Performance Report

IBM Netfinity 5000 (450MHz)

Version 1.0
October 1998

IBM ®

Executive Overview

The IBM Netfinity* 5000 servers, announced worldwide in September 1998, are high-throughput, two-way SMP-capable servers that feature the Intel** 450MHz[1], 400MHz and 350MHz Pentium** II processors, which support 100MHz operations to memory. These new models expand IBM's Netfinity line of midrange servers, providing solid network performance for business-critical applications.

The 450MHz system (Model 8659-3RY) was evaluated using the following Ziff-Davis** benchmarks:

- *NetBench** Version 5.01*

- *ServerBench** Version 4.01*

- *WebBench** Version 2.0*

For comparison, the IBM Netfinity server performance laboratory also conducted measurements with the Compaq** ProLiant** 1600 and Dell** PowerEdge** 2300 systems, each configured with the 450MHz Pentium II processor. All three systems support two-way symmetrical multiprocessing (SMP) operations.

All results from these benchmarks are presented in this report.

Performance Highlights

Following are highlights of the benchmark results. Please review the more detailed information concerning competitive results later in this report.

NetBench 5.01

Under a high-end workload of 60 NetBench clients, the IBM Netfinity 5000 delivered a level of network throughput in a non-array configuration that was:

- **27 percent higher** than that of the Compaq ProLiant 1600

- **5 percent higher** than that of the Dell PowerEdge 2300

Under a high-end workload of 60 NetBench clients, the IBM Netfinity 5000 delivered a level of network throughput in a RAID-5 configuration that was:

- **32 percent higher** than that of the Dell PowerEdge 2300

- **22 percent higher** than that of the Compaq ProLiant 1600

ServerBench 4.01

ServerBench 4.01 was used to measure the performance of the IBM Netfinity 5000 and the competitors' systems as dual-processor application servers running Windows** NT Server 4.0 and providing services to Windows NT** Workstation 4.0 clients.

The IBM Netfinity 5000 achieved a peak level of transactions per second that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems in both the non-array and RAID-5 configurations.

WebBench 2.0

WebBench 2.0 was used to measure the performance of the IBM Netfinity 5000 and the competitors' systems as dual-processor Web servers running Microsoft Internet Information Server 3.0 on Windows NT Server 4.0.

Under a high-end workload of 60 WebBench clients, the IBM Netfinity 5000 delivered throughput that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems in both the non-array and RAID-5 configurations.

Under a high-end workload of 60 WebBench clients, the IBM Netfinity 5000 serviced a number of requests that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems in both the non-array and RAID-5 configurations.

Test Environments and Results

NetBench 5.01

The NetBench 5.01 Disk Mix test suite was used to measure the performance of the IBM Netfinity 5000 and the competitors' systems as single-processor file servers running Novell NetWare 4.11 with Service Pack IWSP4B. For these measurements, Windows NT Workstation 4.0 clients were used.
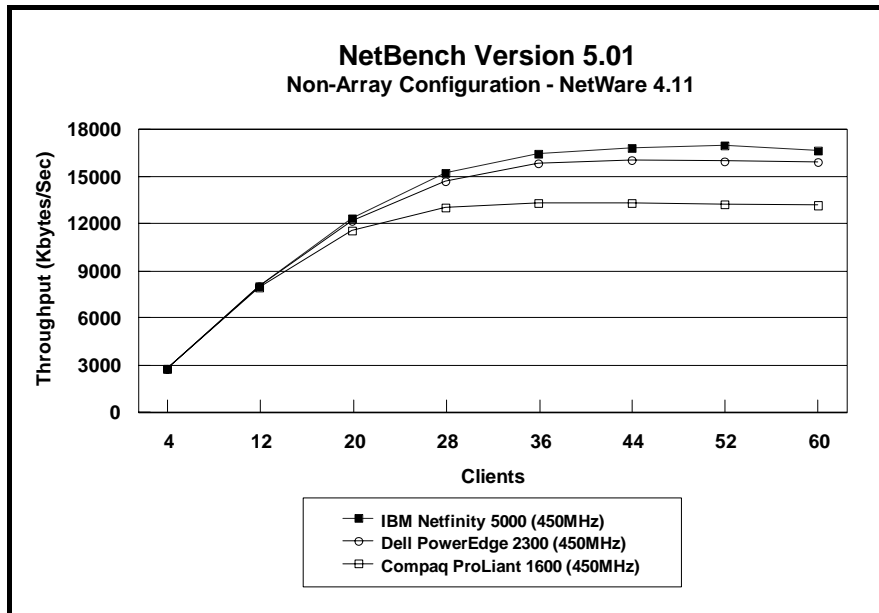
The Disk Mix test results are shown as the number of kilobytes (Kbytes) per second obtained by the server under test.

