Performance Report

IBM Netfinity 3000 (450MHz)

Version 2.0
August 1998

Executive Overview

IBM Netfinity 3000 servers deliver solid performance and excellent functionality to the entry server marketplace. Now, with the 450MHz and 400MHz models of the Netfinity 3000, your small business applications can run even faster or be upgraded to handle today's more complex business requirements. These stylish, uniprocessor systems, announced worldwide in August 1998, feature a powerful 450MHz[1] or 400MHzMHz Intel** Pentium** II microprocessor with 512KB ECC L2 cache and 100MHz operations to memory.*

*The 450MHz system (Model 8476-41U) was evaluated using the following Ziff-Davis** benchmarks:*

- *ServerBench** Version 4.01*
- *NetBench** Version 5.01*

*For comparison, the IBM Netfinity server performance laboratory also conducted measurements with the Compaq** ProSignia** 200, configured with a 300MHz Pentium II processor. The Compaq ProSignia 200 was not available with a 450MHz or a 400MHz Pentium II processor at the time of testing.*

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.

For these benchmarks, the IBM Netfinity 3000 was configured with a 450MHz/100MHz Pentium II processor, and the Compaq ProSignia 200 was configured with a 300MHz/66MHz Pentium II processor. Both systems support one processor only.

ServerBench 4.01

ServerBench 4.01 was used to measure the performance of the IBM Netfinity 3000 and the Compaq ProSignia 200 as single-processor application servers running Windows** NT Server 4.0 and providing services to Windows NT** Workstation 4.0 clients.

The peak level of transactions per second achieved by the IBM Netfinity 3000 was **84 percent higher** than that of the Compaq ProSignia 200.

NetBench 5.01

NetBench 5.01 Disk Mix for Windows for Workgroup Clients was used to measure the performance of the IBM Netfinity 3000 and the Compaq ProSignia 200 as single-processor file servers running Novell** NetWare** 4.11.

Under a high-end workload of 45 NetBench clients, the IBM Netfinity 3000 system provided **45 percent more throughput** than the Compaq ProSignia 200.

Test Environments and Results

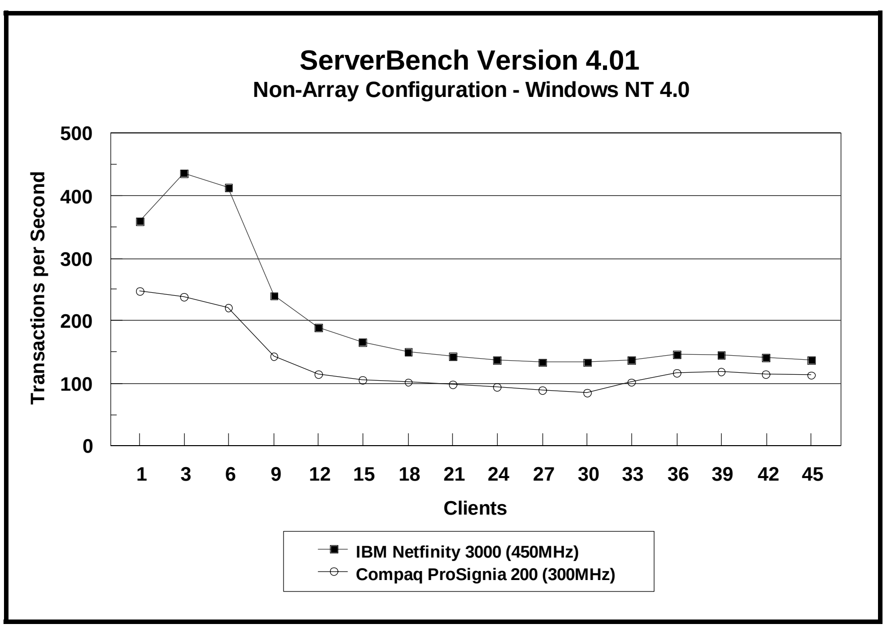
ServerBench 4.01

The ServerBench 4.01 system test suite SYS_45.TST (a modified version of the standard SYS_60.TST) was used to measure the performance of the IBM Netfinity 3000 (450MHz) and the Compaq ProSignia 200 (300MHz) systems, configured as single-processor Pentium II-based 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

The peak level of transactions per second achieved by the IBM Netfinity 3000 was **84 percent higher** than that of the Compaq ProSignia 200.



