Comparison Report

File Server Comparison:

Microsoft Windows NT Server 4.0
and
Novell NetWare 5

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Contents

Executive Summary

Microsoft Windows NT Server 4.0 Is 25.5% Faster Than Novell NetWare 5 as a File Server and Has 2.7 Times Better Price/Performance

Mindcraft tested the file-server performance of Microsoft Windows NT Server 4.0 and Novell NetWare 5 on a Compaq ProLiant 1850R. We tested file sharing using TCP/IP for both servers. Table 1 shows the peak throughput measured for each system in megabits per second (Mbits/S), the price of the software tested, and the price/performance in dollars per Mbits/S.

Table 1: Summary
(larger numbers are better for Throughput, smaller numbers are better for Software Price and Price/Performance)

File Server	Peak Throughput	Software Price	Price/Performance
Windows NT Server 4.0 One-Processor ProLiant 1850R	136.9 Mbits/S	$4,949	**$36.15/Mbits/S**
NetWare 5 One-Processor ProLiant 1850R	111.2 Mbits/S	$10,035	**$90.21/Mbits/S**
Windows NT Server 4.0 Two-Processor ProLiant 1850R	176.1 Mbits/S	$4,949	**$28.11/Mbits/S**
NetWare 5 Two-Processor ProLiant 1850R	131.2 Mbits/S	$$10,035	**$76.49/Mbits/S**

For a one-processor system at peak file server performance, Windows NT Server 4.0 is 18.7% faster than NetWare 5 and its price/performance is 2.5 times better. For a two-processor system, Windows NT Server 4.0 is 25.5% faster than NetWare 5 at peak performance. Its price/performance is 2.7 times better. The most surprising result we found was that a one-processor system running Windows NT Server 4.0 performed 4.2% better than the same system with two processors running NetWare 5.

Mindcraft tested these file servers with the Ziff-Davis Benchmark Operation NetBench 5.01 benchmark. We worked closely with Microsoft and Novell to obtain the best tuning parameters for both operating systems. We avoided using tuning parameters that might be construed as "benchmark specials" because we wanted to give you a better sense of how the products would perform when you deploy them. The Products Tested section gives the detailed operating system tuning we used.

To help you interpret the significance of the NetBench test results, look at the Performance Analysis section. The Price/Performance section shows you how we calculated price/performance.

Even with the release of NetWare 5, Windows NT Server 4.0 still provides the better solution based on performance and price/performance.

Performance Analysis

Looking at the Results

The NetBench 5.01 benchmark measures file server performance. Its primary performance metric is throughput in bytes per second. The NetBench documentation defines throughput as "*The number of bytes a client transferred to and from the server each second. NetBench measures throughput by dividing the number of bytes moved by the amount of time it took to move them. NetBench reports throughput as bytes per second.*" We report throughput in megabits per second to make the charts easier to compare to other published NetBench results.

We tested file-sharing performance on Windows NT Server 4.0 and NetWare 5.0 using TCP/IP as the underlying protocol for both systems. Figure 1 shows the throughput we measured plotted against the number of test systems that participated in each data point.

