White Paper

Balanced Performance in a Departmental Server: An Evaluation of the IBM Netfinity 5500 and the Compaq ProLiant 3000

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IBM ®

Introduction

Compaq's Performance Claim

In May, Compaq announced a new ProLiant[**] 3000 server, describing it as the "industry's only server with a 333MHz[1] Intel[**] Pentium[**] II processor capable of supporting up to 3GB of system memory."

Note: They were able to achieve the 3GB memory capacity by using the Reliance Corporation's Champion[**] 1.0 chip set.

In their press release, they state:

"The Compaq ProLiant 3000 provides customers with the best departmental-class Intel Pentium II application performance as shown recently in a certified Transaction Processing Performance Council (TPC) benchmark. Compaq posted a world record-setting benchmark result of 8,228.4 transactions per minute (tpmC) at just $30.82/tpmC for the ProLiant 3000 running Microsoft[**] SQL Server 6.5 and Windows[**] NT Server 4.0 – the best performance and leading price/performance of any Intel-based or RISC-based dual-processor system."

In associated product description literature, Compaq claimed:

"The Compaq ProLiant 3000 delivers performance and expandability levels that customers won't outgrow. This high-performance server uses the latest in processor and system architecture technology to deliver best-in-class performance while providing increased expansion capabilities to meet the ever-increasing requirements of high-volume file services or entry-level applications... . The new Compaq ProLiant 3000 is an affordable departmental server delivering record-breaking performance and ultimate levels of expandability. The ProLiant 3000 is designed as a departmental or branch office server for Internet/Intranet, file/print and database application functions."

Compaq's claim that the ProLiant 3000's support of 3GB memory enables it to provide customers with the "best-in-class performance" raises several questions:

- What is a departmental server, and what kinds of computing jobs is it designed to perform?

- What constitutes the best balance of processor power, memory, I/O and network resources to enable a departmental server to provide "best-in-class" performance?

- What does it mean to be truly "best in class"?

These are some of the questions that we will address in this report.

Reason for This Study

To help customers in making buying decisions, we conducted a study in which we evaluated the performance of the new 3GB model of the Compaq ProLiant, along with the new IBM* Netfinity* 5500, announced worldwide in April 1998 and generally available June 30, 1998. Designed as a departmental server, the Netfinity 5500 supports a maximum of 1GB of memory today with a planned upgrade path to the Intel Slot 2 processor and support for a maximum of 2GB of memory. At the time of this report, Compaq had not announced a departmental server with upgrade capability to 100MHz Slot 1 or Slot 2.

For this study, we used two industry-standard benchmarks:

- WebBench** 2.0, which performs both static HTML page requests and dynamic Common Gateway Interface (CGI) script requests – these are the two main functions of an enterprise Web server.

- NetBench** 5.01, which measures a system's ability to handle I/O operations as a file server.

We did not measure the Netfinity 5500 using the TPC-C benchmark, and here is the reason: According to the Transaction Processing Performance Council, the "TPC Benchmark C is an OLTP workload. It is a mixture of read-only and update-intensive transactions that simulate the activities found in complex OLTP application environments... ." Departmental-class servers are not typically used in complex OLTP application environments, which require a server to support large memory and disk configurations

as well as the high-availability features that provide fault tolerance to protect data.

The Netfinity 5500 offers many high-availability features (e.g., hot-plug PCI, onboard RAID), but it was not designed to functionally support the large memory and disk configurations required to run the TPC-C benchmark. A look at Compaq's product description for the ProLiant 3000 shows that their server does not offer the high-availability features usually required to support the kind of large memory and disk capacity reflected by the TPC-C benchmark configuration that they measured. For example, the ProLiant 3000 does not support hot-plug PCI, onboard RAID, or redundant network adapters.

The goal for our study was to determine which system offers the balanced performance needed for file-serving and web-serving applications, which are most likely to be found in departmental and branch office environments. Each system was configured with the maximum amount of memory supported; that is, the Compaq ProLiant 3000 was configured with 3GB of memory, and the IBM Netfinity 5500 was configured with 1GB of memory. The results of the study are presented in this report.