Results Summary

Non-Array Configuration

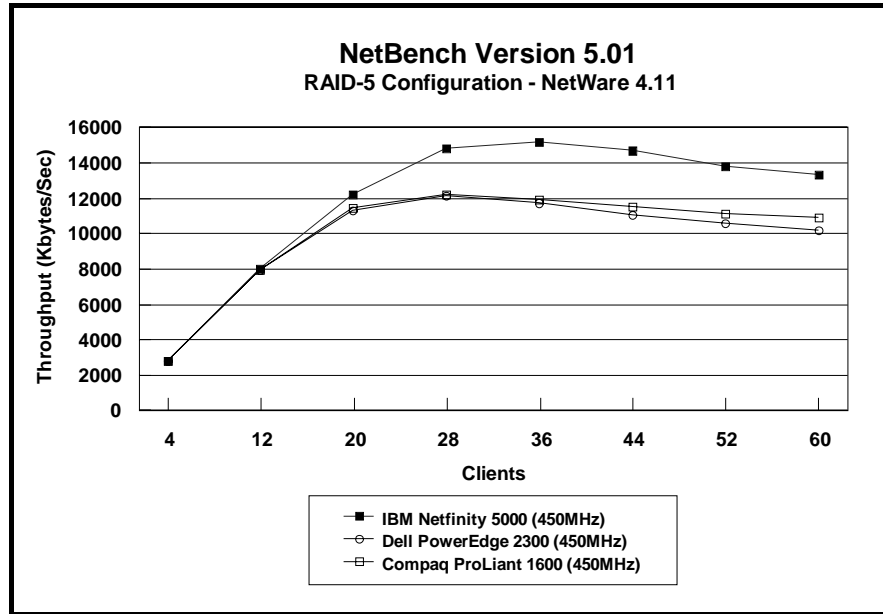Under a high-end workload of 60 NetBench clients, the IBM Netfinity 5000 provided:

- **27 percent more throughput** than the Compaq ProLiant 1600

- **5 percent more throughput** than the Dell PowerEdge 2300

NetBench Version 5.01
Non-Array Configuration - NetWare 4.11

Legend:
- IBM Netfinity 5000 (450MHz)
- Dell PowerEdge 2300 (450MHz)
- Compaq ProLiant 1600 (450MHz)

RAID-5 Configuration

Under a high-end workload of 60 NetBench clients, the IBM Netfinity 5000 provided:

- **32 percent more throughput** than the Dell PowerEdge 2300
- **22 percent more throughput** than the Compaq ProLiant 1600

NetBench Version 5.01
RAID-5 Configuration - NetWare 4.11

(Throughput (Kbytes/Sec) vs Clients chart)

Legend:
- IBM Netfinity 5000 (450MHz)
- Dell PowerEdge 2300 (450MHz)
- Compaq ProLiant 1600 (450MHz)

Measurement Methodology

The Disk Mix test suite was performed using four 100Mbps Ethernet network segments with a total of 60 IBM PC 350 200MHz Pentium-based systems as client workstations attached to the server. Each workstation ran Windows NT Workstation 4.0 and executed the NetBench 5.01 Disk Mix workload, which is based on leading Windows applications.

Each client randomly simulated the Windows for Workgroups 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, 60. Measurements were recorded each time clients were added.

Measurement Analysis

The NetBench 5.01 workload exercises the server in a manner similar to actual Windows applications executing on a networked-attached PC; that is, the NetBench 5.01 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, using

1GB of memory, in this configuration of 60 clients, the cache-hit ratio was more than 95 percent, and the cache buffer in the resource utilization was more than 90 percent. These statistics indicate a higher level of throughput. Also, 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.
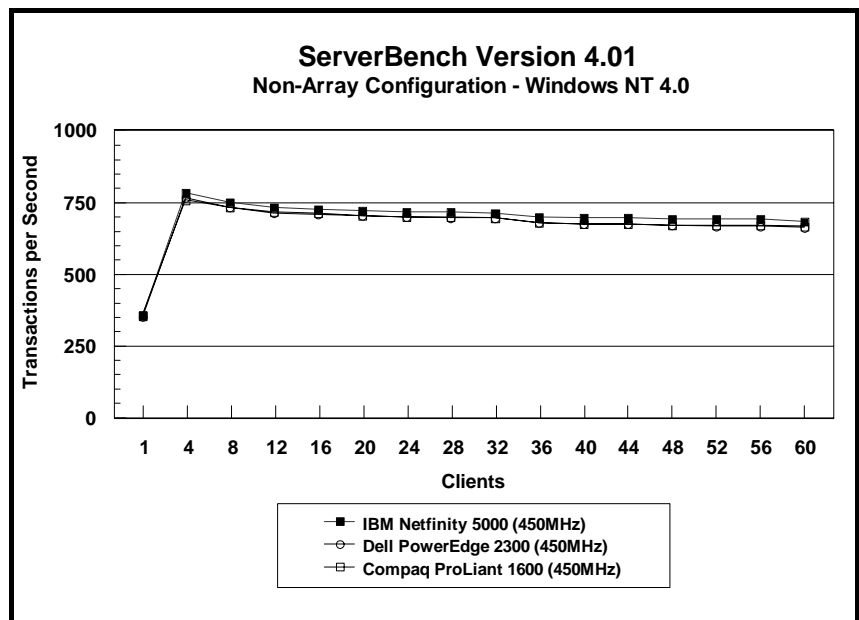
ServerBench 4.01