Figure 1: NetBench Throughput Performance (larger numbers are better)
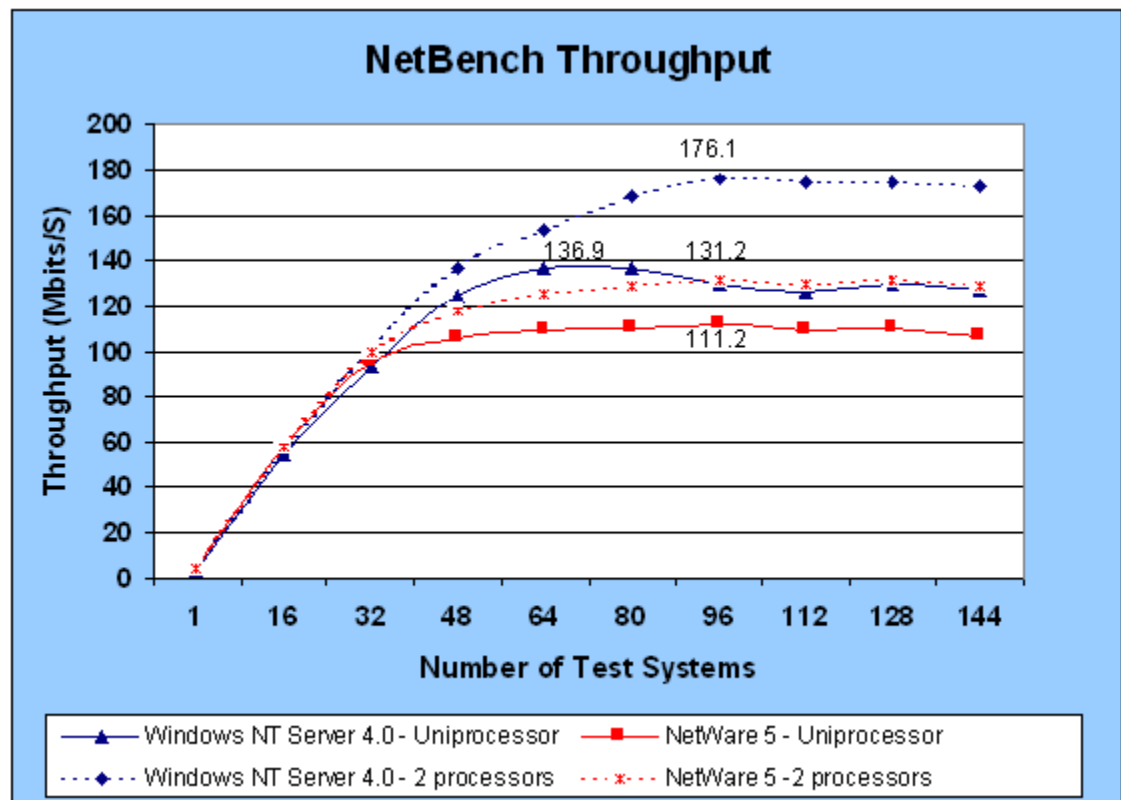
How NetBench 5.01 Works

You need to know how NetBench 5.01 works in order to understand what the NetBench throughput measurement means. NetBench is designed to stress a file server by using a number of test systems to read and write files on it. Specifically, a NetBench test suite is made up of a number of mixes. A mix is a particular configuration of NetBench parameters, including the number of test systems used to load the server. Typically, each mix increases the load on the server by increasing the number of test systems involved while keeping the rest of the parameters the same. We modified the standard NetBench NBDM_60.TST test suite in order to test each product to its maximum performance level and to make the

test run in a reasonable amount of time. For example, we used 144 test systems to make sure that each operating system achieved its maximum performance. The parameters we used are shown in NetBench Test Suite Configuration Parameters.

> *NetBench does a good job of testing a file server under heavy load. To do this, each NetBench test system (called a client in the NetBench documentation) executes a script that specifies a file access pattern. As the number of test systems is increased, the load on a server is increased. You need to be careful, however, not to correlate the number of NetBench test systems participating in a test mix with the number of simultaneous users that a file server can support. This is because each NetBench test system represents more of a load than a single user would generate. NetBench was designed to behave this way in order to do benchmarking with as few test systems as possible while still generating large enough loads on a server to saturate it.*

> *When comparing NetBench results, be sure to look at the configurations of the test systems because they have a significant effect on the measurements that NetBench makes. For example, the test system operating system may cache some or all of the workspace in its own RAM causing the NetBench test program not to go over the network to the file server as frequently as expected. This can significantly increase the reported throughput. In some cases, we've seen reported results that are 75% above the available network bandwidth. If the same test systems and network components are used to test multiple servers with the same test suite configuration, you can make a fair comparison of the servers.*

With this background, let us look at the results in Figure 1 (the supporting details for this chart are in NetBench Configuration and Results).

The three major areas to look at are:

Peak Performance

This tells you the maximum throughput you can expect from a file server. NetBench throughput is primarily a function of how quickly a file server responds to file operations from a given number of test systems. So a more responsive file server will be able to handle more operations per second which will yield higher throughput.