Test Environments and Results
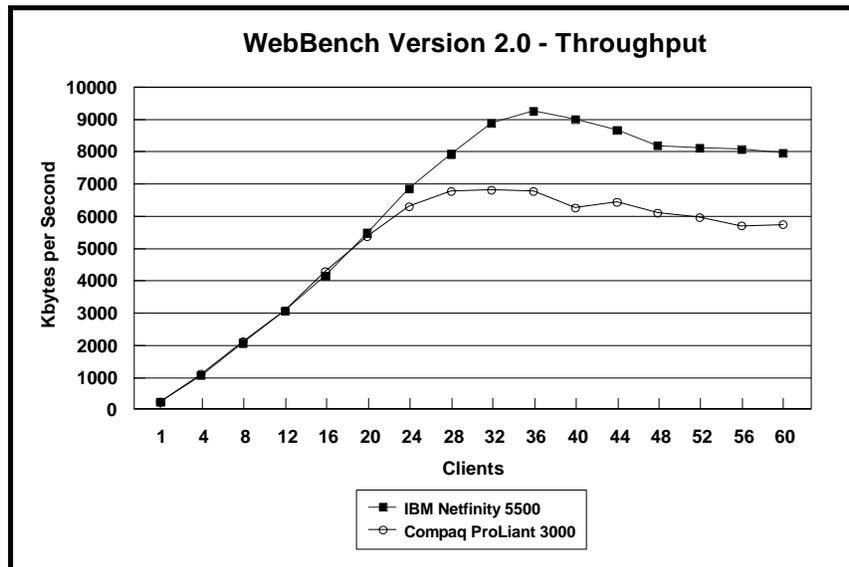
Results Summary

WebBench 2.0

The Ziff-Davis[**] WebBench 2.0 system test suite
NT_SIMPLE_ISAPI20_V20.TST was used to measure the
performance of the IBM Netfinity 5500 and the Compaq ProLiant
3000 systems, configured as 2-way Pentium II-based Web servers
running Microsoft Internet Information Server 3.0 on Microsoft
Windows NT Server 4.0 with Service Pack 3.

This system test suite performs both static HTML page requests
and dynamic Common Gateway Interface (CGI) scripts requests,
which are the two primary functions of a Web server.

Throughput

With a workload of 60 WebBench clients, the IBM Netfinity 5500
delivered **38 percent more throughput** than the ProLiant 3000.

Requests per Second

With a workload of 60 clients, the IBM Netfinity 5500 serviced **38 percent more requests per second** than the ProLiant 3000.

WebBench Version 2.0 - Requests per Second
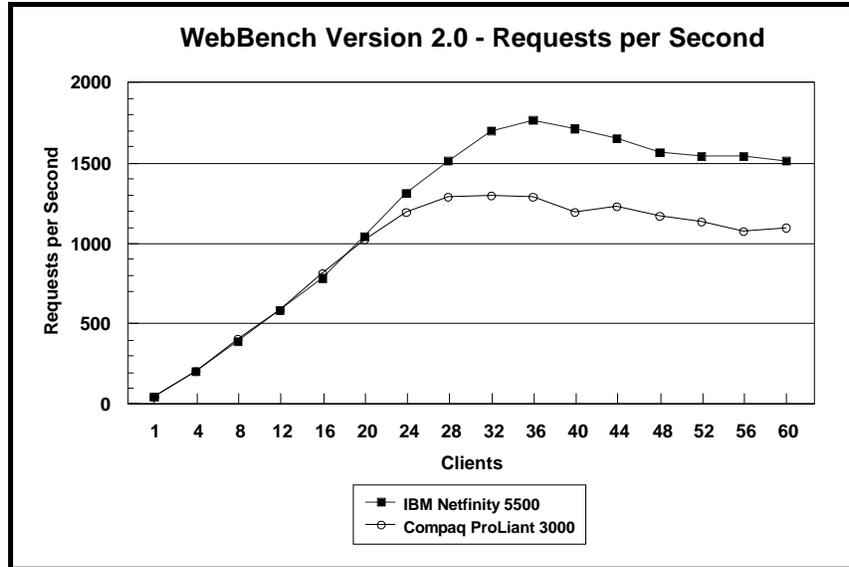
NetBench 5.01

The Ziff-Davis NetBench 5.01 Disk Mix was used to measure the performance of the IBM Netfinity 5500 and the Compaq ProLiant 3000 systems, configured as 2-way Pentium II-based file servers running Microsoft Windows NT Server 4.0.

