Performance Report

IBM Netfinity 7000 M10 (500MHz)

Version 1.1

April 1999

IBM ®

Executive Overview

The newest model of the IBM Netfinity* 7000 M10 server, announced worldwide in March 1999, features the 500MHz Intel** Pentium** III Xeon** processor with 2MB L2 cache. The new server (Model 8680-8RY) was evaluated using the following benchmarks:

- *TPC Benchmark C***

- *SAP** R/3 Two-Tier Sales and Distribution (SD) Benchmark*

- *SPECweb96** Benchmark*

- *Ziff-Davis' ServerBench** Version 4.02 and NetBench** Version 5.01*

For ServerBench and NetBench, the IBM Netfinity server performance laboratory also measured a Netfinity 7000 M10 configured with the 450MHz Pentium II Xeon processor with 2MB L2 cache for comparison with the new 500MHz model.

The results of all the benchmarks mentioned are presented in this report. This report replaces Version 1.0 from March 1999.

Performance Highlights

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

TPC Benchmark C

Running Microsoft** Windows NT** 4.0 Enterprise Edition and Microsoft SQL Server 7.0 Enterprise Edition, the IBM Netfinity 7000 M10 server **delivered a transaction processing performance result of 23,640 tpmC** at a price/performance ratio of $25.20/tpmC. Total solution availability is June 30, 1999. (Results current as of March 25, 1999.)

SAP R/3 Two-Tier Sales and Distribution Benchmark

The Netfinity 7000 M10, configured with four 500MHz Pentium III Xeon processors and running the SAP R/3 Two-Tier SD Benchmark, Release 4.0 B, **achieved 221 SD Benchmark users** on Oracle 8.0.4.2 and Windows NT Server 4.0 Enterprise Edition.

SPECweb96 Benchmark

The IBM Netfinity 7000 M10 server, configured with four 500MHz Pentium III Xeon processors and 2GB of memory, **achieved 8,572 operations per second**, running IBM HTTP Server Version 1.3.3, which integrates IBM's patented Cache Accelerator with Apache Web server technology. In two-way and one-way configurations, the Netfinity 7000 M10 server achieved peak results of 6,622 and 5,959 operations per second, respectively.

ServerBench 4.02

ServerBench 4.02 was used to measure the performance of the IBM Netfinity 7000 M10 500MHz and Netfinity 7000 M10 450MHz systems as four-way application servers running Windows NT Server 4.0.

The peak level of throughput achieved by the IBM Netfinity 7000 M10 500MHz was **5 percent higher** than that of the Netfinity 7000 450MHz for RAID-0 and **6 percent higher** for RAID-5.

NetBench 5.01

NetBench 5.01 Disk Mix Windows for Windows NT Workstation 4.0 clients was used to measure the performance of the IBM Netfinity 7000 M10 500MHz and Netfinity 7000 M10 450MHz systems as single-processor file servers running Novell** NetWare** 4.11 with IWSP6 loaded.

Under a high-end workload of 60 NetBench clients, the IBM Netfinity 7000 M10 500MHz system provided network clients with a level of throughput that was similar to that provided by the Netfinity 7000 M10 450MHz system for RAID-0 and RAID-5.

Test Environments and Results

TPC Benchmark C

Results Summary

Running Microsoft** Windows NT Server 4.0 Enterprise Edition and Microsoft SQL Server 7.0 Enterprise Edition, the IBM Netfinity 7000 M10 server **delivered a transaction processing performance result of 23,640 tpmC at a price/performance ratio of $25.20/tpmC.** Total solution availability is June 30, 1999. (Results current as of March 25, 1999.)