- For the one-processor configuration, Windows NT Server 4.0 peak performance was 136.9 Mbits/second at 64 test systems while NetWare 5 reached a peak of 111.2 Mbits/second at 96 test systems. This means that Windows NT Server's peak performance is 18.7% faster than NetWare's. The test results also show that Windows NT Server 4.0 is 14.4% faster than NetWare 5 at 96 test systems. It is interesting to note that a one-processor system running Windows NT Server 4.0 has 4.2% more throughput than the same system running NetWare 5 with two processors active.
- For the two-processor configuration, Windows NT Server 4.0 performance peaked at 176.1 Mbits/second while NetWare 5 attained a maximum throughput of 131.2 Mbits/second, both at 96 test systems. So the peak throughput of Windows NT Server 4.0 is 25.5% higher than that of NetWare 5.

Shape of the Performance Curve

How a product performs as a function of load is perhaps the most meaningful information NetBench produces. If performance drops off rapidly after the peak, users may experience significant unpredictable and slow response times as the load on the server increases. On the other hand, a product whose performance is flat or degrades slowly after the peak can deliver more predictable performance under load.

- For the one-processor configuration, both Windows NT Server 4.0 and NetWare 5 stay close to their peak performance out to 144 test systems. This means that the server can handle additional load without significant performance degradation.
- For the two-processor configuration, both Windows NT Server 4.0 and NetWare 5 continues to perform within about 2% of their peak performance out to 144 test systems. Because of the flatness of the throughput performance curve, we would expect that both products can handle even more load than we used with predictable response times.

Where Peak Performance Occurs

How quickly these products reach their peak performance depends on the server hardware performance, the operating system performance, and the test system performance. In this case, we tested a fast server platform with significantly slower clients. This test lab setup meant that small numbers of clients could not generate enough requests to utilize the server processor(s) fully. So the part of the throughput performance curve to the left of the peak does not tell us anything of interest. For the products tested the shape of the performance curves after the peaks is relatively flat but does fall off slightly. This means that we did reach the maximum performance of the products. Had the peak occurred at the last data point, we would not have known whether or not we had tested the products to peak performance.

Conclusion

Windows NT Server 4.0 offers high-performance file sharing on one- and two-processor systems. It outperforms NetWare 5 and its performance characteristics help keep users more productive and aid system administrators in providing appropriate file-server capacity.

Price/Performance

We calculated price/performance by dividing the street price of the software tested by the peak throughput measured in megabits per second. We left out the cost of the computer because the tests were run on the same system and because we assumed you were making a decision about which file server software to use.

We obtained a street price of $4,949 for a 144-user license of Windows NT Server 4.0 by requesting a quote from Source One/Microage, a value-added reseller. The quote was $779 for a 5-user license and $30/user * 139 users.

Source One/Microage also quoted us $10,035 as the street price for a 155-user license for NetWare 5 (because of the way Novell licenses NetWare 5, it is less expensive to get a license for the extra eleven users than it would be to get a license for exactly 144 users). The quote was $987 for a 5-user license, $5,649 for a 100-user license, and $3,399 for a 50-user license

Products Tested

Configuration and Tuning

We used the same Compaq ProLiant 1850R to test both Windows NT Server 4.0 and NetWare 5. Table 2 shows the system configuration we used.

Table 2: Compaq ProLiant 1850R Configuration

Feature	Configuration
CPU	2 x 400 MHz Pentium II (only one was enabled for all one-processor tests) Cache: L1: 16 KBI + 16 KB D; L2: 512 KB
RAM	1 GB 100 MHz SDRAM ECC

Disk	SMART-2/DH Array Controller, 16 MB cache, RAID 0, acceleration enabled (50% read and 50% write) with two logical drives:
	Drive C: 1.95 GB (1 x 4.3 GB Ultra Wide SCSI-2 disk disk; 2 partitions)
	   holds OS and paging file; the other partition is unused
	Drive D: 18 GB (6 x 2.1 GB Fast Wide SCSI-2 disks, 3 x 4.3 GB Ultra Wide
	    SCSI-2 disks) holds NetBench data

Networks	1 x Dual NetFlex 3 PCI Network Interface Card (2 x 100Base-TX networks)

Windows NT Server 4.0 Configuration

To run the one-processor tests, we booted the ProLiant 1850R with the uniprocessor kernel version of Windows NT Server 4.0. Similarly, we used the multiprocessor kernel for the two-processor tests.

