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Compaq Computer Corporation

Contents

Enterprise-Class Microsoft Exchange Server Scalability on Compaq ProLiant 7000 Pentium II Xeon Servers

Abstract: *Compaq achieved record-breaking Exchange Server scalability by achieving 15,000 MMB on a ProLiant 7000 server equipped with four 400-MHz Intel Pentium® II Xeon™ processors. Using Microsoft's Load Simulation utility, the ProLiant 7000 with four 400-MHz processors was tested at Compaq's Microsoft Competency Center in Redmond, Washington. The favorable results of this testing demonstrate the superior performance capabilities of four-processor servers based on the Intel Pentium® II Xeon™ processor as compared to eight-processor servers based on the Intel Pentium® Pro available from competitors.*

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. Compaq not only provides world-class server platforms, but also the experience necessary for the successful deployment of messaging and collaborative applications

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Enterprise-Class Microsoft Exchange Server Scalability on Compaq ProLiant 7000 Pentium II Xeon Servers

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Compaq ProLiant 7000

The Compaq ProLiant 7000 is the ultimate standards-based server delivering the most scalable performance and the highest levels of availability. The ProLiant 7000 supports up to four Pentium® II Xeon™ processors and 8 GB of system memory. Its architecture supports Enhanced PCI Hot-Plug and a Triple-Peer PCI bus design (five 64-bit PCI, four 32-bit PCI, and one ISA slot). Standard with the ProLiant 7000 is the 64-bit PCI SMART 3100ES Array Controller that supports 3 Wide Ultra SCSI-3 channels and 64 MB of cache. Leveraging Fibre Channel, the Compaq ProLiant 7000 can support nearly 7 TB of external storage. Combined with the latest high-availability features and processor technology, the ProLiant 7000 is designed for the most demanding and mission-critical applications.

Exchange Server Performance Test Results

The tests were conducted using Microsoft MAPI Messaging Benchmark (MMB). The MAPI Messaging Benchmark (MMB) measures throughput in terms of a specific profile of user actions, executed over an 8 hour working day. This benchmark utilizes the 'Medium User' setting of the Load Simulator MAPI tool. Results should be interpreted as a benchmark for messaging throughput and should not be confused with deployment recommendations. Factors such as backup/restore, topology and other issues should be considered when planning a deployment.

Table 1. Performance Highlights (ProLiant 7000, (4) Pentium® II Xeon™ 400-MHz, 4 GB RAM)

MMB	15,000
Response Time (milliseconds)	343
Messages Submitted (8-hour period)	213,021
Messages Delivered (8-hour period)	260,707
Message Recipients Delivered (8-hour period)	1,179,107
Messages Sent (8-hour period)	57,315

Note: Complete Test results disclosure can be found later in this document.

Table 2. Configuration of the tested Compaq ProLiant 7000

Compaq ProLiant 7000 Tested Configuration
(4) Pentium® II Xeon™ 400-MHz – 1 MB L2 cache per processor
4 GB RAM
(1) SMART 3100ES Array Controller with 64 MB Cache (configured for 100% WB) OS/Pagefile/Exchange DS/MTA Files/Exchange Log Files: (2) 4.3-GB Drives – RAID1 Exchange Information Store Files: (16) 4.3-GB Drives – RAID0
Compaq Netelligent (100BaseTX) network interface card (NIC)
Windows NT Server v4.0 Enterprise Edition (using /3GB BOOT.INI switch) Exchange Server v5.5 – Enterprise Edition

Note: Complete Test results disclosure can be found later in this document.

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 should not be deployed in a real-world Exchange Server deployment. For example, many vendors (including Compaq) publish results using disk subsystems configured with RAID0. While RAID0 does provide the highest levels of disk subsystem performance, it fails to provide any protection against data loss. Compaq recommends deploying an Exchange Server with disk fault tolerance such as RAID1 or RAID5 for the highest levels of data protection.

Second, most vendors, including Compaq, conduct benchmarks for Exchange Server that are *single-server* in nature. Also, 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.

While it is significant that the ProLiant 7000 server can successfully scale to 15,000 medium MAPI e-mail users (MMB) in a single-server benchmark exercise, Compaq recommends careful evaluation of all issues involved in real-world Exchange Server deployments – issues such as management, administration, and disaster recovery.

MAPI Messaging Benchmark (MMB) - LoadSim Medium User Redefined

To distinguish clearly between throughput benchmarks and capacity planning information for Microsoft Exchange Server, Microsoft has established the MAPI Messaging Benchmark (MMB) based on the workload from LoadSim Medium User profile. The MAPI Messaging Benchmark representative workload focuses on the resulting throughput and clearly communicates the profile under test.

The workload profile has not changed from the former LoadSim Medium User, but expressed in clearer fashion. The intent is to make sure that customers can understand the MAPI Messaging Benchmark workload and can compare it to other platforms. In addition, the renaming of the benchmark reinforces that the test is a measurement of messaging throughput and that additional considerations are required in capacity planning.

MMB Transaction Load

The transaction load created by the benchmark is equivalent to the user actions over an eight-hour day as shown in Table 3.

Table 3. Average User Actions

User Action	Actions Per Day
Check Inbox	12
Send Message	14.18
Avg. Recipients per Message	4.7
Messages Received	66.3
Read Message	81.3
Move Message	16.3
Delete Message	32.5
Update Calendar	5

30% of all mail messages have one distribution list recipient. Average size of DL 10 recipients. (Recipients created by distribution lists are included in the summary above.) All users are logged on prior to the benchmark as they are assumed to be using mail in a corporate setting. Mail is not cleared from the deleted items folder during the test as this is assumed to happen when the user logs off.

