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Contents

Microsoft Exchange Server record-breaking scalability achieved with 4-processor Compaq ProLiant 6400R Pentium III Xeon

Abstract: *Compaq accomplished record-breaking Exchange Server scalability by achieving a* ***26,000 MAPI Messaging Benchmark (MMB)*** *on a Compaq ProLiant 6400R server with four 550 Megahertz Intel Pentium III Xeon processors. Using Microsoft's Load Simulation (LoadSim) utility, the ProLiant 6400R with four 550 MHz processors was tested with a workload of 26,000 MMB. This result is the highest MAPI Messaging Benchmark (MMB) to date from any vendor on a 4P system, and demonstrates superior scalability. The Compaq ProLiant 6400R provided an average CPU utilization rate of* ***72.7%*** *during the 26,000 MMB test. The weighted 95th percentile response-time score was* ***201 milliseconds,*** *and the average send-queue size for the four-hour steady-state period was* ***14.3 messages****.*

Compaq enables a confident deployment and management of Microsoft Exchange Server on their products by conducting extensive integration engineering and capacity planning. 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 in order 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 successful deployments of messaging and collaborative applications.

Notice

Microsoft Exchange Server record-breaking scalability achieved with 4-processor Compaq ProLiant 6400R Pentium III Xeon Solutions Guide prepared by Messaging and Collaboration Business Unit

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Introduction

Compaq ProLiant 6400R

The Compaq ProLiant 6400R is the ultimate standards-based server delivering the most scalable performance and the highest levels of availability. The ProLiant 6400R supports up to four Pentium® III Xeon™ processors and 4 GB of system memory. Its architecture supports Enhanced PCI Hot-Plug and five 64-bit PCI, and one ISA slot). The Compaq ProLiant 6400R can support nearly 7 TB of external storage. Combined with the latest high-availability features and processor technology, the ProLiant 6400R is designed for the most demanding and mission-critical applications.

- Supports one to four Intel Pentium® III Xeon 550 MHz processors with 512-KB, 1-MB, or 20MB L2 Cache
- Innovative, space saving 4U (7") rack-optimized design
- Six 64-bit slots (5 PCI Hot Plug and 1 shared PCI/ISA)
- ECC protected buffered EDO DIMM memory (expandable to 4 GB)
- Support for SmartStart and Compaq Insight Manager
- 24X CD ROM drive and floppy drive
- Compaq NC3131 64 bit dual-port 10/100 Controller upgradeable to Gigabit
- Uncompromising reliability features:
    - Industry Standard push button PCI Hot Plug
    - Hot plug drives
    - New, redundant hot plug fan design provides protection for entire system
    - ECC protected memory and processor bus
    - ASR-2 and Online Recovery Server Option
    - Optional redundant hot plug power supplies
    - Optional redundant power processor modules
    - Optional redundant NICs
    - Integrated Remote Console (IRC)
- Diagnostic interlocks for enhanced serviceability
- Tool-free internal design for easy access to system components
- Protected by Compaq Services, including a limited three-year parts, labor and on-site warranty[1] with optional 4-hour response. Pre-Failure Warranty[1] and Compaq Service and Support Programs available on a Worldwide basis

Test Methodology

The tests were conducted using Microsoft Messaging Application Program Interface (MAPI) Messaging Benchmark. 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 (LoadSim) MAPI tool. Results should be interpreted as a benchmark for comparing messaging throughput of various servers and configurations and should not be confused with deployment recommendations. Factors such as backup/restore, topology and other issues should be considered when planning a deployment.

Exchange Server Performance Test Results

Test Result Highlights

Table 1: Performance Highlights (Compaq ProLiant 6400R, (4) Pentium III Xeon 550-MHz)

MAPI Messaging Benchmark (MMB)	26,000
Response Time (milliseconds)	201
Messages Submitted (4-hour steady-state period)	181,423
Message Recipients Delivered (4-hour steady-state period)	995,156
Messages Sent (4-hour steady-state period)	48,381

Note: Complete disclosure of test results can be found in Appendix A of this document.

Table 2: Tested Configuration

COMPAQ PROLIANT 6400R TESTED CONFIGURATION
Four (4) Pentium III Xeon 550-MHz Processors – 2 MB L2 cache per processor
4 GB RAM
One (1) Compaq SMART 3200 Array Controller with 64 MB Cache; one (1) Compaq SMART 4200 Array Controller OS/Exchange DS/MTA Files: Two (1 + 1) 4.3-GB Drive – RAID 1 Pagefile: One (1) 4.3-GB Drive Exchange Log Files: four (2 + 2) 4.3-GB Drives– RAID 1 Exchange Information Store Files: Forty-eight (48) 9.2-GB Drives – RAID 0
Compaq NC3131 64 bit dual-port 10/100 Controller – 2 ports
Windows NT Server Version 4.0 Enterprise Edition (using /3GB BOOT.INI switch) with Service Pack 5 Exchange Server Version 5.5 – Enterprise Edition with Service Pack 2

Note: Complete disclosure of test results can be found in Appendix A of this document.

What the Benchmarks Don't Tell You

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

First, consider whether benchmark tests 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 benchmark tests 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 Compaq ProLiant 6400R server can successfully scale to 26,000 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 LoadSim Medium User profile formerly used, but is now expressed in clearer fashion. The intent is to make sure that customers can understand the MAPI Messaging Benchmark workload and can compare the MMB for one platform to the MMB for other platforms. In addition, the renaming of the benchmark reinforces the fact 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 outlined in Table 3 over an eight-hour day.

Table 3: MMB Transaction Load

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

Thirty percent of all mail messages have one distribution-list recipient. The average size of the distribution list (DL) is ten recipients. (Recipients created by distribution lists are included in the summary transaction load outlined in Table 3). All users are logged on prior to the benchmark measurement as the users 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 occur 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 following Table 4.

