release 4.01, Microsoft Excel** 5.0, Microsoft Word 6.0a for Windows, and Claris** FileMaker** Pro 2.12.

Each client randomly simulated the Windows application workloads, accessing shared and unshared data files located on the server. Each client used a workspace of 80MB. Clients were added incrementally as follows: 4, 12, 20, 28, 36, 44, 52 and 60. Measurements were recorded each time clients were added. See Section 5, “Test Disclosure Information,” for testbed details.

Measurement Analysis

The NetBench Version 5.0 workload exercises the server in a manner similar to actual Windows applications executing on a networked-attached PC; that is, the NetBench Version 5.0 Disk Mix emulates the actual I/O operations performed by leading Windows applications, placing a diverse load on the server by using multiple files, different request sizes and different network file operations.

As clients are added to the network, the I/O workload (i.e., the number of I/O requests to the server) increases, requiring more server resources, such as network adapter transfers, processing power, memory and disk operations. Initially, with a small number of clients, server resources are adequate to handle requests. During this time, the server’s network adapter becomes the bottleneck.

The Disk Mix test requires each client to have its own directory and also to be able to access the shared directory in the server. As the number of clients increases, any workload involving non-shared data files creates a burden on the disk subsystem. As a result, competition for caching user data in server memory causes the bottleneck to migrate from the network adapter to the disk subsystem.

In addition, when a server’s memory buffer space is exhausted, requests are forced to go directly to the disk; therefore, the performance bottleneck quickly migrates from the network adapter to the disk subsystem, resulting in a low, disk cache-hit-ratio. Moreover, if the disk subsystem cannot quickly write “dirty” (updated) data in memory to disk, thereby freeing memory for other I/O requests, memory fills up, creating a disk backlog.

The exact number of clients required to move the bottleneck from the network adapter to the disk subsystem is dependent upon many factors. However, the most significant contributors are the I/O workload, server memory, and server disk subsystem performance. Because the Disk Mix’s I/O workload is predefined, server memory and server disk subsystem performance contribute most to the server’s disk cache-hit-ratio.

Server hardware can be configured so that the results of the NetBench Disk Mix test highlight the performance of either the server network adapter or the server disk subsystem. For example, if a large amount of memory and a fixed number of 60 simultaneous clients are used, the bottleneck will always be on the server network adapter. If too little memory is used, the bottleneck will most likely occur at the disk subsystem. The ideal measurement configuration should utilize enough memory and simultaneous clients to demonstrate the performance of the server network adapter and the server disk subsystem. This was our goal for the Disk Mix test.

In evaluating the performance results of any measurement, it is important to understand the relationship between the server configuration and the workload generated by the benchmark. We experimented with several configurations. For these servers in this configuration of 60 clients, we found that using 128MB (eight 16MB single in-line memory modules to enable four-way memory interleaving) of memory accounted for a high percentage of cache-hits. Also, the entire server was stressed as the workload increased. The reason is that the 100Mbps network adapter provided sufficient bandwidth to allow the server's subsystems (i.e., memory, disk and processor complex) to be saturated. This is important because in most production environments, the number of users is dynamic, and the server bottleneck may change several times daily. Showing both the network adapter and disk subsystem bottlenecks provides more useful information about how the server will perform in production environments.

NetBench is designed to measure the ability of a file server to respond to client file open, close, read and write I/O operations. Our measurements show that increasing the processor speed alone provides little, if any, increase in throughput for most file server environments. However, additional CPU power can provide improvements for servers that are supporting a very large number of users.