Message Mix Description

The weights used when the Load Simulator randomly selects which message to send are listed in the Table 4.

Table 4. Message Mix Description

Message Files	Body	Attachment	Content Description	Weight
Ups1k.msg	1K		Body as RTF	60
Ups2k.msg	2K		Body as RTF	16
Ups4k.msg	4K		Body as RTF	4
Ups10kat.msg	1K	10K	Body as RTF - Notepad attachment	6
Upsxlatt.msg	1K	15K	Body as RTF - Microsoft Excel spreadsheet attached	4
Upswdatt.msg	1K	16K	Body as RTF - Microsoft Word document attached	4
Upsbmobj.msg	0.5K	43K	Body as RTF - Bitmap attachment	2

Load Simulator

The main tool used in generating the workload the MMB benchmark was Microsoft 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. For more information on LoadSim Medium canonical profiles, refer to the LoadSim documentation at http://www.microsoft.com/exchange/library/loadsim55x86.exe.

Table 5. TEST DISCLOSURE

LoadSim Clients	Configuration
Network Topology (100Base T, Token Ring, etc.)	100 Base-TX
Number and type of clients	(≤40) 2x5/133, 128 MB RAM (≤ 400 users each) or better (indicates minimum configuration)
Number and type of hubs/concentrators (full duplex, switching, etc.)	Compaq Netelligent 5708 Switch and Netelligent 2624 Hubs
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.

Benchmark Tuning

Table 6 shows tuning parameters for Exchange Server that varied from default settings for purposes of the benchmark exercise. Compaq recommends using the default settings specified by the Microsoft Exchange Performance Optimizer for production server deployments.

Table 6. Benchmark Tuning

Parameter	Default Setting	Benchmark Setting
IS Buffers (4K each)	524,000	375,000
Max Open Tables	32,000	200,000
IS Send Threads	4	8

IS Deliver Threads	4	8
MTA Submit/Deliver Threads	2	8
MTA TCP Threads	2	6
MTA TCP Control Blocks	20	25

Table 7. Version Information (Server)

Name	Type	Version or Date
Compaq NT SSD	Software/Drivers	2.09
SMART ECI Driver	Software/Drivers	1.06
System Firmware	ROM	7/8/98
SMART 3100ES Firmware	ROM	2.72
Windows NT Server EE	Operating System	4.0 SP3
Exchange Server EE	Application	5.5 (Build 1960.8)

Table 8. Performance Data

15,000 MMB **(Measured during test run at steady state)**	
Summary	
Supported Benchmark Load	15,000 MMB
Weighted 95th-Percentile Score	343 milliseconds
Benchmark Profile	MMB (Medium MAPI User)
Protocol	Exchange MAPI
Length of Steady State	4 hours
Length of Test	8 hours
Transaction Load (hourly)	
Messages Submitted	26,627.69
Message Recipients Delivered	147,388.46
Messages Sent	7,164.49
Transaction Load (per Second)	
Message Opens/Sec	53.75
Folder Opens/Sec	14.05
RPC Read Bytes/Sec	47,250.31
RPC Write Bytes/Sec	383,111.15
Transaction Queues	
IS Send Queue Average Length	5.50
MTA Work Queue Average Length	8.04

Processor Utilization	
System Processor Utilization (%)	83.74%
System Processor Queue Length	4.29
System Context Switches/Sec	5438
Process % CPU Time – Store	272.33%
Process % CPU Time – DS	25.38%
Process % CPU Time – MTA	15.91%
Memory Utilization	
Available Bytes	1838 MB
Pages/Sec	0.015
Process Working Set Bytes – Store	1.99 GB
Process Virtual Bytes – Store	2.78 GB
Logical Drive Utilization	
IS Database Disk Reads/Sec	409.40
IS Database Disk Writes/Sec	244.01
IS Database Average Disk Queue Length	11.36
IS Log Disk Reads/Sec	0.93
IS Log Disk Writes/Sec	159.82
IS Log Average Disk Queue Length	0.34

Note: Performance results were measured using Microsoft NT Performance Monitor. Measurements were obtained by measuring averages for the period of steady-state activity (i.e. after 15, 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

Table 9. User Response Times (Latencies) from Load Simulator

Client Actions	95th-Percentile Response Time (in Milliseconds)
Read	260
Send	531
Delete	421
Move	550
Submit	441

Related Documents

The following 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

Microsoft Exchange Server 5.5 on the Compaq ProLiant 850R,

http://www.compaq.com/support/techpubs/whitepapers/ECG0710698.html

Microsoft Exchange Server 5.5 on the Compaq ProLiant 3000,

http://www.compaq.com/support/techpubs/whitepapers/ECG0720698.html

Microsoft Exchange Server 5.5 on the Compaq ProLiant 6000 Class Servers,

http://www.compaq.com/support/techpubs/whitepapers/ECG0730698.html

Compaq Deployment and Configuration Guide: Microsoft Exchange Server on Compaq ProLiant Servers,

http://vcmproapp02.compaq.com/

Performance of Exchange Server 4.0 on Compaq ProLiant Servers,

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

"Deschutes" Family Processor Technology,

http://www.compaq.com/support/techpubs/whitepapers/ecg0500698.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 Array Controller Technology,

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

Hardware vs. Software Fault Tolerance,

http://www.compaq.com/support/techpubs/whitepapers/ECG0660298.html

Compaq Pentium Pro Processor-based Servers,

http://www.compaq.com/support/techpubs/whitepapers/308A0496.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