Table 4: Weights Given to Different Types of Messages in LoadSim Random Selection

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	6
			Notepad attachment	
Upsxlatt.msg	1K	15K	Body as RTF Microsoft Excel spreadsheet attached	4
Upswdatt.msg	1K	16K	Body as RTF	4
			Microsoft Word document attached	
Upsbmobj.msg	0.5K	43K	Body as RTF	2
			Bitmap attachment	
Upsxlobj.msg	1K	17K	Body as RTF	4
			Excel spreadsheet attachment	

Load Simulator

The tool used in generating the workload for the MMB benchmark was Microsoft Load Simulator (LoadSim). Load Simulator is a tool for simulating a client-user load on a server running Microsoft Exchange. Its purpose is to enable a single Windows NT server, 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 actual 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://backoffice.microsoft.com/downtrial/moreinfo/loadsimulator.asp

Appendix A

LoadSim Client

Table A-1 details the configuration of the LoadSim clients used to simulate multiple Microsoft Exchange users generating the MMB workload for the MMB measurement.

Table A-1: Configuration of LoadSim Client

LoadSim Clients	Configuration
Model	Compaq Deskpro-EN 450
Client CPU types and speeds	1P/450-MHz Pentium II processor
Number of clients	37 clients with 256MB RAM (1000 users for 22; 500 users for 4; 250 users for six; 100 users for five systems)
Network Topology (100Base T, Token Ring, etc.)	100 Base-TX
Network Controllers	Compaq 10/100 TX
Client network software name and version	Microsoft Windows NT Workstation 4.0 with SP4
LoadSim version	5.5 (Build 2187)

Performance Data

Performance data for the MMB measurement are detailed in Table A-2.

Table A-2: 26,000 MMB (Measured During Test Run at Steady State)

Summary	
Supported Benchmark Load	26,000 MMB
Benchmark Profile	MAPI Messaging Benchmark
Protocol	Exchange MAPI
Length of Steady State	4 hours
Length of Test	8 hours
Unless otherwise noted, values listed are averages over entire steady state period.	
Transaction Load (hourly)	
Messages Submitted	45,355.75
Message Recipients Delivered	248,788.75
Messages Sent	12,095.27

continued

Table A-2 *(continued)*

Transaction Load (per Second)	
Message Opens/Sec	89.1
Folder Opens/Sec	23.9
RPC Read Bytes/Sec	82,113
RPC Write Bytes/Sec	488,036
Transaction Queues	
IS Send Queue Average Length	14.1
MTA Work Queue Average Length	3.2
Processor Utilization	
System Processor Utilization (%)	72.7%
System Processor Queue Length	5.2
System Context Switches/Sec	12,871
Process % CPU Time - Store	236.19%
Process % CPU Time - DS	16.98%
Process % CPU Time - MTA	15.11%
Memory Utilization	
Available Bytes	2.08GB
Pages/Sec	0.021
Process Working Set Bytes - Store	1.79GB
Process Virtual Bytes - Store	2.98GB
Logical Drive Utilization	
IS Database Disk Reads/Sec	1214
IS Database Disk Writes/Sec	461
IS Database Average Disk Queue Length	10.9
IS Log Disk Reads/Sec	0.0
IS Log Disk Writes/Sec	147.4
IS Log Average Disk Queue Length	0.048

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 26,000 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/DeployAdmin.htm

User Response Times

Table A-3 details response times for various user actions during benchmark testing.

Table A-3: User Response Times (Latencies) from Load Simulator

Client Actions	95th-Percentile Response Time (in Milliseconds)
Read	150
Send	310
Delete	104
Move	161
Submit	108

Descriptive Terms

Messages Submitted

Submit calls made by clients. This equates to total message sends by users.

Messages Sent

Messages that the Information Store sends to the MTA (not messages sent by clients). Normally all messages submitted by the clients are sent to the MTA, except in the case where all recipients are local mailboxes. In that case, since all the deliveries can be performed locally, no message is sent to the MTA.

Message Recipients Delivered

Separate mailboxes that messages have been delivered to. Think of this as the number of Reads that are 'caused' by sending a message (one per recipient).

Message Opens/Sec

Messages accessed for reading per second.

Folder Opens/Sec

Folders opened for browsing per second.

RPC Read Bytes/Sec

RPC Bytes read from clients (i.e., submit calls).

RPC Write Bytes/Sec

RPC Bytes written to clients (i.e., message opens).

IS Send Queue Average Length

Send Queue Size is the number of messages in the private information store's send queue.

MTA Work Queue Average Length

Work Queue Length is the number of outstanding messages in the Work Queue, which indicates the number of messages not yet processed to completion by the MTA.

Appendix B: Related Documents

The following documents are available on the Compaq website.

Compaq and Microsoft Demonstrate Enterprise Scalability with Exchange Server 5.5,

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

Microsoft Exchange Server 5.5 on the Compaq ProLiant 850R,

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

Microsoft Exchange Server 5.5 on the Compaq ProLiant 3000,

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

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

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

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

www.compaq.com/support/techpubs/whitepapers/ecg0500698.html

Disk Subsystem Performance and Scalability,

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

Configuring Compaq RAID Technology for Database Servers,

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

Compaq SMART Array Controller Technology,

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

Hardware vs. Software Fault Tolerance,

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

Compaq Pentium Pro Processor-based Servers,

www.compaq.com/support/techpubs/whitepapers/308A0496.html

Configuring the Compaq ProLiant 5000 Server for Peak Performance,

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

Compaq White Paper Index,

www.compaq.com/support/techpubs/whitepapers