The ServerBench 4.01 test suite SYS_60.TST was used to measure the performance of the IBM Netfinity 5000 and the competitors' systems configured as dual-processor, application servers running Windows NT Server 4.0.

ServerBench 4.01 provides an overall transactions-per-second (TPS) score showing how well the server handles client requests for a variety of operations involving the server's processors, disk and network subsystems.
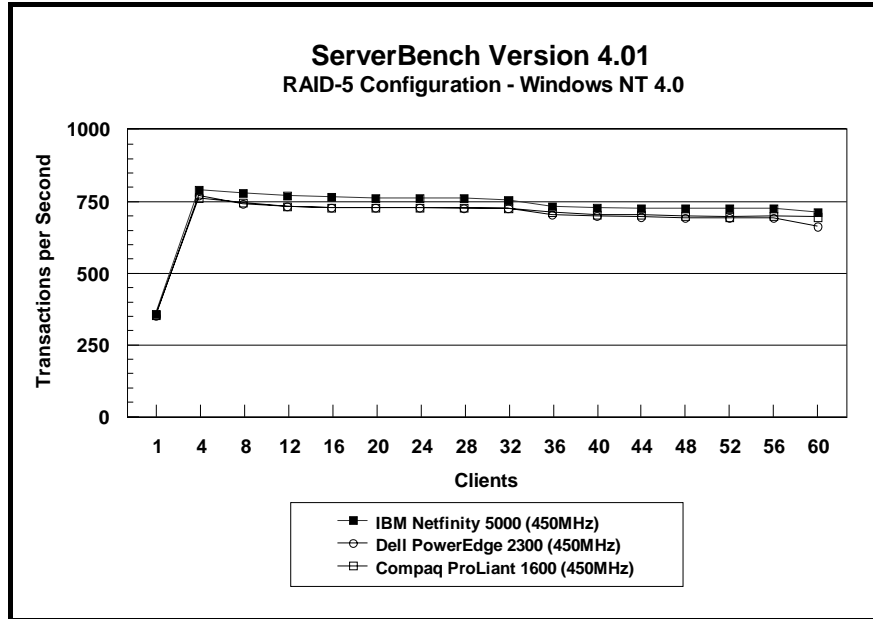
Results Summary

Non-Array Configuration

The IBM Netfinity 5000 achieved a peak level of transactions per second that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems.

ServerBench Version 4.01
Non-Array Configuration - Windows NT 4.0

RAID-5 Configuration

The IBM Netfinity 5000 achieved a peak level of transactions per second that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems.

ServerBench Version 4.01
RAID-5 Configuration - Windows NT 4.0

[Chart: Transactions per Second vs Clients]

Legend:
- IBM Netfinity 5000 (450MHz)
- Dell PowerEdge 2300 (450MHz)
- Compaq ProLiant 1600 (450MHz)

Measurement Methodology

The test suite was performed using four 100Mbps Ethernet network segments with a total of 60 IBM PC 750 166MHz systems as client workstations, which ran Windows NT 4.0 Workstation and executed SYS_60.TST. This workload includes the client/server, processor, server/client, random read, and random write requests typically made in a client/server computing environment. (The default values were used for all NT registry variables. The NT default is 'Max throughput for file sharing'.)

A transaction is a request issued by any one of the 60 clients; the TPS score is the number of transactions per second completed by the server under test. In the ServerBench environment, the server will not service the next request until it has finished the previous one. A higher TPS indicates better performance.

The clients randomly send requests to the server. These requests produce different types of loads on the server. The server performs the work by disk caching if system memory is available, or swapping mapped memory out to paged files if system memory is full.

The SYS_60.TST test suite contains a total of 16 test mixes. Measurements of transactions per second were recorded as a

weighted harmonic mean of the total TPS obtained by all clients in each test mix as clients were added. Clients were added incrementally as follows: 1, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60.

