



## Open Benchmark Phase 3: Windows NT Server 4.0 and Red Hat Linux 6.0

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### White Paper Contents

## Phase 3 Results

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In Phase 3 of the Open Benchmark both Red Hat and Microsoft were free to use the latest software available and to make other configuration changes to the same Dell PowerEdge 6300/400 server used in Phases 1 and 2. Also, we tested both one- and four-processor configurations of the Dell server.

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For Phase 3 Mindcraft used the same version of Windows NT Server 4.0 as in Phases 1 and 2. Red Hat chose to use Red Hat Linux 6.0 upgraded to the 2.2.10 kernel. See the [Products Tested](#) section below for other software, hardware and configuration changes.

The other significant change in Phase 3 was the use of both Windows 95 and Windows NT NetBench clients for the file-server tests.

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### File-Server Performance

[Figure 1](#) shows the file-server performance we measured and the scaling between one- and four-processor configurations. Linux file-server performance on a four-processor system increases by 43% over a one-processor system. Windows NT Server, on the other hand, improves performance on a four-processor system by 105% over a one-processor system.

### Related Article

Figure 1: File Server Performance in Phase 3  
(larger numbers are better)

- [PC Week's Story](#)

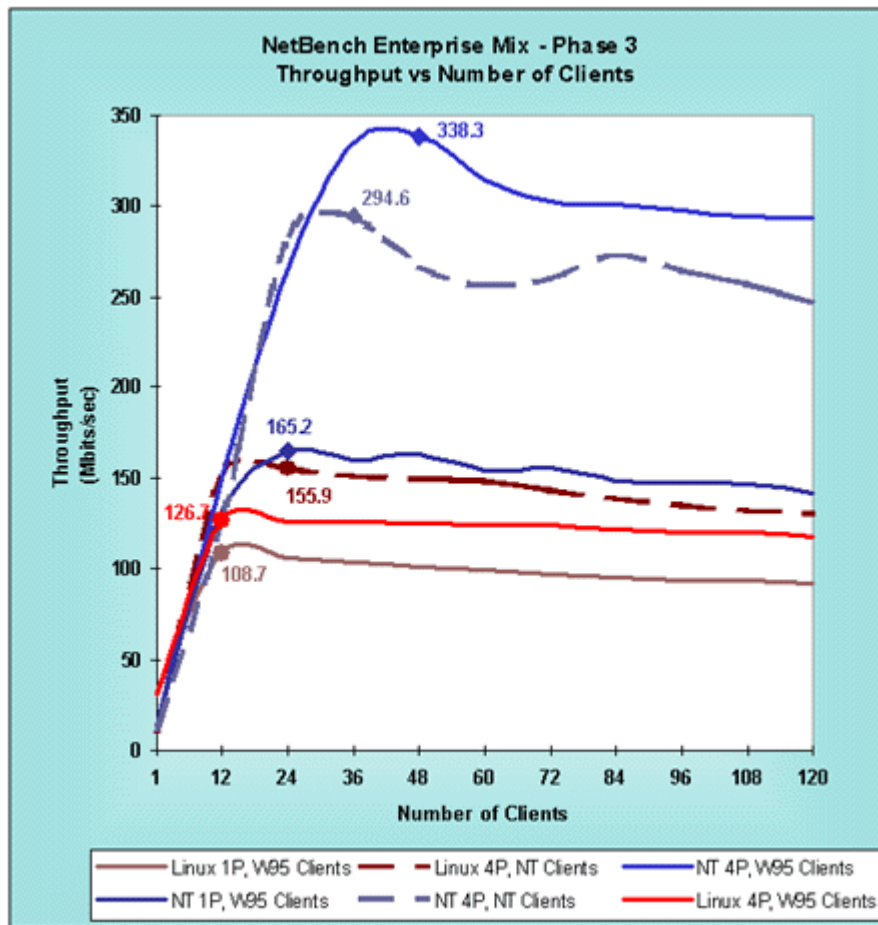


Figure 1 shows that even the one-processor configuration running Windows NT Server is a faster file server than any of the Linux configurations. Table 1 summarizes the Windows NT Server speed advantage over Linux.