Tested Configuration		tpmC	$ / tpmC
IBM Netfinity 7000 M10 C/S		23,640	$25.20 / tpmC
Database	Microsoft SQL Server 7.0 Enterprise Edition		
Operating System	Microsoft Windows NT Server 4.0 Enterprise Edition		
TP Monitor	IBM TXSeries V4.2 for Windows NT		
Availability Date	June 30,1999		
Configuration	Client / Server		
5-Year Cost of Ownership	$595,772		
Benchmark Revision	Rev. 3.4		

The priced configuration consisted of one IBM Netfinity 7000 M10 server with four 500MHz Pentium III Xeon processors (each with 2MB L2 cache) and 4GB[2] of memory. The configuration included twenty-five IBM Netfinity EXP15 Rack Storage Expansion Enclosures, which housed a total of 2275GB of storage to accommodate database growth over a 180-day period. Four IBM Netfinity 5000 servers, each configured with two 500MHz Pentium III processors and 384MB of memory, were used as clients connected to the Netfinity 7000 M10 via a 100BaseT Ethernet LAN. The four clients serviced the requests from a total of 19,100 emulated users.

About TPC Benchmark C

Based on an order-entry workload, the TPC-C benchmark exercises the database components used to perform a wide range of tasks of varying complexity associated with an online transaction processing (OLTP) application. The benchmark application environment is that of a wholesale supplier with many distributors. The workload consists of order-entry processing and related transactions. The metrics used are throughput as measured by the number of New-Order transactions completed per minute (tpmC) and the associated system cost per tpmC, reported as $/tpmC, and the total solution availability date.

The TPC-C performance metrics are tpmC and $/tpmC. The throughput metric, tpmC, represents the average number of New-Order transactions completed per minute during the measurement interval. The price/performance metric, $/tpmC, represents the cost of each tpmC and is determined by dividing the cost of the priced configuration by the average tpmC achieved on that system during the measurement interval. The price/performance metric encourages benchmark sponsors to test realistic system environments, and it enables readers of TPC-C results to make valid comparisons between published results. The two TPC-C metrics should be considered together.

The TPC-C specification sets forth specific guidelines to ensure that this benchmark successfully emulates a real-world application. Other factors besides the hardware platform influence the TPC-C results. These factors include the database software and operating system used, as well as the benchmark sponsor's tuning expertise. The reader should keep these factors in mind when comparing TPC-C results reported by different benchmark sponsors.

For a complete description of the benchmark and executive summaries for competitors' results, visit the TPC Web site at:
http://www.tpc.org

The TPC-C Executive Summary for the IBM Netfinity 7000 M10 is also available at IBM's Netfinity Web site at:
http://www.pc.ibm.com/us/techlink/srvperf.html

SAP R/3 Two-Tier SD Benchmark

SAP AG developed its standard application benchmarks primarily to assure the quality of its R/3 System distributed application suite, which consists of seven system components: FI for Financial, MM for materials management, SD for Sales and Distribution, PP for Production and Planning, WM for Warehouse Management, PS for Project System, and HR for Human Resources. The benchmark suite is designed to test the performance of a system of hardware, software and the R/3 System applications.

The SD module benchmark has become the most popular of the seven SAP modules for reporting the number of users supported. Because of its complexity, the SD application represents the best mix of users accessing the different modules across the database. SAP has developed a conversion factor, based on the SD benchmark score, from which a common throughput score can be derived for each of the other benchmarks.

The SAP benchmark consists of two scenarios: central, or two-tier, and distributed, or three-tier. For the central benchmark, the database server and application server run on the same physical machine. For the distributed benchmark, the database server and the application server run on different physical machines. The results presented in this report are based on the two-tier benchmark only.

Results Summary

The IBM Netfinity 7000 M10 server, running the SAP R/3 Two-Tier SD Benchmark Release 4.0 B, **achieved 221 SD Benchmark users** with 1.97 seconds average response time and a measured throughput of 66,000 dialog steps per hour, equivalent to 22,000 processed order line items per hour, with an average CPU utilization of 99 percent for the database server

The environment for this benchmark was an IBM Netfinity 7000 M10 database server using four 500MHz Pentium III Xeon processors with 2MB L2 cache each, 4GB of main memory, and 655GB of total disk space running Windows NT Server 4.0 Enterprise Edition with Service Pack 3, Oracle 8.0.4.2 and SAP's R/3 Release 4.0 B. This benchmark fully complied with SAP's issued benchmark regulations and was audited and certified by SAP. Details can be obtained from IBM and SAP AG.

