PERFORMANCE BRIEF

MICROSOFT EXCHANGE SERVER 5.5 ON THE COMPAQ PROLIANT 6000-CLASS SERVERS

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Internet Solutions Business Unit

Compaq Computer Corporation

Compaq ProLiant servers deliver proven performance for Microsoft Exchange Server customers

COMPAQ Microsoft FRONTLINE PARTNERSHIP

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Microsoft Exchange Server is quickly becoming the leading messaging and collaboration application platform. Many customers deploying messaging and collaborative applications are asking important scalability and server sizing questions. To demonstrate Exchange Server 5.5 scalability on the ProLiant 6000-class servers (includes the ProLiant 6000, 6500 and 7000), Compaq's Internet Solutions Business Unit conducted tests of 3000 to 7000 simultaneous MAPI e-mail users at Compaq's Microsoft Competency Center located in Redmond, WA.

Microsoft Exchange Server has been the focal point for extensive partnership, 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. The purpose of this performance brief is to demonstrate the capabilities of the ProLiant 6000-class server product line and provide a basis for comparison and decision-making in real-world deployment scenarios.

Compaq ProLiant 6000/6500/7000

The Compaq ProLiant 6000-class family of servers offers a high-performance application server platform that provides unprecedented levels of expandability, reliability and availability that customers won't outgrow. These flagship servers use 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 client/server applications. Additionally, the Compaq ProLiant 6000-class servers include advanced fault-tolerant capabilities along with rapid recovery features that provide maximum uptime and reliable server operation while lowering total cost of ownership.

Key Features

- **200-MHz Pentium Pro Processor** (Quad-processor capability)
- **512K or 1 MB level-2 cache per processor**
- **ECC, EDO or Fast Page Mode (FPM) memory** expandable to 4 GB
- **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)**
- **Integrated Management Display (IMD)**
- **Hot-Pluggable Power Supply** with optional Hot-Pluggable Redundant Power Supply (RPS)
- **Available in both Tower and Rack form factors**
- **Support for Microsoft Cluster Server (MSCS)** available with ProLiant Clusters
- **Compaq Insight Manager and SmartStart**
- **Protected by a three-year on-site limited warranty and extended Pre-Failure Warranty** which covers Pentium Pro processors, memory and disk drives, as well as a wide range of Compaq Services.

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 1000 ms or less is considered an acceptable response time for e-mail users utilizing Exchange Server's MAPI protocol.

Performance Highlights

User Load	3,000	4,000	5,000	6,000	7,000
Response Time (milliseconds)	110	133	169	218	343
Average CPU Utilization	15.61%	22.55%	29.91%	41.92%	54.68%
Messages Delivered (8 hour)	44,278	59,796	75,134	88,770	102,316

COMPAQ PROLIANT 6000 TESTED CONFIGURATION
(4) Pentium Pro/200-MHz – 1 MB Level-2 cache
512 MB RAM
(2) SMART-2/DH Array Controllers 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)
Windows NT Server v4.0 with SP3 Exchange Server v5.5 – Enterprise Edition (Tuning: Perfwiz defaults)

NOTE: Tested configurations may support higher user loads. In addition, the ProLiant 6000-class family of servers is capable of larger hardware configurations (memory and disk subsystems). This summary indicates performance results for tested configurations only. Test results disclosure can be found in Appendix A.

What the Benchmarks Don't Tell You

Many hardware vendors, including Compaq, engage in benchmarking activities for Microsoft Exchange Server. In fact, Compaq was the first hardware vendor to publish results for Exchange Server 5.5 (see Appendix B: Related Documents – *Compaq and Microsoft Demonstrate Enterprise Scalability with Exchange Server 5.5*). 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

Compaq Delivers the Leading Messaging and Collaboration Platforms

When deploying messaging systems such as Microsoft Exchange Server, one must consider not only the performance and capacity of the server but also its price/performance. Several competing hardware vendors offer platforms that are also capable of supporting heavy user loads, but provide these systems at a price significantly higher than Compaq's price. Compaq delivers leading performance on industry-standard platforms with lowest total cost of ownership.