Table 1: File Server Speed Advantage of Windows NT Server over Linux

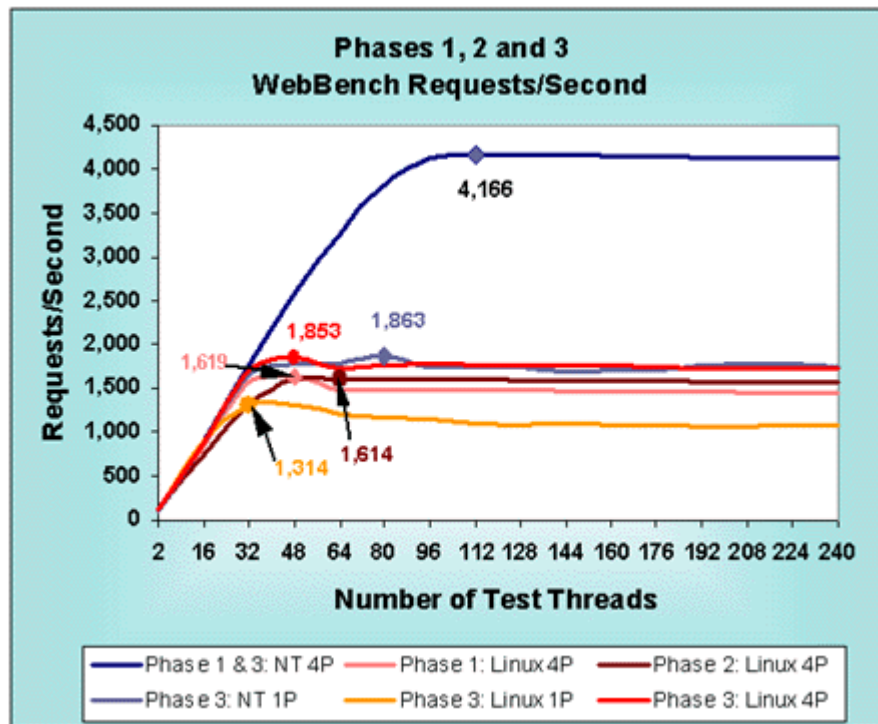
# of Processors	Client Type	Windows NT Is Faster Than Linux By
1	Windows 95	1.5 times
4	Windows NT	1.9 times
4	Windows 95	2.7 times

**Web-Server Performance**

Figure 2 shows the Web-server performance for all of the phases. It shows that Red Hat was able to achieve 14% better performance in Phase 3 than in Phase 2. This was accomplished by using Linux 2.2.10 and different tuning for Apache, including static file caching. See the Products Tested section below for the details.

The Web-server tests show that Windows NT Server is 2.2 times faster than Linux 2.2.10/Apache 1.3.6 on a four-processor server and 1.4 times faster on a one-processor server.

Figure 2: Web Server Performance in Phases 1, 2 and 3 (larger numbers are better)



The performance scaling differences between Linux and Windows NT Server are even more pronounced for Web servers. Linux increases four-processor system performance by 42% over a single processor system. This compares to the 124% performance scaling improvement Windows NT Server demonstrates.

## Performance Analysis

### File Server Performance Analysis

If you have not already read the [Looking at NetBench Results](#) in the Phase 1 and 2 document, it may help you understand this analysis. The supporting details for [Figure 1](#) are in the [NetBench Configuration and Results](#) part of this white paper.

The Windows NT Server 4.0 file-server peak performance increased between Phase 1 and Phase 3 primarily because we partitioned the RAID into four 7 GB partitions. This greatly reduced contention for the critical log file resource of the NT File System. Partitioning makes sense in real-world situations because it allows for more efficient system administration.

As a result of the partitioning, the four-processor Windows NT file-server performance increased over that in Phase 1 by about 9% with Windows 95 clients. When we switched to Windows NT clients, Windows NT Server turned in 294.6 Mbits/second of throughput, about 13% slower than with Windows 95 clients. Nevertheless, Windows NT Server still outperformed Linux/Samba by 1.9 times when both were tested using Windows NT clients.

The Red Hat engineers made several significant server configuration changes in addition to the Linux upgrade including:

- Replacing the RAID controller with another SCSI controller.
- Creating a software RAID 0 logical drive of 4 GB spread across eight disks for the NetBench data.

The four-processor Linux/Samba test results using Windows 95 clients show that these configuration changes made no performance difference when compared to Phase 2. Thus, the Linux/Samba performance bottleneck is somewhere other than the disk subsystem. We believe the major reasons for the poor Linux/Samba performance are:

1. A single threaded TCP stack;
2. Large-grained locking in the kernel; and
3. Samba running in user space.

The shapes of the performance curves for both Windows NT Server 4.0 and Linux/Samba indicate that we reached peak performance and went beyond it. Performance for both Windows NT Server 4.0 and Linux/Samba degrades slowly as the load is increased past the peak performance load. So both systems should deliver predictable performance even under overload conditions.

## Web-Server Performance Analysis

If you have not already read the [Looking at WebBench Results](#) in the Phase 1 and 2 document, it may help you understand this analysis.

We used the standard WebBench zd\_static\_v20.tst test suite, modified to increase the number of test threads to 240 (120 system with 2 threads each) for Phase 3.

The supporting details for [Figure 2](#) are in the [WebBench Configuration and Results](#) part of this white paper.

The Linux/Apache configuration changes in Phases 3 improved the four-processor performance by 15% over Phase 2. We believe that most of this improvement came from memory mapping (caching) the data files in Apache and from the Apache "top fuel" patch.