- ▫ Windows NT Server 4.0 with Service Pack 3 installed
- ▫ SMART-2/DH driver version 1.75
- ▫ Server set to maximize file sharing
- ▫ Foreground application boost set to NONE
- ▫ Set registry entries Set registry entries
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services:

  - • Cpqnf31 and Cpqnf32\Parameters\MaxReceives = 200
  - • Tcpip\Parameters\Tcpwindowsize = 17520

NetWare 5 Configuration

To run the one-processor tests, we booted the ProLiant 1850R with the symmetric multiprocessor platform specific module (PSM) CPQMPK.PSM commented out in the STARTUP.NCF file. Similarly, we used the multiprocessor kernel for the two-processor tests. That PSM was included for the two-processor tests.

- ▫ NetWare 5 with only IP installed
- ▫ Classic NetWare file system used for the data
- ▫ Changes in STARTUP.NCF:

  - • Set maximum packet receive buffers=512
  - • Set minimum packet receive buffers=256
  - • Set maximum physical receive packet size=1514
  - • ncp packet signature option=0

- ▫ Changes in AUTOEXEC.NCF:

  - • Set enable file compression=off
  - • Set maximum concurrent disk cache writes=2000
  - • Set maximum service processes=256
  - • Set minimum service processes=128
  - • Set immediate purge of deleted files=on
  - • Set read ahead enabled=off
  - • Set enable hardware write back=on
  - • Set dirty disk cache delay time=2.3
  - • Set dirty directory cache delay time=1.2
  - • Set maximum directory cache buffers=1500
  - • Set minimum directory cache buffers=750
  - • Set directory cache allocation wait time=0.5
  - • Set directory cache buffer nonreferenced delay=10

NetWare 5 Client Configuration

We set the following parameters in the Advanced Settings for the NetWare Client 3.00:

- ▫ File Write Through = No
- ▫ Delay Writes = On
- ▫ Close Behind Ticks = 65535

We also set the following values in the registry on each client:

- ▫ HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Vxd\MSTCP\DefaultRcvWindow = "23360"

Test Lab

The Test Systems and Network Configuration

Mindcraft ran these tests using a total of 144 test systems made up of three types. Table 3, Table 4, and Table 5 show the system configurations. We used 72 Type A systems, 24 Type B systems, and 48 Type C systems.

Table 3: Type A Test Systems Configuration

Feature	Configuration
CPU	133 MHz Pentium. All are identical Mitac systems.
RAM	32 MB
Disk	1 GB IDE; standard Windows 95 driver
Network	All systems used Intel E100B LAN Adapter (100Base-TX) using e100b.sys driver version 2.02 Network software: Windows 95 TCP/IP driver.
Operating System	Windows 95, version 4.00.950

Table 4: Type B Test Systems Configuration

Feature	Configuration
CPU	133 MHz Pentium. All are identical Mitac systems.
RAM	32 MB
Disk	1 GB IDE; standard Windows 95 driver
Network	All systems used Intel E100B LAN Adapter (100Base-TX) using e100b.sys driver version 2.02 Network software: Windows 98 TCP/IP driver.
Operating System	Windows 98

Table 5: Type C Test Systems Configuration

Feature	Configuration
CPU	100 MHz Pentium. All are identical HP Vectra VL systems.
RAM	32 MB
Disk	1 GB IDE; standard Windows 98 driver
Network	All systems used DEC DE500 Fast Ethernet NIC adapter. Network software: Windows 98 TCP/IP driver.
Operating System	Windows 98

Two switched networks made up of 12 Bay Networks LS28115 switches connected the test systems to the Compaq ProLiant 1850R. Figure 2 shows the test lab configuration.