Measurement Analysis

ServerBench's server application on Windows NT provides up to 47 service threads with 60 clients, plus one thread for each server processor. For this test, the servers were configured with two processors; therefore, 49 service threads were used. A client workstation generates a request for the server to begin the next phase of a mix or to ask the server to perform some operation. The server creates a new service thread and passes that connection with the client to an I/O completion port.

As clients are added to the network, the I/O workload increases, requiring more service threads to be allocated to the clients. When all the service threads have been allocated, any new client requests cannot be serviced until an I/O completion port becomes available. Using four 100Mbps network adapters provided sufficient bandwidth to the application server.

ServerBench requires a large amount of system memory to produce a meaningful result. When workload increases gradually, the processor subsystem (processor and system memory) provides adequate service to all requests by caching them in the system memory, which is the primary factor affecting the TPS throughput.

As workload continued to increase (i.e., more clients joined the test mixes), system memory was exhausted, and the server had to rely on the disk subsystem for virtual memory. When this happened, the bottleneck shifted to the disk subsystem, and the application became disk-bound. Running ServerBench with Windows NT may result in a low cache-hit ratio because some NT system threads (e.g., cache manager's lazy writer thread, memory manager's mapped page writer thread) will automatically move some mapped memory into paged files. If a client happens to request that paged-out data again, a cache-hit-miss will result.

The exact number of clients required to move the bottleneck from the processor to the disk subsystem depends on the amount of installed system memory. In these measurements, the application was processor-bound when running from 4 to 8 clients; with more than 40 clients, the application became disk-bound.
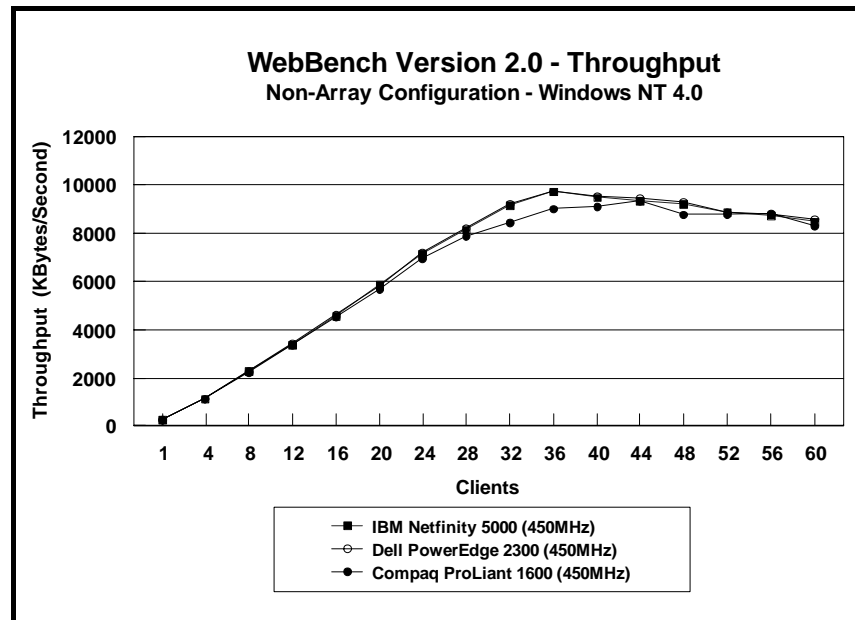
WebBench 2.0

The WebBench 2.0 test suite NT_SIMPLE_ISAPI20_V20.TST was used to measure the performance of the IBM Netfinity 5000 and the competitors' systems as dual-processor, Web servers running Microsoft Internet Information Server 3.0 on Microsoft Windows NT Server 4.0 with Service Pack 3.

This test suite performs both static HTML page requests and dynamic Internet Server API (ISAPI) requests, which are the two primary functions of an enterprise Web server running Microsoft Internet Information Server.
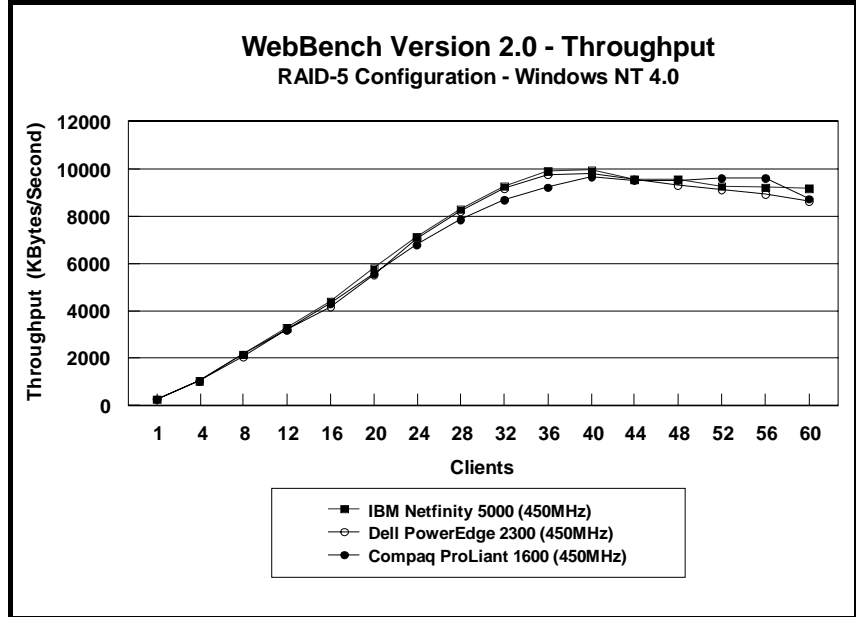
Results Summary