These benchmarks were completed at IBM's Netfinity Server Performance Laboratory in Research Triangle Park, NC, USA, by

IBM engineers, and the results were certified with the information detailed above.

For a complete list of SAP R/3 Benchmark results, visit:

http://www.sap.com/products/techno

Click on Quickfinder and select Standard Application Benchmarks. Scroll to the bottom of the page, and click on R/3 Benchmarks - Results, Version 4.1.

SPECweb96 Benchmark

Results Summary

The IBM Netfinity 7000 M10 server continues to deliver industry-leading SPECweb96 results on Windows NT Server 4.0 in four-way, two-way and one-way Intel-based configurations.

The IBM Netfinity 7000 M10 server, configured with four 500MHz Pentium III Xeon processors with 2MB of L2 cache and 2GB of memory, **achieved 8,572 operations per second with an average response time of 13.9 milliseconds per operation**.

The IBM Netfinity 7000 M10 server, configured with two 500MHz Pentium III Xeon processors with 2MB of L2 cache and 2GB of memory, **achieved 6,622 operations per second with an average response time of 18.8 milliseconds per operation**.

The IBM Netfinity 7000 M10 server, configured with one 500MHz Pentium III Xeon processor with 2MB of L2 cache and 2GB of memory, **achieved 5,959 operations per second with an average response time of 16.5 milliseconds per operation**.

These latest Netfinity performance milestones were achieved using IBM HTTP Server Version 1.3.3 and Netfinity Web server acceleration on NT, and Alteon Networks' ACEnic Gigabit Ethernet Adapter with Jumbo Frame support, which improves bulk data transfer performance and minimizes packet-processing overhead on servers. Also used was the ACEswitch 180, a per-port-selectable 10/100/1000 Mbps switch.

Note: SPECweb96 results based on Windows NT Server 4.0 should not be compared with SPECweb96 results based on beta versions of Windows 2000**, which will not be generally available as a product until the fourth quarter of 1999. Windows 2000 contains network performance enhancements that significantly boost SPECweb96 performance.

SPECweb96, with its standardized workload and implementation, measures a system's ability to perform as a World Wide Web server for static pages. The workload simulates the accesses to a Web service provider, where the server supports multiple pages for a number of different organizations. This benchmark is useful in evaluating systems that handle millions of hits per day and multiple hits per second. SPECweb96 provides the most objective, most representative benchmarks for measuring Web server performance.

SPECweb96 defines two metrics: operations per second and average response time in milliseconds per workload. An

"operation" is an HTTP request for an HTML file or an object referenced in an HTML file.

More information about these results is available at IBM's Netfinity Web site at:
http://www.pc.ibm.com/us/techlink/srvperf.html

SPECweb96 reports for results cited in this article, as well as all other published results, are available on the World Wide Web at:
http://www.specbench.org/osg/web96

ServerBench 4.02

Ziff-Davis' ServerBench 4.02 test suite SYS_60.TST was used to measure the performance of the IBM Netfinity 7000 M10 500MHz and the Netfinity 7000 M10 450MHz systems as four-way application servers running Windows NT Server 4.0.