Figure 2: Test Lab Configuration
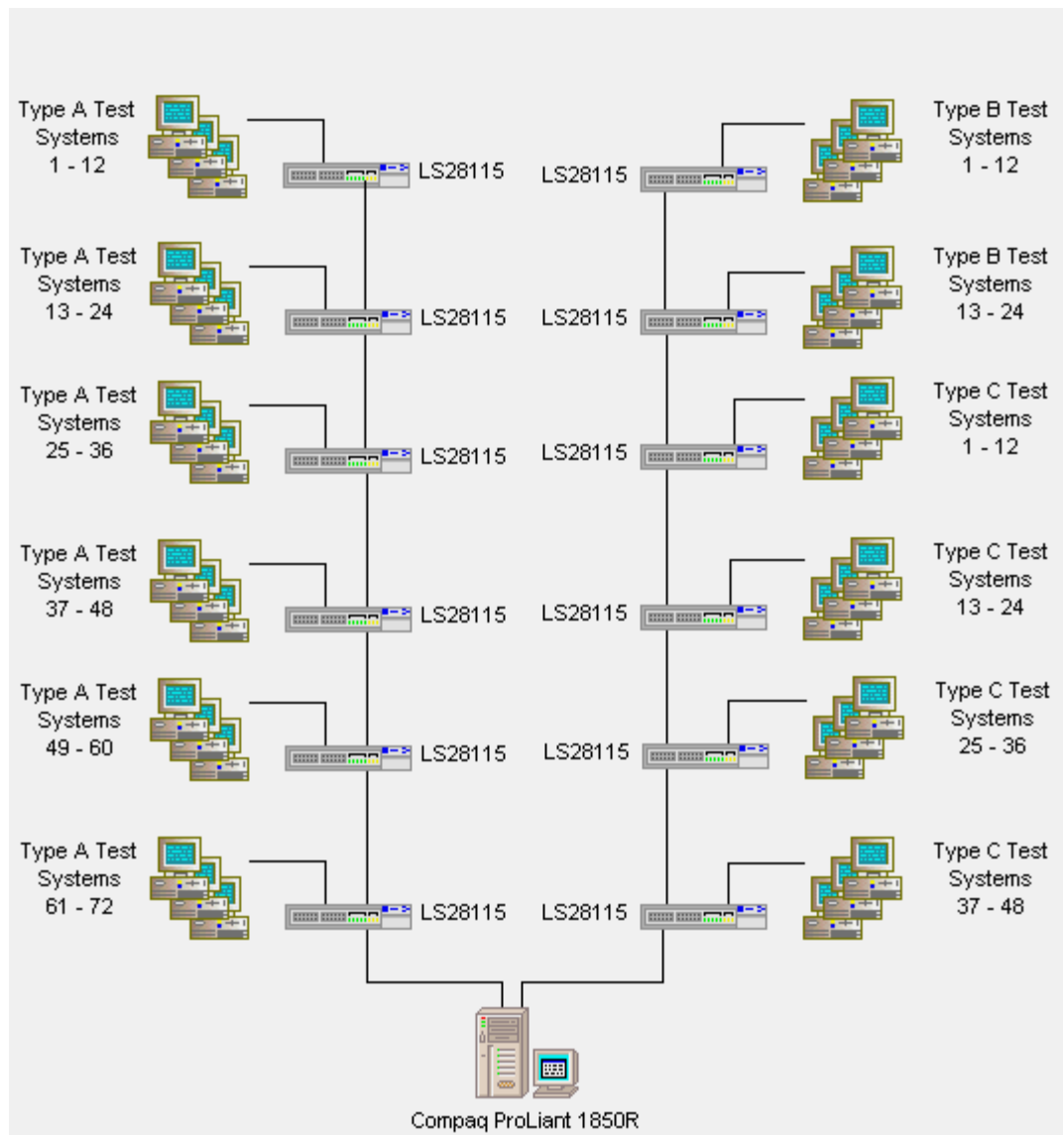
Mindcraft Certification

Mindcraft, Inc. was commissioned by Microsoft Corporation to produce an independent and unbiased assessment of the file-server performance of Windows NT Server 4.0 and NetWare 5 using NetBench 5.01. We conducted the performance tests described in this report on September 22 and 24, 1998.

Mindcraft certifies that the results reported herein represent the file-server performance of Microsoft Windows NT Server 4.0 and Novell NetWare 5 running on a Compaq ProLiant 1850R as measured by NetBench 5.01.