With a workload of 52 clients, the IBM Netfinity 5500 provided **25 percent more throughput** than the Compaq ProLiant 3000.

NetBench Version 5.01 - Throughput
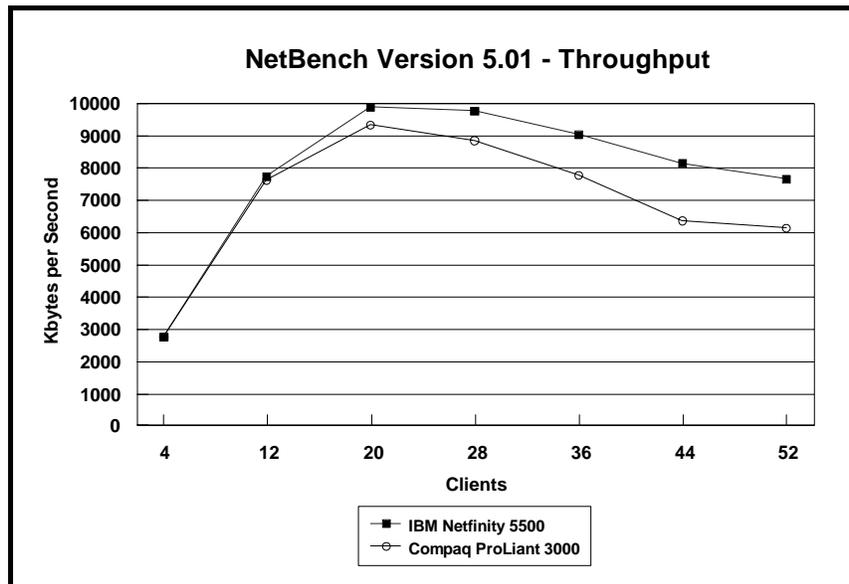
WebBench 2.0

For WebBench 2.0, four 100Mbps Ethernet network segments with a total of 60 client workstations attached to the server were used.

Each workstation ran Windows NT Workstation 4.0 and executed the WebBench 2.0 NT_SIMPLE_ISAPI20_V20.TST workload, which includes HTML pages requests and Common Gateway Interface (CGI) requests, two of the primary functions of a web server.

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. The NT_SIMPLE_ISAPI20_V20.TST test suite contains a total of 16 mixes.

NetBench 5.01

The Disk Mix test suite was performed using four 100Mbps Ethernet network segments and a total of 52 client workstations attached to the server under test. 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 NT Workstation 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.

Measurement Analysis

The IBM Netfinity 5500 outperformed the ProLiant 3000 as a true departmental-class server. The measured systems were configured and tuned identically except for the amount of installed memory. Each was configured with the maximum amount of memory it could support: the ProLiant 3000 with 3GB and the Netfinity 5500 with 1GB. The results of both WebBench and NetBench clearly showed that excessive memory capacity alone does not contribute to obtaining outstanding performance for a departmental-class server.

Departmental- or branch office-class servers perform optimally when they are designed with a balance of memory capacity, processor performance, PCI bus throughput, and front-side bus performance. The IBM Netfinity 5500 utilizes a balanced design,

which enables it to outperform the Compaq ProLiant 3000 in departmental and branch office environments.

The ProLiant 3000 does not use the latest system architecture technology such as the new Slot 1 Pentium II processor, which provides a 100MHz processor bus and 100MHz SDRAM, all of which are available today on the IBM Netfinity 5500. Instead, the ProLiant 3000 uses the older 66MHz processor, bus, memory and older Pentium II technology.

Compaq claims that the ProLiant 3000 delivers best-in-class performance based on its TPC-C benchmark result. The TPC-C benchmark is a robust transaction processing benchmark, but the type of system it is designed to measure does not represent a reasonable configuration for departmental or branch office server environments, primarily for the reasons stated in the "Introduction."