4 Server Configurations

WebBench 1.0

Non-RAID Configurations

Features	IBM PC Server 704 200MHz	Compaq ProLiant 5000 200MHz	HP NetServer LX Pro 200MHz
Processor	Four 200MHz Pentium Pro	Four 200Hz Pentium Pro	Four 200MHz Pentium Pro
Memory	512MB ECC	512MB ECC	512MB ECC
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	None	None	None
Disk Drive	Four IBM 4.51GB Wide Ultra SCSI Drives (7200 rpm)	Four Compaq 2.10GB Fast/Wide SCSI-2 Drives (7200 rpm)	Four HP 2.13GB Fast/Wide SCSI-2 Drives (7200 rpm)
Disk Drive Adapter	One[1] IBM Wide Ultra SCSI PCI Bus on Planar	One SCSI-2/P Fast/Wide PCI Bus on Planar	One Ultra SCSI-2 Fast/Wide PCI Bus on Planar
Disk Driver	AIC78XX.SYS	SYMC810.SYS	AIC78XX.SYS
Network Adapter	Four IBM 100/10 PCI Ethernet Adapters	Four Netelligent 10/100 TX PCI Ethernet Adapters	Four HP DeskDirect LAN Adapters
Bus	PCI	PCI	PCI
Network Driver	E100B.SYS	NETFLX3.SYS	E100B.SYS
Network Operating System	Windows NT Server 4.0	Windows NT Server 4.0	Windows NT Server 4.0
System Partition Size	300MB	300MB	300MB
File Compression	Off	Off	Off
File System	NTFS	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default	Predefined Default
WebBench Version	WebBench 1.0	WebBench 1.0	WebBench 1.0

[1] Two Wide Ultra SCSI PCI connectors are available on the PC Server 704 system's planar; however, only one connector was used for this test.

RAID-5 Array Configurations

Features	IBM PC Server 704 200MHz	Compaq ProLiant 5000 200MHz	HP NetServer LX Pro 200MHz
Processor	Four 200MHz Pentium Pro	Four 200Hz Pentium Pro	Four 200MHz Pentium Pro
Memory	512MB ECC	512MB ECC	512MB ECC
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	RAID-5	RAID-5	RAID-5
Disk Drive	Four IBM 4.51GB Wide Ultra SCSI Drives (7200 rpm)	Four Compaq 2.10GB Fast Wide SCSI-2 Drives (7200 rpm)	Four HP 2.13GB Fast/Wide SCSI-2 Drives (7200 rpm)
Disk Array Controller	One IBM PC ServeRAID SCSI Adapter	One Compaq SMART 2/P Array Controller	One HP Dual-Channel Fast/Wide SCSI-2 PCI Disk Array Controller
Disk Driver	ISPRAIDN.SYS	CPQARRAY.SYS	DAC960NT.SYS
Network Adapter	Four IBM 100/10 PCI Ethernet Adapters	Four Netelligent 10/100 TX PCI Ethernet Adapters	Four HP DeskDirect LAN Adapters
Bus	PCI	PCI	PCI
Network Driver	E100B.SYS	NETFLX3.SYS	E100B.SYS
Network Operating System	Windows NT Server 4.0	Windows NT Server 4.0	Windows NT Server 4.0
System Partition Size	300MB	300MB	300MB
File Compression	Off	Off	Off
File System	NTFS	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default	Predefined Default
WebBench Version	WebBench 1.0	WebBench 1.0	WebBench 1.0

NetBench 5.0

Non-RAID Configurations

Features	IBM PC Server 704 200MHz	Compaq ProLiant 5000 200MHz	HP NetServer LX Pro 200MHz
Processor	One 200MHz Pentium Pro	One 200Hz Pentium Pro	One 200MHz Pentium Pro
Memory	128MB ECC	128MB ECC	128MB ECC
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	None	None	None
Disk Drive	Four IBM 4.51GB Wide Ultra SCSI Drives (7200 rpm)	Four Compaq 2.10GB Fast/Wide SCSI-2 Drives (7200 rpm)	Four HP 2.13GB Fast/Wide SCSI-2 Drives (7200 rpm)
Disk Drive Adapter	One[1] IBM Wide Ultra SCSI PCI Bus on Planar	One SCSI-2/P Fast/Wide PCI Bus on Planar	One Ultra SCSI-2 Fast/Wide PCI Bus on Planar
Disk Driver	AIC7870.DSK V2.11	CPQS710.DSK V2.03	AIC7870.DSK V2.11
Network Adapter	Two IBM 100/10 PCI Ethernet Adapters	Two Netelligent 10/100 TX PCI Ethernet Adapters	Two HP DeskDirect LAN Adapters
Bus	PCI	PCI	PCI
Network Driver	E100B.LAN V1.47	CPQNF3.LAN V2.10	HPTX.LAN V1.40
Network Operating System	Novell NetWare 4.11	Novell NetWare 4.11	Novell NetWare 4.11
NetWare Volume Block Size	32KB	32KB	32KB
File Compression	Off	Off	Off
Block Allocation	On	On	On
Data Migration	Off	Off	Off
NetBench Version	NetBench 5.0	NetBench 5.0	NetBench 5.0

[1] Two Wide Ultra SCSI PCI connectors are available on the PC Server 704 system's planar; however, only one connector was used for this test.