Mindcraft used its Phase 1 four-processor Windows NT WebBench results instead of re-running the test for Phase 3. [Figure 2](#) shows the Windows NT one-processor Web server performance matches that of the Linux four-processor configuration.

## Products Tested

We used the same [Dell PowerEdge 6300/400 server](#) that was used in Phases 1 and 2.

## Software Products and Tuning

### Windows NT Server 4.0 File-Server Configuration

We tested using Windows NT Server 4.0 Enterprise Edition with Service Pack 4 installed. We made the following configuration and tuning changes:

- Used 1024 MB of RAM (set maxmem=1024 in boot.ini)
- Server set to maximize throughput for file sharing
- Foreground application boost set to NONE
- Set registry entries:
  - HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services:
    - \NDIS\Parameters\ProcessorAffinityMask=0
    - Tcpip\Parameters\Tcpwindowsize = 65535
    - \lanmanserver\parameters\InitWorkItems=256

- \lanmanserver\parameters\MaxWorkItems=256
- \lanmanserver\parameters\SizReqBuf=16644
- \lanmanserver\parameters\LinkInfoValidTime=10000
- \lanmanserver\parameters\MaxWorkItemIdleTime=1800
- Used the NIC control panel to set the following for all four NICs:
  - Receive Buffers = 200 (default is 32; this setting is under "Advanced Settings")
  - NIC speed = 100 Mbit (default is "auto")
  - Duplex=full (default is "auto")
- Spooler service was disabled
- Page file size set to 1012 MB on the same drive as the OS
- The RAID file systems were formatted with 16 KB allocation unit size (the /a option of the format command) and an NTFS file system. The RAID was divided into four 7 GB partitions and the NetBench data was equally divided among the partitions
- Increased the file system log on each RAID file system to 65536 K using the chkdsk f: /l:65536 command
- Used the affinity tool to bind one NIC to each CPU  
(<ftp://ftp.microsoft.com/bussys/winnt/winnt-public/tools/affinity/>) only for the four-processor configuration

## Windows NT Server 4.0 Web-Server Configuration

- Used Internet Information Server 4 (IIS 4) as the Web server
- Used the NIC control panel to set the following for all four NICs:
  - Coalesce Buffers = 32 (default is 8)
  - Receive Buffers = 1023
  - Transmit Control Blocks = 80 (default is 16)
  - Adaptive Transmit Threshold = on (default is on)
  - Adaptive Technology = on (default is on)
  - Adaptive Inter-Frame Spacing = 1 (default is 1)
  - Map Registers = 64 (default is 64)
- SMTP, FTP, MSDTC, and Browser services were disabled
- Set registry entries:  
HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services:
  - \InetInfo\Parameters\ListenBackLog=200
  - \InetInfo\Parameters\ObjectCacheTTL=0xFFFFFFFF
  - \InetInfo\Parameters\OpenFileInCache=0x5000
- Using the IIS Manager
  - Set Logging – "Next Log Time Period" = "When file size reaches 100 MB"
  - Set performance to "More than 100,000"
  - Removed all ISAPI filters
  - Removed all Home directory application mappings except .asp
  - Removed permissions for "Application Settings"
- The RAID file system was formatted with 16 KB allocation unit size (the /a option of the format command) and an NTFS file system.
- Increased the file system log on each RAID file system to 65536 K using the chkdsk f: /l:65536 command
- Logs on the F: drive (RAID) along with the WebBench data files
- Server set to maximize throughput for applications when doing WebBench tests
- The other tunes for the file-server configuration were kept

## Linux 2.2.10 Configuration

The Red Hat engineers started with Red Hat Linux 6.0 and upgraded it to the Linux 2.2.10 kernel. They also made the following configuration and tuning changes:

- Used 1024 MB of RAM (set mem=960M in lilo.conf)

- Used a buffer.c patch
- Used an new eepr0100 driver
- Made changes to tpc.c

We have included a separate Web page with all of the [Linux configuration files](#) Red Hat used.

### Samba 2.0.3 Configuration

- Used the pre-compiled version of Samba 2.0.3
- Started Samba manually before each test
- Used a software RAID 0 on 8 disks. Added another SCSI controller to do this

We have included a separate Web page with the [Samba configuration files](#) Red Hat used.

### Apache 1.3.6 Configuration

- Compiled Apache 1.3.6 using gcc version 2.7.2.3 and glibc 2.0.7
- Started Apache manually before each test
- Used mod\_mmap\_static module to pre-load all files in Apache

We have included a separate Web page with the [Apache configuration files](#) Red Hat used.

## The Test Lab

We used the same test lab configuration for Phase 3 that we used for Phases 1 and 2. The only change made was to run Windows NT Workstation 4.0 on the clients for the appropriate NetBench tests.

[← Phases 1 and 2](#)

[FAQ](#)

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