The TPC-C benchmark is one of the only benchmarks that requires large amounts of memory to obtain good results. Although the ProLiant 3000 performed well on the TPC-C, it does not offer the same level of performance on other benchmarks designed to measure a departmental server. For a departmental server to be considered best-in-class, we believe it should demonstrate the best performance in other application environments as well.

Using industry-standard benchmarks, the IBM Netfinity Performance Lab performed a series of measurements to illustrate the performance obtained from the IBM Netfinity 5500 configured with 1GB of memory compared to the performance measured for a similarly configured Compaq ProLiant 3000 using 3GB of memory. In all cases, the IBM Netfinity 5500 outperformed the Compaq ProLiant 3000 even though the ProLiant was configured with an additional 2GB of memory. These results clearly demonstrate that the balanced, optimized design of the IBM Netfinity 5500 is a superior choice for departmental and workgroup environments.

Server Configurations

WebBench 2.0

Features	IBM Netfinity 5500 400MHz/512KB	Compaq ProLiant 3000 333MHz/512KB
Processor	Two 400MHz/100MHz Pentium II	Two 333MHz/66MHz Pentium II
Memory	1GB ECC SDRAM	3GB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)
Bus	PCI	PCI
RAID Level	RAID-0	RAID-0
Disk Drive	Six 9.1GB^2 Wide Ultra SCSI Drives (10K rpm)	Six 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	ServeRAID II Ultra SCSI PCI Bus on Planar	SMART-2/DH Array Controller
Disk Driver	IPSRAIDN.SYS	CPQARRAY.SYS
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controller
Network Driver	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
System Partition Size	1GB	1GB
File System	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default
WebBench Version / Test Suite	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

NetBench 5.01

Features	IBM Netfinity 5500 400MHz/512KB	Compaq ProLiant 3000 333MHz/512KB
Processor	Two 400MHz/100MHz Pentium II	Two 333MHz/66MHz Pentium II
Memory	512MB ECC SDRAM	512MB ECC EDO
L2 Cache	512KB (Write-Back)	512KB (Write-Back)
Bus	PCI	PCI
RAID Level	RAID-0	RAID-0
Disk Drive	Six 9.1GB Wide Ultra SCSI Drives (10K rpm)	Six 9.1GB Wide Ultra SCSI Drives (10K rpm)
Disk Drive Adapter	ServeRAID II Ultra SCSI PCI Bus on Planar	SMART-2/DH Array Controller
Disk Driver	IPSRAIDN.SYS	CPQARRAY.SYS
Network Adapter	Four IBM EtherJet 100/10 PCI Adapters	Four Netelligent 10/100 TX PCI UTP Controller
Network Driver	E100BNT.SYS	NETFLEX3.SYS
Network Operating System	Windows NT Server 4.0	Windows NT Server 4.0
System Partition Size	1GB	1GB
File System	NTFS	NTFS
Allocation Unit Size	Predefined Default	Predefined Default
NetBench Version / Test Suite	NetBench 5.01 / Disk Mix	NetBench 5.01 / Disk Mix

Test Disclosure Information

WebBench 2.0

The 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 Pack 3

Web Server: Microsoft Internet Information Server 3.0

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	Microsoft Windows NT Workstation 4.0

NetBench 5.01

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

Version: NetBench 5.01

Mixes

- Disk Mix

- Clients: 4, 12, 20, 28, 36, 44, 52

- Client workspace: 80MB

- Total runtime: 11 minutes

- Ramp up and down: 30 seconds

Network Operating System: Microsoft Windows NT Server 4.0

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	52
Hubs	3COM Super Stack II 100TX Ethernet
Clients per Segment	13
CPU / Memory	200MHz Pentium / 32MB
Network Adapter	IBM 100/10 PCI Ethernet Adapter (Bus 0)
Software	Microsoft Windows NT Workstation 4.0
Cache	L2 = 256KB
Controller Software	Microsoft Windows NT Workstation 4.0

Notes

[1] MHz denotes the internal clock speed of the microprocessor only; other factors also 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.