Throughput for Non-Array Configuration

Under a high-end workload of 60 WebBench clients, the IBM Netfinity 5000 delivered throughput that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems.

WebBench Version 2.0 - Throughput
Non-Array Configuration - Windows NT 4.0

- IBM Netfinity 5000 (450MHz)
- Dell PowerEdge 2300 (450MHz)
- Compaq ProLiant 1600 (450MHz)

Throughput for RAID-5 Configuration

Under a high-end workload of 60 WebBench clients, the IBM Netfinity 5000 delivered throughput that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems.
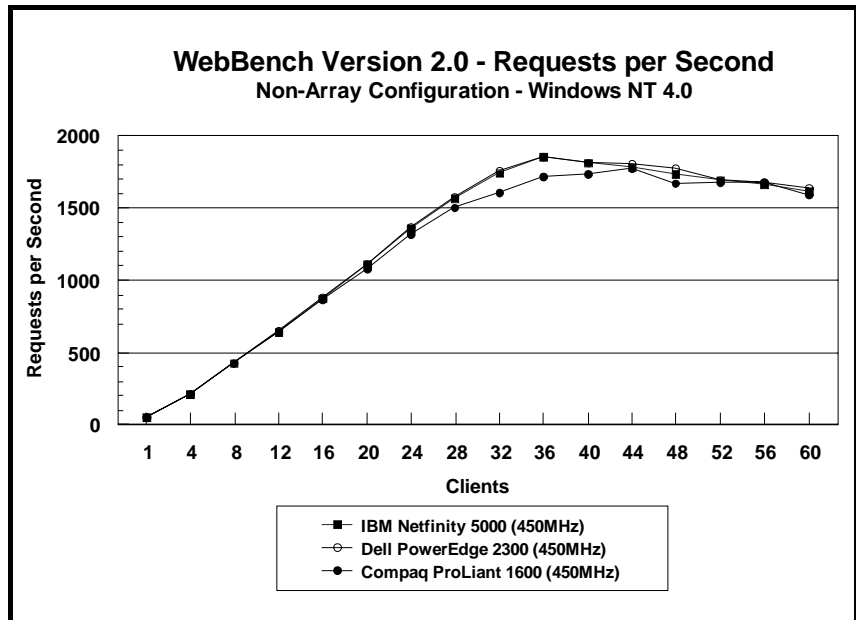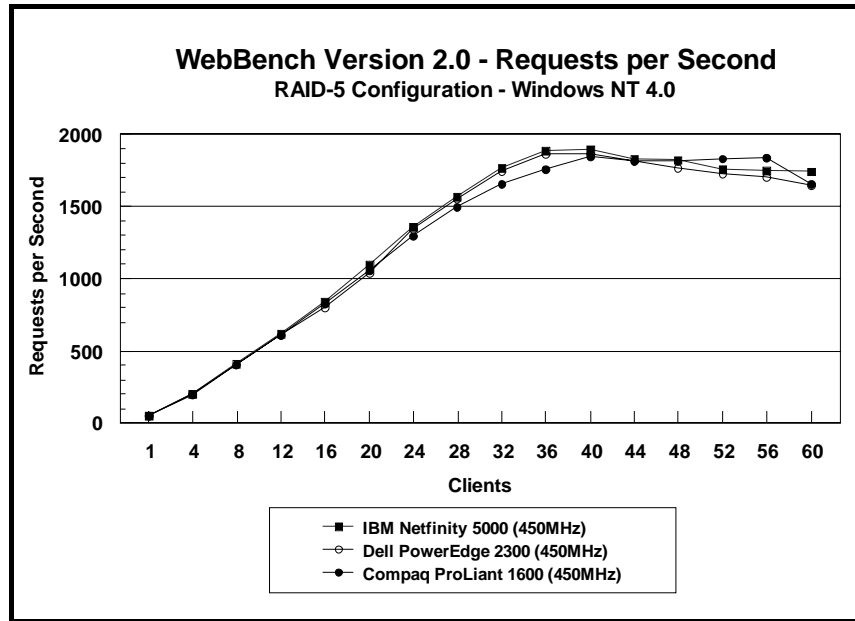
WebBench Version 2.0 - Throughput
RAID-5 Configuration - Windows NT 4.0

Requests per Second for Non-Array Configuration

Under a high-end workload of 60 WebBench clients, the IBM Netfinity 5000 serviced a number of requests that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems.

