PERFORMANCE BRIEF

MICROSOFT EXCHANGE SERVER 5.5 ON THE COMPAQ PROLIANT 3000

May 1998

Internet Solutions
Business Unit

Compaq Computer
Corporation

Compaq ProLiant servers deliver proven performance for Microsoft Exchange

Server customers

The Compaq ProLiant 3000 offers the best performance and leading price/performance of any Intel-based or RISC-based dual-processor system available today. To demonstrate Microsoft Exchange Server 5.5 scalability on the Compaq ProLiant 3000 server, tests of user loads from 1000 to 5000 simultaneous MAPI e-mail users were conducted at Compaq's Microsoft Competency Center located in Redmond, Washington.

Microsoft Exchange Server has been the focal point for extensive development and testing by both Microsoft and Compaq. Throughout this activity, Compaq and Microsoft have worked to optimize Microsoft Exchange Server performance on Compaq server products to provide an optimal balance between performance, availability, manageability, and cost. This performance brief provides a basis for determining the number of users that can be supported when deploying Microsoft Exchange Server on the ProLiant 3000 server.

Compaq ProLiant 3000

The Compaq ProLiant 3000 delivers performance and expandability levels that customers will not 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. Additionally, the Compaq ProLiant 3000 includes advanced fault-tolerant capabilities and rapid recovery features providing maximum uptime and reliable server operation while lowering total cost of ownership.

Key Features

- **300/333-MHz Pentium II Processor** (dual-processor capability) and an upgrade path to next-generation Intel Pentium II processor architectures that support SDRAM and 100-MHz GTL bus technology
- **512K level-2 writeback cache per processor**
- **I_2O Connector**
- **Highly Parallel System Architecture** for improved system bandwidth
- **ECC-protected memory bus and cache**
- **64 MB of ECC EDO memory** expandable to 3 GB
- **5 PCI and 3 shared PCI/EISA slots** (a total of 8 slots)
- **Internal mass storage capacity** up to 109.2 GB
- **External mass storage capacity** up to 1.5 TB (12 ProLiant Storage Systems Model F1)
- **Netelligent 10/100 TX PCI UTP Controller**
- **Dual Channel Integrated Wide-Ultra SCSI-3 Controller**
- **Integrated Remote Console and Automatic Server Recovery-2 (ASR-2)**
- **750-Watt Hot-Pluggable Power Supply** with optional Hot-Pluggable Redundant Power Supply (RPS)
- **Compaq Insight Manager and SmartStart**
- **Protected by a three-year on-site limited warranty and extended Pre-Failure Warranty** which covers Pentium II processors, memory and disk drives, as well as a wide range of Compaq Services.

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Performance Results

The tests were conducted using Microsoft's Load Simulator tool. For each test, the Load Simulator Medium MAPI canonical profile was chosen. The Medium MAPI profile reflects the task workload of a typical corporate e-mail user, including common daily mail tasks such as send, browse, read, and forward, as well as calendaring tasks and distribution list usage. The Response Time score represents a 95th-percentile score of the measured test run. The score is expressed in milliseconds (ms). A Response Time score of 1000ms or less is considered an acceptable response time for e-mail users utilizing Exchange Server's MAPI protocol.

Performance Highlights (ProLiant 3000, 2 CPU, 512 MB RAM)

User Load	1,000	2,000	3,000	4,,000	5,000
Response Time (milliseconds)	92	102	130	181	249
Average CPU Utilization	6.40%	14.53%	23.55%	35.86%	55.08%
Messages Delivered (8-hour period)	19,119	38,853	57,089	77,572	95,559

NOTE: Similar results can be expected using a Compaq ProLiant 3000R. Tested configurations may support higher user loads. This summary indicates performance results for tested configurations only. Test result disclosure can be found in Appendix A.

COMPAQ PROLIANT 3000 TESTED CONFIGURATION
(2) Pentium II/ 300-MHz – 512K Level-2 writeback cache per processor
512 MB RAM
(2) SMART-2/DH Array Controller OS/Pagefile/Exchange DS/MTA Files: (2) 4.3-GB Drives – RAID1 Exchange Log Files: (2) 4.3-GB Drives – RAID1 Exchange Information Store Files: (10) 4.3-GB Drives – RAID5
Compaq Netelligent (100BaseTX) network interface card (NIC)
Windows NT Server v4.0 with Service Pack 3 Exchange Server v5.5 – Standard Edition (Tuning: Perfwiz defaults)

What the Benchmarks Don't Tell You

It is important to understand that benchmarks such as these are designed to give Exchange Server implementation planners baseline references for understanding the capabilities of hardware platforms from a single vendor such as Compaq or other competing hardware vendors. When interpreting these benchmarks, two things should be kept in mind.