5 Test Disclosure Information

WebBench 1.0

The measurements were conducted using Ziff-Davis' WebBench 1.0 running the NT_SIMPLE_CGI20_V1.TST test suite with Windows NT Workstation 4.0 clients as described below:

Version: WebBench 1.0

Mixes

- NT_SIMPLE_CGI20_V1.TST
- Clients 1, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60
- Ramp up: 30 seconds
- Ramp down: 30 seconds
- Length: 300 seconds
- Think: 0 seconds
- Delay: 0 seconds
- Threads per client: 1
- Receive buffer size: 4KB
- Keep-alive: Off

Network Operating System: Windows NT Server 4.0

Web Server: Microsoft Internet Information Server 2.0

Testbed Disclosure

All products used for these measurements were shipping versions available to the general public. All measurements were performed without independent verification by Ziff-Davis.

Network	100Mbps Ethernet
Clients	60
Hubs	Asante 100Mbps Ethernet
Clients per Segment	15
CPU / Memory	166MHz Pentium / 32MB
Network Adapter	IBM 100/10 PCI Ethernet Adapter (Bus 0)
Software	Microsoft Windows NT Workstation 4.0
Cache	L2 = 512KB
Controller Software	Windows NT Workstation 4.0

NetBench 5.0

The NetBench measurements were conducted using Ziff-Davis' NetBench 5.0 running the Disk Mix Windows for Workgroup Clients as described below:

Version: NetBench 5.0

Mixes

- Disk Mix
- Clients 4, 12, 20, 28, 36, 44, 52, 60
- Client workspace: 80MB
- Total runtime: 11 minutes
- Ramp up and down: 30 seconds

Network Operating System: NetWare 4.11 with 410PT6 loaded.

NOS Parameters

- Immediate Purge of Deleted Files = ON
- Enable Disk Read after Write Verify = OFF
- Minimum Packet Receive Buffers = 700
- Maximum Packet Receive Buffers = 1400
- Set NCP Packet Signature Option = 0
- Maximum Physical Receive Package Size = 1514
- Reserved Buffer Below 16MEG = 200
- Maximum Service Processes = 70
- Maximum Concurrent Directory Cache Write = 50
- Dirty Directory Cache Delay Time = 10
- Maximum Concurrent Disk Cache Write = 50
- Maximum Directory Cache Buffers = 500
- Minimum Directory Cache Buffers = 150
- Minimum File Cache Buffers = 150
- Maximum Number of Directory Handles = 30
- Dirty Disk Cache Delay Time = 5
- Directory Cache Allocation Wait Time = 2.2 seconds
- Directory Cache Buffer Non-Referenced Delay = 30
- Maximum Interrupt Events = 100,000

If clients drop out, set the following:

- Number of Watchdog Packets = 50
- Delay Between Watchdog Packets = 10 Minutes
- Delay Before First Watchdog Packet = 20 Minutes

To monitor the dropping out of clients, set:

- Console Display Watchdog Logouts = On

Testbed Disclosure

All products used for these measurements were shipping versions available to the general public. All measurements were performed without independent verification by Ziff-Davis.

Network	100Mbps Ethernet
Clients	60
Hubs	Asante 100Mbps Ethernet
Clients per Segment	30
CPU	133MHz / 16MB Pentium
Network Adapter	IBM 100/10 PCI Ethernet Adapter (Bus 0)
Software	IBM DOS 6.3
	NetWare DOS Requester
	LSL.COM (8-3-95)
	E100BODI (5-21-96)
	IPXODI (8-8-95)
	VLM.EXE (11-08-94)
Cache	L2 = 512KB
Controller Software	PC-DOS Version 6.3 Microsoft Windows for Workgroups 3.11

Clients NET.CFG

- Checksum = 0
- Large Internet Packet = On
- PB Buffers = 10
- PBurst Read Windows Size = 64
- PBurst Write Windows Size = 64
- Cache Buffers = 64
- Cache Write = On
- Cache Buffers Size = 4096
- True Commit = Off
- Signature Level = 0

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