WebBench Version 2.0 - Requests per Second
Non-Array Configuration - Windows NT 4.0

Requests per Second for RAID-5 Configuration

Under a high-end workload of 60 WebBench clients, the IBM Netfinity 5000 serviced a number of requests that was **competitive** with the Compaq ProLiant 1600 and Dell PowerEdge 2300 systems.

WebBench Version 2.0 - Requests per Second
RAID-5 Configuration - Windows NT 4.0

Y-axis: Requests per Second (0, 500, 1000, 1500, 2000)
X-axis: Clients (1, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60)

- IBM Netfinity 5000 (450MHz)
- Dell PowerEdge 2300 (450MHz)
- Compaq ProLiant 1600 (450MHz)

Measurement Methodology

The servers were configured with four 100Mbps Ethernet adapters. Each adapter/segment contained 15 IBM PC 750 systems running Windows NT Workstation 4.0 for a total of 60 clients. Each client, using the WebBench 2.0 NT_SIMPLE_ISAPI20_V20.TST workload, randomly issued two types of transactions:

• Static HTML page requests, which simulates an actual Web browser, fetching predesigned HTML pages from the server using the HTTP protocol.

• Dynamic Internet Server API requests, which execute on the server and create the HTML response data, thereby using the server's processing resources.

At the beginning of the test, the controller sets up a random pattern in each client, so that all 60 clients do not request the same file at the same time.

The NT_SIMPLE_ISAPI20_V20.TST test suite contains a total of 16 mixes. Each mix uses 30 seconds as ramp-up time, 30 seconds as ramp-down time, during which measurements were not made.

Each mix runs for 300 seconds and consists of 80 percent static and 20 percent dynamic requests. 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.

After the 16 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 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.

To get a valid measure of the server's performance, the requests-per-second and the throughput scores should reach a point where they flatten out. This "flattening out" indicates that the server has been saturated, or fully loaded. In these measurements, adding clients increased the total requests-per-second and throughput scores. For the Netfinity 5000, the curve increased

from 1 to 36 clients, peaked at 40 clients (depending on whether non-array or RAID-5 was used), and then dropped off, indicating that the server had reached its saturation point. Ideally, the curves after the saturation point should remain at the same level where the server's resources (e.g., processor, 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.

Server Configurations

NetBench 5.01

Non-Array Configurations

Features	IBM Netfinity 5000 450MHz/512KB	Dell PowerEdge 2300 450MHz/512KB	Compaq ProLiant 1600 450MHz/512KB
Processor	One 450MHz Pentium II	One 450MHz Pentium II	One 450MHz Pentium II
Memory	1024MB ECC SDRAM	1024MB ECC SDRAM	1024MB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	Non-Array	Non-Array	Non-Array
Disk Drive	Five IBM 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Dell 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Compaq 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	Integrated Wide Ultra SCSI PCI Controller	Integrated Ultra SCSI PCI Controller	Integrated Wide Ultra SCSI Controller
Disk Driver	AIC7870.DSK V 4.03	AIC7870.DSK V4.03	CPQS710.DSK V2.12
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Intel Pro 100/10 Ethernet PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controllers
Bus	PCI	PCI	PCI
Network Driver	E100B.LAN V3.23	E100B.LAN V3.23	CPQNF3.LAN V2.42
Network Operating System	NetWare 4.11 with IWSP4B Loaded	NetWare 4.11 with IWSP4B Loaded	NetWare 4.11 with IWSP4B Loaded
NetWare Volume Block Size	16KB	16KB	16KB
File Compression	Off	Off	Off
Block Allocation	On	On	On
Data Migration	Off	Off	Off
NetBench Version / Test Suite	NB5.01 / Disk Mix	NB5.01 / Disk Mix	NB5.01 / Disk Mix