First, consider whether benchmarks are performed on what can be referred to as *customer-deployable configurations.* A hardware vendor may publish a result that is based on a platform or configuration that one would never use in a real-world Exchange Server deployment. For example, many vendors have published results using disk subsystems configured with RAID0 disk arrays. While RAID0 does provide the highest levels of disk subsystem performance, it fails to provide any protection against data loss. One must consider the implications of the same benchmark performed on a system using RAID5. This would provide the necessary fault tolerance that typical deployments require, but delivers different performance. In addition, most vendors, including Compaq, conduct benchmarks for Exchange Server that are *single-server* in nature.

Second, keep in mind that benchmarks do not account for issues such as backup and disaster recovery or information store maintenance sizing. Whatever the issue, care must be taken when interpreting benchmarks to ensure that they represent useful information for your Exchange Server deployment and are based on valid simulation methodologies.

Load Simulator

The main tool used in generating the workload for this scalability demonstration was the Microsoft Exchange Server Load Simulation utility called Load Simulator. Load Simulator is a tool for simulating a client user load on an Exchange Server. Its purpose is to enable a single Windows NT machine called a LoadSim client to simulate multiple Microsoft Exchange client users.

The operation of Load Simulator users is governed by a Load Simulator profile. This profile controls factors such as how long a Load Simulator "day" is, how many e-mail messages to send in a day's time, how many times to open and read e-mail, whether to use distribution lists, whether to use public folders, etc.

Load Simulator creates a highly accurate simulation of reality. It mimics the full Microsoft Exchange Client in many respects. First, it uses .MSG files, the same format used by the Exchange Client. This guarantees that messages generated by Load Simulator have the same properties as those sent by real users of the Exchange Client. Second, Load Simulator uses the same MAPI remote procedure call (RPC) semantics as those used by the Client. Third, Load Simulator registers MAPI change notifications in the same manner as they are registered by the Client. Finally, Load Simulator even emulates the Microsoft Exchange Client list box cache, which the Client uses for folder and message panes in the viewer when a user browses and selects messages on the server.

Several steps are necessary to performing a successful simulation. The Load Simulator setup and initialization process comes first. Load Simulator creates the test topology by first generating the user directory entries. Next, the test store is initialized and populated with the test messages and folder items. The tests are typically run for up to 8 hours depending upon the user load simulated and amount of time required to reach a steady state for measurement purposes. During a test run, users log on to the Exchange Server and begin processing various messaging tasks. Task response time data is logged to the LSPERF.LOG file and client messages and error logging are stored in the LOADSIM.OUT file. To produce test scores, the LSLOG utility is used to parse out the LSPERF.LOG file and calculate the response time score. By default, 95th- and 50th-percentile response time scores are calculated. Ninety-fifth-percentile response time scores for the MAPI/RPC protocol should be less than 1000 ms, according to Microsoft. Also, the Exchange Server IS Send Queue and the MTA Work Queue (other message and delivery queues should also be considered, depending on the protocol) must consistently return to near zero during the steady-state period for which test measurements are taken. Queues that continue to grow and fail to return to near zero indicate that the server is not sustaining the required workload. There should be no errors logged by the LoadSim clients during the test. When these conditions are met, a successful test run has been completed. For more information on LoadSim Medium canonical profiles, please refer to the LoadSim documentation at http://www.microsoft.com/exchange/library/loadsim55x86.exe.

Balancing Scalability and Availability

While server performance and capacity are key criteria in selecting a messaging deployment platform, one must also consider price/performance. Several competing hardware vendors offer platforms capable of supporting heavy user loads. They also provide these systems at a price significantly higher than Compaq's price. Compaq delivers leading performance on industry-standard platforms with the lowest total cost of ownership.

For many corporations, messaging and collaboration have quickly become mission critical. Unscheduled downtime for any server can result in a significant loss of productivity. To limit exposure to downtime, Exchange Server 5.5 and Compaq ProLiant Clusters provide high availability through Microsoft Cluster Server (MSCS). When MSCS is deployed on Compaq ProLiant Clusters, enterprise-messaging customers can achieve scalability without sacrificing the reliability that is required in an enterprise environment.

Another critical concern is backup and disaster recovery. Compaq provides industry-leading tape array and library hardware solutions integrated with applications such as Computer Associates' Cheyenne ArcServe. These solutions will help meet the requirements of enterprise customers deploying messaging and collaboration applications.