Measurement Methodology

The system test suite was performed using three 100Mbps Ethernet network segments with a total of 45 IBM PC 750 166MHz systems as client workstations attached to the server. Each workstation ran Windows NT 4.0 Workstation and executed the ServerBench 4.01 SYS_45.TST workload, modified for a network of 45 clients, which 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 45 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 for work 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_45.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, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45.

Measurement Analysis

ServerBench's server application on Windows NT provides up to 45 service threads with 45 clients, plus one thread for each server processor. For this test, the servers were configured with one processor; therefore, 46 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 three 100Mbps network adapters provided sufficient bandwidth to the application server.

ServerBench usually requires a large amount of system memory in order 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 3 to 6 clients; with more than 9 clients, the application became disk-bound.

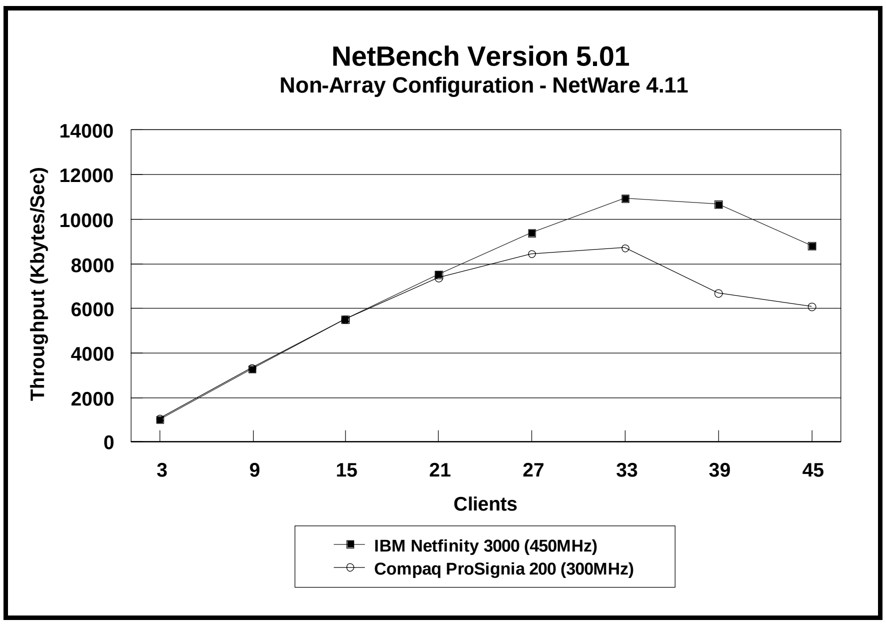
NetBench 5.01

The NetBench 5.01 Disk Mix test suite was used to measure the performance of the IBM Netfinity 3000 (450MHz) and the Compaq ProSignia 200 (300MHz) as single-processor Pentium II-based file servers running Novell NetWare 4.11 with Service Pack IWSP4B. For these measurements, Windows for Workgroups 3.11 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

Under a high-end workload of 45 NetBench clients, the IBM Netfinity 3000 system provided **45 percent more throughput** than the Compaq ProSignia 200.



Measurement Methodology

The Disk Mix test suite was performed using three 100Mbps Ethernet network segments with a total of 45 IBM PC 350 133MHz Pentium-based systems as client workstations attached to the server. Each workstation ran Windows for Workgroups 3.11 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: 3, 9, 15, 21, 27, 33, 39. 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 45 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 45 clients, we found that 128MB of memory optimized the throughput and also stressed the server 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.