NetBench 5.01

RAID-5 Configurations

Features	IBM Netfinity 5000 450MHz/512KB	Dell PowerEdge 2300 450MHz/512KB	Compaq ProLiant 1600 450MHz/512KB
Processor	One 450MHz Pentium II	One 450MHz Pentium II	One 450MHz Pentium II
Memory	1024MB ECC SDRAM	1024MB ECC SDRAM	1024MB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	RAID-5	RAID-5	RAID-5
Disk Drive	Five IBM 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Dell 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Compaq 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	ServeRAID-3H Ultra2 SCSI Adapter	PowerEdge RAID II Adapter	SMART-2/DH Array Controller
Disk Driver	IPSRAID.HAM V2.81	IPSRAID.HAM V 2.81	CPQDA386.DSK V3.10
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Intel Pro 100/10 Ethernet PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controllers
Bus	PCI	PCI	PCI
Network Driver	E100B.LAN V3.23	E100B.LAN V3.23	CPQNF3.LAN V2.42
Network Operating System	NetWare 4.11 with IWSP4B Loaded	NetWare 4.11 with IWSP4B Loaded	NetWare 4.11 with IWSP4B Loaded
NetWare Volume Block Size	16KB	16KB	16KB
File Compression	Off	Off	Off
Block Allocation	On	On	On
Data Migration	Off	Off	Off
NetBench Version / Test Suite	NB5.01 / Disk Mix	NB5.01 / Disk Mix	NB5.01 / Disk Mix

ServerBench 4.01

Non-Array Configurations

Features	IBM Netfinity 5000 450MHz/512KB	Dell PowerEdge 2300 450MHz/512KB	Compaq ProLiant 1600 450MHz/512KB
Processor	Two 450MHz Pentium II	Two 450MHz Pentium II	Two 450MHz Pentium II
Memory	1024MB ECC SDRAM	1024MB ECC SDRAM	1024MB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	Non-Array	Non-Array	Non-Array
Disk Drive	Five IBM 9.1GB[2] Wide Ultra SCSI Drives (10K rpm)	Five Compaq 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Dell 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	Integrated Wide Ultra SCSI PCI Controller	Integrated Ultra SCSI PCI Controller	Integrated Wide Ultra SCSI Controller
Disk Driver	AIC789X.SYS	AIC7U2.SYS	SYMC810.SYS
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Dell 100/10 Ethernet PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controllers
Bus	PCI	PCI	PCI
Network Driver	E100BNT.SYS	E100BNT.SYS	NETFLEX3.SYS
Network Operating System	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3
System Partition Size	1GB	1GB	1GB
File System	NTFS	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default	Predefined Default
ServerBench Version / Test Suite	ServerBench 4.01 / SYS_60.TST	ServerBench 4.01 / SYS_60.TST	ServerBench 4.01 / SYS_60.TST

ServerBench 4.01

RAID-5 Configurations

Features	IBM Netfinity 5000 450MHz/512KB	Dell PowerEdge 2300 450MHz/512KB	Compaq ProLiant 1600 450MHz/512KB
Processor	Two 450MHz Pentium II	Two 450MHz Pentium II	Two 450MHz Pentium II
Memory	1024MB ECC SDRAM	1024MB ECC SDRAM	1024MB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	RAID-5	RAID-5	RAID-5
Disk Drive	Five IBM 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Dell 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Compaq 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	ServeRAID-3L Ultra2 SCSI Adapter	PowerEdge RAID II Adapter	SMART-2/DH Array Controller
Disk Driver	IPSRAIDN.SYS	PEDGE.SYS	CPQARRAY.SYS
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Dell 100/10 Ethernet PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controllers
Bus	PCI	PCI	PCI
Network Driver	E100BNT.SYS	E100BNT.SYS	NETFLEX3.SYS
Network Operating System	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3
System Partition Size	1GB	1GB	1GB
File System	NTFS	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default	Predefined Default
ServerBench Version / Test Suite	ServerBench 4.01 / SYS_60.TST	ServerBench 4.01 / SYS_60.TST	ServerBench 4.01 / SYS_60.TST

WebBench 2.0

Non-Array Configurations

Features	IBM Netfinity 5000 450MHz/512KB	Dell PowerEdge 2300 450MHz/512KB	Compaq ProLiant 1600 450MHz/512KB
Processor	Two 450MHz Pentium II	Two 450MHz Pentium II	Two 450MHz Pentium II
Memory	1024MB ECC SDRAM	1024MB ECC SDRAM	1024MB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	Non-Array	Non-Array	Non-Array
Disk Drive	Five IBM 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Dell 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Compaq 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	Integrated Wide Ultra SCSI PCI Controller	Integrated Wide Ultra SCSI PCI Controller	Integrated Wide Ultra SCSI PCI Controller
Disk Driver	AIC789X.SYS V2.10	AIC78U2.SYS V2.10	CPQ32FS2.SYS
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Intel Pro 100/10 Ethernet PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controllers
Bus	PCI	PCI	PCI
Network Driver	E100BNT.SYS	E100BNT.SYS	NETFLEX3.SYS
Network Operating System	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3
System Partition Size	1GB	1GB	1GB
File System	NTFS	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default	Predefined Default
WebBench Version / Test Suite	WebBench 2.0 / NT_SIMPLE_ISAPI20_V20.TST	WebBench 2.0 / NT_SIMPLE_ISAPI20_V20.TST	WebBench 2.0 / NT_SIMPLE_ISAPI20_V20.TST
Web Server	Microsoft Internet Information Server 3.0	Microsoft Internet Information Server 3.0	Microsoft Internet Information Server 3.0