Another important consideration is the mission-critical nature of collaborative applications and messaging within your organization. While it is possible to support 7,000 or more users on a single ProLiant 6000-class server, the trade-off for using one server may be a loss of productivity when this single potential point of failure is unavailable. In addition, backup and recovery measures for an Exchange Server of that magnitude would be complex, time-consuming, and at the outer limits of current backup technologies. The question is not whether you can support thousands of users on a single system, but whether it is always prudent to do so. Exchange Server 5.5 and Compaq ProLiant Clusters address this important issue. Microsoft has added support for Microsoft Cluster Server (MSCS) to Exchange Server 5.5. With Microsoft Cluster Server deployed on Compaq ProLiant Clusters, enterprise-messaging customers can achieve both the scalability and reliability that is required in this environment. For backup and disaster recovery, Compaq provides industry-leading tape array and library hardware solutions integrated with applications such as Computer Associates' Cheyenne ArcServe to meet the requirements of enterprise customers deploying messaging and collaboration applications.

Compaq has invested heavily in collaborative and messaging applications. Microsoft Exchange Server has been optimized and integrated for Compaq servers and provided on Compaq SmartStart. SmartStart allows users of Exchange Server to integrate with confidence by facilitating the installation of Exchange Server on Compaq servers without errors. Another area of significant investment is the Internet Solutions Business Unit at Compaq. Compaq has numerous engineering resources working on site at Microsoft with various Windows NT and BackOffice groups like the Exchange Server team to ensure tightly coupled integration and superior performance on Compaq servers. For enterprise collaborative application and messaging deployments, Compaq is the clear choice.

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 6000, 4 CPU, 512 MB RAM)

(Measured during test run at steady state)

Indicator	3,000 Users	4,000 Users	5,000 Users	6,000 Users	7,000 Users
Response Time (ms)	110	133	169	218	343
IS Buffer Cache Hit %	98.94%	98.92%	98.64%	98.17%	97.67%
Disk Queue Length - IS Volume	1.45	2.275	3.675	6.517	12.95
Disk Queue Length - Log Volume	0.022	0.028	0.033	0.038	0.043
Average Read I/Os – IS	64.67	95.11	146.33	231.95	340.33
Average Write I/Os - IS	39.28	54.06	72.1	93.13	113.16
Average Write I/Os - Log	49.83	63.59	72.6	81.95	89.17
Average Pages/sec	0.020	0.019	0.037	0.049	0.032
Average Available Bytes	4.93 MB	4.88 MB	4.84 MB	4.83 MB	4.76 MB
IS Send Queue Average	0.333	0.394	0.768	1.49	5.16
IS Receive Queue Average	0.525	0.495	0.616	0.586	0.646
MTA Work Queue Average	0.202	0.293	0.485	0.747	0.889
Message Opens/sec	11.8	16.02	19.48	23.3	26.93
Average RPC Operations/sec	147.26	200.87	243.57	292.06	340.11
Message Submitted (8 hours)	44,278	59,796	75,134	88,770	102,316
Calculated Messages/User	14.75	14.94	15.02	14.79	14.61
Average Local Delivery Time	15.96	20.68	29.36	49.19	131.52
Average CPU Utilization	15.61%	22.55%	29.91%	41.92%	54.68%
Average Context Switches/sec	1311	1733	2182	2826	3347
Average CPU Queue Length	0.091	0.141	0.303	0.646	0.889
Working Set – STORE	464,MB	464,MB	462,MB	460,MB	458,MB
Virtual Bytes – STORE	905,MB	905,MB	909,MB	931,MB	966,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 7,000 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/ecg0961197.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 6000,

http://www.compaq.com/products/servers/proliant6000/index.html

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