Server Configurations

ServerBench 4.01

Features	IBM Netfinity 3000 450MHz/512KB	Compaq ProSignia 200 300MHz/512KB
Processor	One 450MHz Pentium II	One 300MHz Pentium II
Memory	128MB ECC SDRAM	128MB EDO/FPM
L2 Cache	512KB (Write-Back)	512KB (Write-Back)
RAID Level	Non-Array	Non-Array
Disk Drive	Three IBM 9.1GB Wide Ultra SCSI Drives (7200 rpm)	Three Compaq 4.3GB Wide Ultra SCSI Drives (7200 rpm)
Disk Drive Adapter	One Wide Ultra SCSI PCI Adapter	One Wide Ultra SCSI PCI Adapter
Disk Driver	AIC78XX.SYS	SYMC810.SYS
Network Adapter	Two IBM EtherJet 100/10 PCI Adapters and one 100Mbps Ethernet Controller Interface	Two Netelligent 100Mbps Ethernet PCI Adapters and one NetFlex-3 100Mbps Ethernet Controller Interface
Bus	PCI	PCI
Network Driver	E100BNT.SYS	NETFLX3.SYS
Network Operating System	Windows NT Server 4.0 with Service Pack 3	Windows NT Server 4.0 with Service Pack 3
System Partition Size	1GB	1GB
File System	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default
ServerBench Version / Test Suite	ServerBench 4.01 / SYS_45.TST (Modification of SYS_60.TST)	ServerBench 4.01 / SYS_45.TST (Modification of SYS_60.TST)

NetBench 5.01

Features	IBM Netfinity 3000 450MHz/512KB	Compaq ProSignia 200 300MHz/512KB
Processor	One 450MHz Pentium II	One 300MHz Pentium II
Memory	128MB ECC SDRAM	128MB EDO/FPM
L2 Cache	512KB (Write-Back)	512KB (Write-Back)
RAID Level	Non-Array	Non-Array
Disk Drives	Three IBM 9.1GB Wide Ultra SCSI Drives (7200 rpm)	Three 4.3GB Wide Ultra SCSI Drives (7200 rpm)
Disk Drive Adapter	One Wide Ultra SCSI PCI Adapter	One Wide Ultra SCSI PCI Adapter
Disk Driver	AIC7870.DSK V4.03	CPQS710.DSK V2.11
Network Adapters	Three IBM EtherJet 100/10 PCI Adapters and one 100Mbps Ethernet Controller Interface	Two Netelligent 100Mbps Ethernet PCI Adapters and one NetFlex3 100Mbps Ethernet Controller Interface
Bus	PCI	PCI
Network Driver	E100B.LAN V3.23	CPQNF3.LAN V2.42
Network Operating System	NetWare 4.11 with IWSP4B loaded	NetWare 4.11 with IWSP4B loaded
NetWare Volume Block Size	32KB	32KB
File Compression	Off	Off
Block Allocation	On	On
Data Migration	Off	Off
Disk Mix	NB5.01 / Windows for Workgroups 3.11	NB5.01 / Windows for Workgroups 3.11

Test Disclosure Information

ServerBench 4.01

The ServerBench measurements were conducted using Ziff-Davis' ServerBench 4.01 running the SYS_45.TST test suite with Windows NT Workstation 4.0 as described below:

Version: ServerBench 4.01

Mixes

- System Test Mixes
- Clients: 1, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45
- Data Segment Size: 16MB
- Segment Access Ratio: 1
- Ramp up: Default setup
- Ramp down: Default setup
- Delay: 0
- Think: 0

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

Testbed Disclosure

The Netfinity 3000 450MHz model is planned to be available September 15, 1998. All other 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	45
Hubs	3COMM 100Mbps Ethernet
Clients per Segment	15
CPU / Memory	166MHz Pentium / 64MB
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

NetBench Version 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: 3, 9, 15, 21, 27, 33, 39, 45
- 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 = 100
- Dirty Directory Cache Delay Time = 10
- Maximum Concurrent Disk Cache Write = 100
- Maximum Directory Cache Buffers = 700
- Minimum Directory Cache Buffers = 150
- Minimum File Cache Buffers = 150
- Maximum Number of Directory Handles = 30
- Dirty Disk Cache Delay Time = 5
- Directory Cache Buffer Non-Referenced Delay = 30
- Directory Cache Allocation Wait Time = 2.2 seconds

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

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Network	100Mbps Ethernet
Clients	45
Hubs	Asante 100Mbps Ethernet
Clients per Segment	15
CPU / Memory	133MHz Pentium / 16MB
Network Adapter	IBM 100/10 PCI Ethernet Adapter (Bus 0)
Software	IBM DOS 6.3 / Microsoft Windows for Workgroups 3.11
	NetWare DOS Requester
	LSL.COM (8-3-95)
	E100BODI (5-21-96)
	IPXODI (8-8-95)
	VLM.EXE (11-8-94)
Cache	L2 = 256KB
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

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Notes

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