WebBench 2.0

RAID-5 Configurations

Features	IBM Netfinity 5000 450MHz/512KB	Dell PowerEdge 2300 450MHz/512KB	Compaq ProLiant 1600 450MHz/512KB
Processor	One 450MHz Pentium II	One 450MHz Pentium II	One 450MHz Pentium II
Memory	1024MB ECC SDRAM	1024MB ECC SDRAM	1024MB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)	512KB (Write-Back)
RAID Level	RAID-5	RAID-5	RAID-5
Disk Drive	Five IBM 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Dell 9.1GB Wide Ultra SCSI Drives (10K rpm)	Five Compaq 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	ServeRAID-3H Ultra2 SCSI Adapter	PowerEdge RAID II Adapter	SMART-2/DH Array Controller
Disk Driver	IPSRAIDN.SYS	PEDGE.SYS	CPQARRAY.SYS
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Intel Pro 100/10 Ethernet PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controllers
Bus	PCI	PCI	PCI
Network Driver	E100BNT.SYS	E100BNT.SYS	NETFLEX3.SYS
Network Operating System	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3
System Partition Size	1GB	1GB	1GB
File System	NTFS	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default	Predefined Default
WebBench Version / Test Suite	WebBench 2.0 / NT_SIMPLE_ISAPI20_V20.TST	WebBench 2.0 / NT_SIMPLE_ISAPI20_V20.TST	WebBench 2.0 / NT_SIMPLE_ISAPI20_V20.TST
Web Server	Microsoft Internet Information Server 3.0	Microsoft Internet Information Server 3.0	Microsoft Internet Information Server 3.0

Test Disclosure Information

NetBench 5.01

The NetBench measurements were conducted using Ziff-Davis' NetBench 5.01 running the Disk Mix with Windows for Workgroups clients as described below:

Version: NetBench 5.01

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 IWSP4B 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 Packet Size = 1514
- Reserved Buffer Below 16MB = 200
- Maximum Service Processes = 70
- Maximum Concurrent Directory Cache Write = 200
- Dirty Directory Cache Delay Time = 3
- Maximum Concurrent Disk Cache Write = 1000
- Maximum Directory Cache Buffers = 500
- Minimum Directory Cache Buffers = 150
- Minimum File Cache Buffers = 300
- 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 = 15
- Maximum Interrupt Events = 1000
- Set Enable File Compression = Off

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 are 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	200MHz Pentium
Network Adapter	IBM 100/10 PCI Ethernet Adapter (Bus 0)
Software	Windows NT Workstation 4.0
	Network Service - Client Service for NetWare
	Network Protocol - NWLink IPX/SPX compatible Teansport - NWLink NetBIOS - TCP/IP Protocol
Cache	L2 = 256KB
Controller Software	Microsoft Windows 95 Novell Loginw 95

ServerBench 4.01

The ServerBench measurements were conducted using Ziff-Davis'
ServerBench 4.01 running the SYS_60.TST test suite with
Windows NT Workstation 4.0 as described below:

Version: ServerBench 4.01

Mixes

- System Test Mixes
- Clients: 1, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56,
  60
- Data Segment Size: 16MB
- Delay Time: 0
- Think Time: 0
- Ramp up: Default setup
- Ramp down: Default setup

Network Operating System: Windows NT Server 4.0 with Service
Pack 3

Testbed Disclosure

All products are 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	Windows NT 4.0 Workstation
Cache	L2 = 512KB
Controller Software	Microsoft Windows NT Workstation 4.0

WebBench 2.0

The WebBench measurements were conducted using Ziff-Davis' WebBench 2.0 running the NT_SIMPLE_ISAPI20_V20.TST test suite with Windows NT Workstation 4.0 clients as described below:

Version: WebBench 2.0

Mixes

- NT_SIMPLE_ISAPI20_V20.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
- Web Server: Logon Disabled

Network Operating System: Windows NT Server 4.0 with Service Pack 3

Web Server: Microsoft Internet Information Server 3.0

Testbed Disclosure

All products are 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

Notes

[1] MHz denotes the internal/external clock speed of the microprocessor only, not application performance. Many fa ctors affect application performance.

[2] When referring to hard disk capacity, GB, or gigabyte, means one thousand million bytes. Total user-accessible capacity may vary depending on operating environment.