ServerBench 4.02 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

RAID-0 Configuration

The Netfinity 7000 M10 500MHz achieved a peak level of throughput at eight clients that was **5 percent higher** than the Netfinity 7000 M10 450MHz.
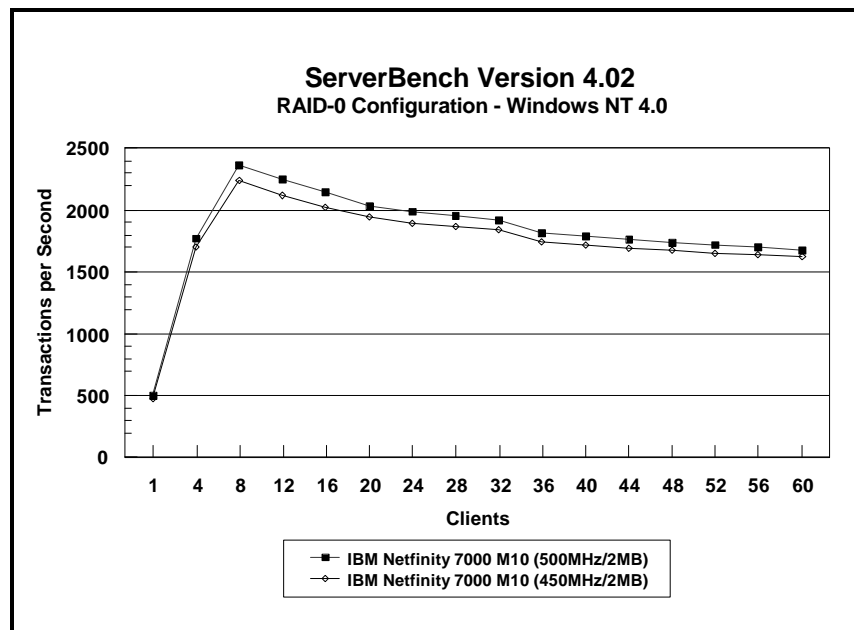
RAID-5 Configuration

The Netfinity 7000 M10 500MHz achieved a peak level of throughput at eight clients that was **6 percent higher** than the Netfinity 7000 M10 450MHz.

ServerBench Version 4.02
RAID-5 Configuration - Windows NT 4.0
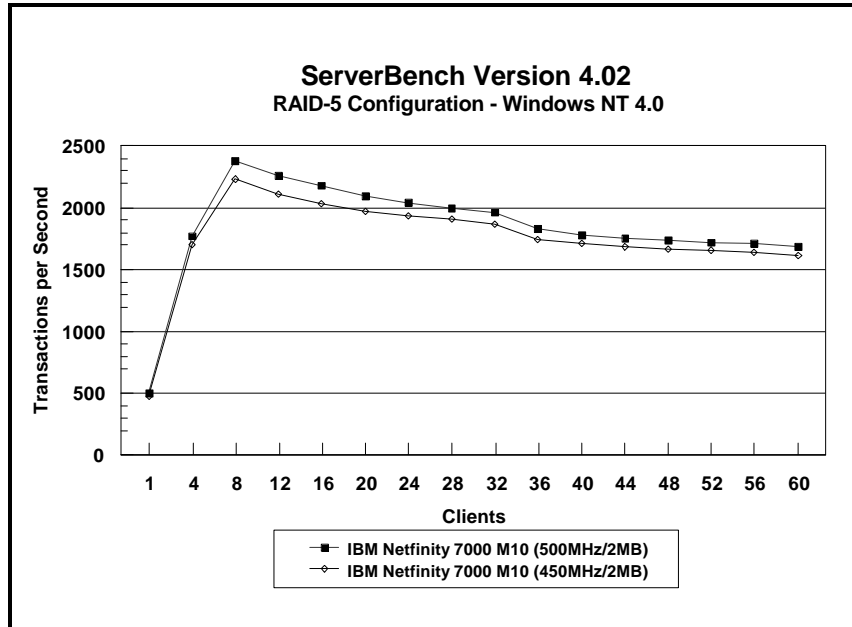
Measurement Methodology

The system test suite was performed using four 100Mbps Ethernet network segments with a total of 60 IBM PC 750 166MHz systems as client workstations attached to the server. Each workstation ran Windows NT Workstation 4.0 and executed the ServerBench 4.02 SYS_60.TST workload, 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 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. Thus, a higher number of transactions per second 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 16 test mixes. Measurements of transactions per second (TPS) 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 four processors; therefore, a total of 51 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 our measurements, the application was processor-bound when running from 4 to 8 clients; with more than 40 clients, the application became disk-bound.