Our test results should be reproducible by others who use the same test lab configuration as well as the computer and software configurations and modifications documented in this report.

NetBench Configuration and Results

NetBench Test Suite Configuration Parameters

Parameter	Value	Comment
Ramp Up	1 iteration	Iteration is one complete execution of the Disk Mix script. This is the number of iterations at the beginning of a test mix during which NetBench ignores any file operations that occur.
Ramp Down	1 iteration	Iteration is one complete execution of the Disk Mix script. This is the number of iterations at the end of a test mix during which NetBench ignores any file operations that occur.
Length	3 iterations	This is the number of iterations during which NetBench measures any file operations that occur.
Delay	5 seconds	How long a test system is to wait before starting a test after it is told by the controller to start. Each test system will pick a random number less than or equal to this value to stagger the start times of all test systems.
Think Time	2 seconds	How long each test system will wait before performing the next piece of work.
Workspace	20 MB	The size of the data files used by a test system, each of which has its own workspace.
Save Workspace	Yes	The last mix has this parameter set to No to clean up after the test is over.
Number of Mixes	10	Each mix tests the server with a different number of test systems. Mix 1 uses 1 system, Mix 2 uses 8 systems, and subsequent mixes increment the number of test systems by 8.
Number of Clients	144	The maximum number of test systems available to be used by any test mix. The actual number of test systems that participate in a mix depends on the number specified in the mix definition and whether an error occurred to take a test system out of a particular mix.

Windows NT Server 4.0 on a One-Processor ProLiant 1850R

Mix Name	Clients Participating	Total Throughput (bytes/sec)	Total Throughput (Mbits/sec)
dm_1_client	1	1,399,759	3.6
dm_16_clients	16	21,275,693	54.1
dm_32_clients	32	36,928,840	93.9
dm_48_clients	48	48,863,390	124.3
dm_64_clients	64	53,825,532	136.9
dm_80_clients	80	53,504,561	136.1
dm_96_clients	96	51,125,699	130.0
dm_112_clients	112	49,660,736	126.3
dm_128_clinets	128	51,114,238	130.0
dm_144_clients	144	49,980,019	127.1

Windows NT Server 4.0 on a Two-Processor ProLiant 1850R

Mix Name	Clients Participating	Total Throughput (bytes/sec)	Total Throughput (Mbits/sec)
dm_1_client	1	1,395,784	3.5
dm_16_clients	16	21,433,259	54.5
dm_32_clients	32	39,803,117	101.2
dm_48_clients	48	53,619,584	136.4
dm_64_clients	64	60,398,111	153.6
dm_80_clients	80	66,259,945	168.5
dm_96_clients	96	69,234,756	176.1
dm_112_clients	112	68,552,318	174.3
dm_128_clinets	128	68,658,893	174.6
dm_144_clients	144	67,739,350	172.3

NetWare 5.0 on a One-Processor ProLiant 1850R

Mix Name	Clients Participating	Total Throughput (bytes/sec)	Total Throughput (Mbits/sec)
dm_1_client	1	1,537,850	3.9
dm_16_clients	16	22,779,605	57.9
dm_32_clients	32	37,306,261	94.9
dm_48_clients	48	41,420,989	105.3
dm_64_clients	64	42,705,676	108.6
dm_80_clients	80	43,147,944	109.7
dm_96_clients	96	43,740,243	111.2
dm_112_clients	112	42,884,473	109.1
dm_128_clinets	128	43,163,095	109.8
dm_144_clients	144	41,982,754	106.8

NetWare 5.0 on a Two-Processor ProLiant 1850R

Mix Name	Clients Participating	Total Throughput (bytes/sec)	Total Throughput (Mbits/sec)
dm_1_client	1	1,529,287	3.9
dm_16_clients	16	22,483,997	57.2
dm_32_clients	32	39,129,948	99.5
dm_48_clients	48	46,214,992	117.5
dm_64_clients	64	49,321,379	125.4
dm_80_clients	80	50,647,538	128.8
dm_96_clients	96	51,588,577	131.2
dm_112_clients	112	50,987,320	129.7
dm_128_clinets	128	51,518,476	131.0
dm_144_clients	144	50,735,956	129.0

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