APPENDIX A: TEST DISCLOSURE

LoadSim Clients	Configuration
Network type (10Base T, Token Ring, etc.)	100 Base-TX
Number and type of clients	(≤40) 2x5/133, 128 MB RAM (≤ 250 users each) or better (indicates minimum configuration)
Number and type of hubs/concentrators (full duplex, switching, etc.)	Compaq Netelligent 5708 Switch and Netelligent 2624 Hub
Number of clients/segment	20
Client CPU type and speed in percentages	2P/133-MHz Pentium processors or better
Client network controller broken down by percentages	Compaq Netelligent 10/100
Client network software name and version (drivers, protocols, redirector)	Microsoft Windows NT Workstation 4.0 with SP3 TCP/IP
Size of any client network cache	None
Network controller software	Compaq Netelligent 10/100 driver
LoadSim version	5.5 (Build 2187)

NOTE: Response time measurements were taken from a LoadSim Control Client simulating 100 users configured with 96 MB RAM and a Pentium/166 CPU. The client is located on an isolated network segment connected to a 100-Mb/s switch.

Performance Data Disclosure (ProLiant 3000, 2 CPU, 512 MB RAM)

(Measured during test run at steady state)

Indicator	1,000 Users	2,000 Users	3,000 Users	4,000 Users	5,000 users
Response Time (ms)	92	102	130	181	249
IS Buffer Cache Hit %	99.53%	99.29%	99.19%	99.11%	98.72%
Disk Queue Length – IS Volume	0.225	0.68	1.29	2.442	4.828
Disk Queue Length – Log Volume	0.008	0.015	0.02	0.026	0.029
Average Read I/Os – IS	12.552	39.884	72.177	118.071	196.096
Average Write I/Os – IS	8.119	24.126	39.247	56.217	76.195
Average Write I/Os – Log	20.951	37.80	51.083	63.611	71.824
Average Pages/sec	0.022	0.036	0.046	0.092	0.131
Average Available Bytes	4.85 MB	4.94 MB	4.89 MB	4.88 MB	4.86 MB
IS Send Queue Average	0.01	0.172	0.293	0.596	2.273
IS Receive Queue Average	0.707	0.545	0.515	0.626	0.818
MTA Work Queue Average	0.051	0.111	0.232	0.303	0.556
Messages Open/sec	4.069	8.076	11.905	16.334	19.784
Average RPC Operations/sec	49.941	99.412	147.227	200.172	245.75
Messages Submitted (8 hours)	14,892	30,284	44,815	60,718	74,516
Calculated Messages/User	14.892	15.142	14.938	15.179	14.90
Average CPU Utilization	6.40%	14.53%	23.55%	35.86%	55.08%
Average Context Switches/Sec	498	855	1210	1582	1954
Average CPU Queue Length	0.152	0.303	0.687	1.141	1.818
Working Set – STORE	420 MB	467 MB	464 MB	463 MB	462 MB
Virtual Bytes – STORE	724 MB	773 MB	793 MB	805 MB	835 MB

NOTE: Performance results measured using Microsoft NT Performance Monitor. Measurements were obtained by measuring averages for the period of steady-state activity (i.e. after 5,000 users were successfully logged on). Tests measure the messaging throughput of a single-server, single-site topology. For deployment-specific information contact a Microsoft or Compaq representative. More information can be found at:
http://www.microsoft.com/exchange/support/deployment/planning/deploy.asp?A=5&B=1

APPENDIX B: RELATED DOCUMENTS

These documents are available on the Compaq website.

Compaq and Microsoft Demonstrate Enterprise Scalability with Exchange Server 5.5,

http://www.compaq.com/support/techpubs/whitepapers/ECG00961197.html

Performance of Exchange Server 5.0 on Compaq ProLiant 6000-class Servers,
http://www.compaq.com/support/techpubs/whitepapers/ECG0520897.html

Performance of Exchange Server 4.0 on Compaq ProLiant Servers,

http://www.compaq.com/support/techpubs/whitepapers/444A0696.html

Disk Subsystem Performance and Scalability,

http://www.compaq.com/support/techpubs/whitepapers/ECG0250997.html

Configuring Compaq RAID Technology for Database Servers,

http://www.compaq.com/support/techpubs/technotes/184206-1html

Compaq SMART-2 Array Controller Technology,

http://www.compaq.com/support/techpubs/whitepapers/667A0697.html

Hardware vs. Software Fault Tolerance,

http://www.compaq.com/support/techpubs/whitepapers/ECG066/0298.html

Pentium II Processor Technology,

http://www.compaq.com/support/techpubs/whitepapers/046_0897.html

Configuring the Compaq ProLiant 5000 Server for Peak Performance,

http://www.compaq.com/support/techpubs/whitepapers/679A0697.html

Compaq White Paper Index,

http://www.compaq.com/support/techpubs/whitepapers

Compaq ProLiant 3000,

http://www.compaq.com/products/servers/proliant3000/index.html

Compaq ProLiant 3000R,

http://www.compaq.com/products/servers/proliant3000r/index.html

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