NetBench 5.01

The NetBench 5.01 Disk Mix was used to measure the performance of the IBM Netfinity 7000 M10 500MHz and the Netfinity 7000 M10 450MHz systems as single-processor file servers running Novell NetWare 4.11 with Service Pack IWSP6. For these measurements, NetBench 5.01 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.
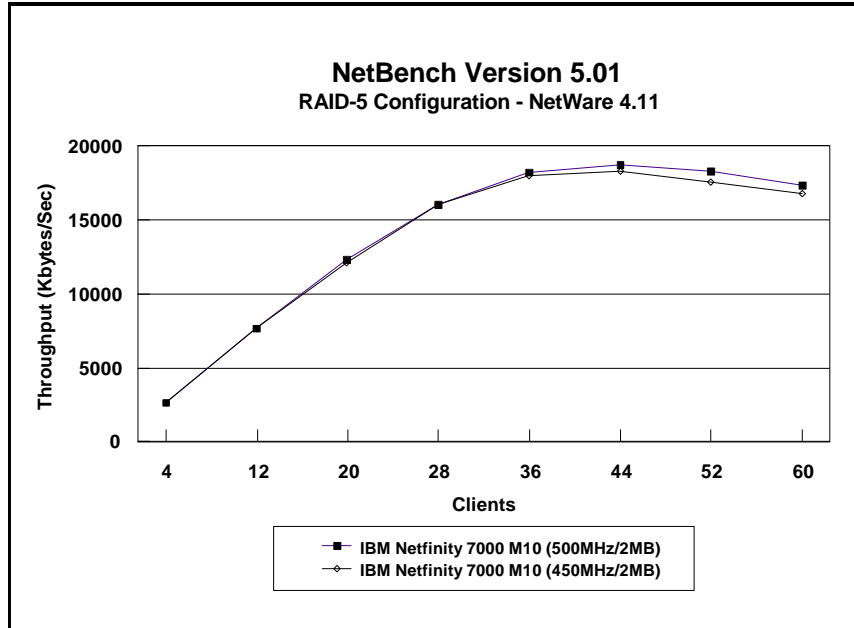
Results Summary

RAID-0 Configuration

Under a high-end workload of 60 NetBench clients, the IBM Netfinity 7000 M10 500MHz server provided network clients with a level of throughput similar to that of the Netfinity 7000 M10 450MHz server.

NetBench Version 5.01
RAID-0 Configuration - NetWare 4.11
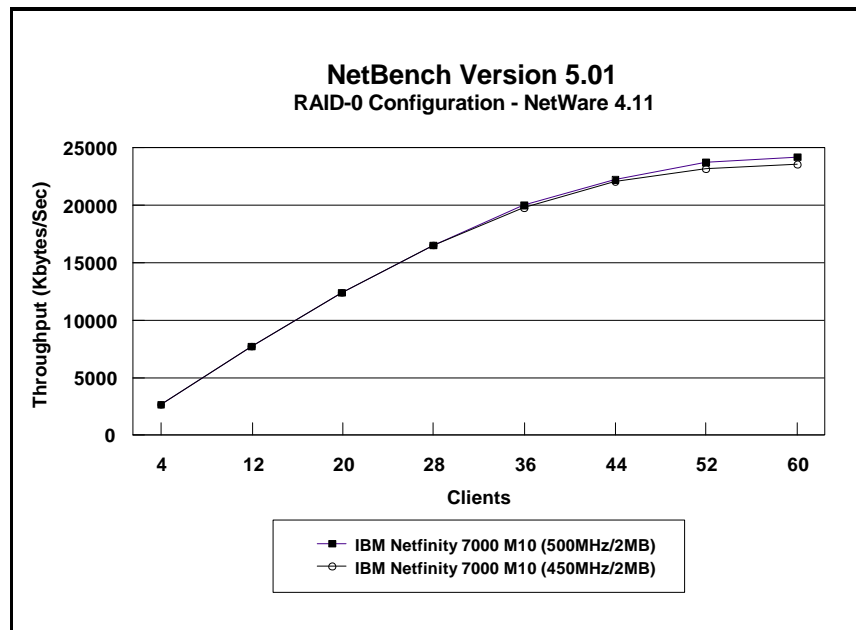
RAID-5 Configuration

Under a high-end workload of 60 NetBench clients, the IBM
Netfinity 7000 M10 500MHz provided network clients with a level
of throughput similar to that of the Netfinity 7000 M10 450MHz.

NetBench Version 5.01
RAID-5 Configuration - NetWare 4.11

Throughput (Kbytes/Sec) vs Clients

- IBM Netfinity 7000 M10 (500MHz/2MB)
- IBM Netfinity 7000 M10 (450MHz/2MB)

**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 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

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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.

Server Configurations

ServerBench 4.02

Features	IBM Netfinity 7000 M10 / 500MHz	IBM Netfinity 7000 M10 / 450MHz
Processor	Four 500MHz Pentium III Xeon	Four 450MHz Pentium II Xeon
Memory	1GB ECC	1GB ECC
L2 Cache	2MB ECC (Write-Back)	2MB ECC (Write-Back)
RAID Level	RAID-0 and RAID-5	RAID-0 and RAID-5
Disk Drives	Nine 9.1GB 10K Wide Ultra SCSI Drives	Nine 9.1GB 10K Wide Ultra SCSI Drives
Disk Drive Adapter	One ServeRAID-3H Ultra2 SCSI Adapter	One ServeRAID-3H Ultra2 SCSI Adapter
Disk Driver	ISPRAIDN.SYS	ISPRAIDN.SYS
Network Adapters	Four IBM EtherJet 100/10 PCI Adapters	Four IBM EtherJet 100/10 PCI Adapters
Bus	PCI	PCI
Network Driver	IBMFENT.SYS	IBMFENT.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
Test Suite	ServerBench 4.02 SYS_60.TST	ServerBench 4.02 SYS_60.TST

NetBench 5.01

Features	IBM Netfinity 7000 M10 / 500MHz	IBM Netfinity 7000 M10 / 450MHz
Processor	One 500MHz Pentium III Xeon	One 450MHz Pentium II Xeon
Memory	1GB ECC	1GB ECC
L2 Cache	2MB (Write-Back)	2MB (Write-Back)
RAID Level	RAID-0 and RAID-5	RAID-0 and RAID-5
Disk Drives	Nine 9.1GB 10K Wide Ultra SCSI Drives	Nine 9.1GB 10K Wide Ultra SCSI Drives
Disk Drive Adapter	One ServeRAID-3H Ultra2 SCSI Adapter	One ServeRAID-3H Ultra2 SCSI Adapter
Disk Driver	ISPRAID.HAM V2.81	ISPRAID.HAM V2.81
Network Adapters	Four IBM EtherJet 100/10 PCI Adapters	Four IBM EtherJet 100/10 PCI Adapters
Bus	PCI	PCI
Network Driver	E100B.LAN V3.63	E100B.LAN V3.63
Network Operating System	NetWare 4.11 with IWSP6 Loaded	NetWare 4.11 with IWSP6 Loaded
NetWare Volume Block Size	16KB	16KB
File Compression	Off	Off
Block Allocation	On	On
Data Migration	Off	Off
Disk Mix	NB5.01/Windows NT Workstation 4.0	NB5.01/Windows NT Workstation 4.0

Test Disclosure Information

ServerBench 4.02

The measurements were conducted using Ziff-Davis' ServerBench 4.02 running the Windows NT Workstation 4.0 clients as described below:

Version: 4.02

Mixes

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

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

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	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 5.01

The NetBench measurements were conducted using Ziff-Davis' NetBench 5.01 running the Disk Mix Windows NT Workstation 4.0 clients as described below:

Version: 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 IWSP6 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 = 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 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	60
Hubs	3COM Super Stack II Hub 100TX
Clients per Segment	15
CPU	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

Notes

[1] MHz only measures microprocessor internal clock speed, 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.