Compaq ActiveAnswers

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Prepared by Knowledge Management and Messaging Business Unit

Enterprise Solutions Division

Compaq Computer Corporation

Contents

With Windows 2000, Compaq achieves highest MMB on a 2-processor system: 15,500 MMB on ProLiant ML370 733 MHz Pentium III

Abstract: *Compaq demonstrated a 15,500 Exchange MAPI Messaging Benchmark (MMB) operating on a ProLiant ML370 powered by two - 733 Megahertz Intel Pentium® III processors. The system was configured with Microsoft Windows 2000 Advanced Server and Microsoft Exchange V5.5.*

*Compaq achieved new record-breaking Exchange Server scalability by achieving **15,500 MMB** with a **176-millisecond** response time on a ProLiant ML370 server equipped with two 733-MHz Intel Pentium® III processors. Using Microsoft's Load Simulation utility, the ProLiant ML370 with two 733-MHz processors was tested at Compaq's Performance Center in Nashua, New Hampshire. This performance result demonstrates the highest numbers of benchmarked MMB to date on ANY 2-processor system, from ANY vendor. It also shows that migrating from NT4.0 to Windows 2000 in an Exchange environment may show an improvement in performance.*

The Compaq ProLiant ML370 provided an average CPU utilization rate of 61.7% during the 15,500 MMB test. The weighted 95th percentile response-time score was 176-milliseconds, and the average send-queue size for the four-hour steady state was 19.1 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

With Windows 2000, Compaq achieves highest MMB on a 2-processor system: 15,500 MMB on ProLiant ML370 733 Pentium III

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Introduction

ProLiant ML370

The new Compaq ProLiant ML370 offers uncompromising performance, expanded availability and unprecedented configuration flexibility coupled with industry leading manageability. The redesigned 5U chassis houses state-of-the-art components such as the new dual processor capable 667MHz and 733MHz Pentium III processors from Intel, 133MHz registered SDRAM ECC DIMM memory and a 133MHz Front-Side bus to deliver the high levels of performance expected from a Compaq ProLiant. In addition, the new dual-peer PCI bus architecture provides access to high bandwidth 64 bit/33MHz PCI slots while an optional Integrated Smart Array Controller has been added to offer additional performance and availability. The highly serviceable chassis houses ten bays allowing customers to deploy the drive and backup scenario they require for their Web hosting, mail, file/print or small database applications without having to make functionality tradeoffs. Coupling the optional Integrated Smart Array Controller (RAID On Chip - ROC) with the standard Hot Plug Drive capability allows for ease of remote maintenance while the new chassis design extends this serviceability to allow ease of physical access to all internal components. Remote administration is optimized through features such as Integrated Remote Console and, with the addition of the new optional Compaq "Remote Insight Board - Lights Out Edition", administration functions are extended to provide a full "Virtual Presence" from any remote site.

- Highly serviceable 5U design is optimized for both Tower and Rack environments where it provides enhanced serviceability features designed to reduce ownership costs
- Tool-free access to major components simplifies maintenance and repair maximizing valuable IT resource time
- Integrated Smart Array Controller (RAID On Chip - ROC) option delivers RAID capability without requiring the use of a PCI slot
- Significant component commonality with other servers reduces spare parts inventory cost

Performance

- Up to two 667MHz or 733MHz Pentium III processors
- RCC 3.0 LE Chipset, supporting 133MHz Front Side bus
- 128MB (expandable to 4GB) of 133MHz ECC Registered SDRAM DIMM
- Dual-peer PCI bus architecture
- 6 - PCI slots (four 64-bit/33MHz, two 32-bit/33MHz)
- 6 x 1" Wide Ultra2 or Wide Ultra3 hot plug SCSI hard drives
- Embedded NC3163 Fast Ethernet NIC 10/100 supporting Wake On Lan

Expandability and Flexibility

- Up to two Pentium III processors
- Up to 4 GB SDRAM memory support
- Up to 109.2GB of hot pluggable storage
- Removable media bay supporting 1 full height or 2 half height devices
- 6 PCI slots (4 - 64-bit, 2-32-bit)

Reliability and Availability

- ECC protected memory
- Hot plug drives
- Optional Integrated Array Controller for RAID 0, 1, 1 + 0, 5 (RAID On Chip - ROC)
- Optional hot plug redundant power supply
- Optional high performance RAID controllers
- Optional redundant NIC capability

Serviceability and Manageability

- Tool-free in-the-rack access to major components
- Single thumbscrew system board removal
- Front panel LEDs for power and drive status indication
- Optional Integrated Management Display
- Optional Remote Insight, Lights-Out Edition option kit providing enhanced remote management.
- Compaq management tools such as SmartStart, Compaq Insight Manager, Rack Builder Pro, Info Messenger, and Active Answers improve customers' productivity, uptime and implementation time.

For more information about the ProLiant ML370, please refer to the Compaq web site, at http://www.compaq.com/products/servers/ProLiantml370/index.html

Test Methodology

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 and is meant to represent mail traffic from a typical corporate e-mail user, including common daily mail tasks such as send, browse, read, and forward, as well as scheduling tasks and distribution list usage.

Results should be interpreted as a benchmark for messaging throughput and should not be confused with deployment recommendations. Factors such as backup/restore, among others, should be considered when planning a deployment. This test measures throughput in a single server, single site topology on this hardware configuration. This can provide a benchmark for comparing hardware and/or software products, but cannot be used as a deployment guide for production environments. For deployment specific information contact a Microsoft or Compaq representative, or you can visit the following site:

http://www.microsoft.com/exchange/DeployAdmin/DeployAdmin.htm

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. The tests were completed in accordance with Microsoft Exchange Server OEM Benchmarking Policy Guidelines version 1.2.

Exchange Server Performance Test Results

Test Result Highlights

Table 1: Performance Highlights (Compaq ProLiant ML370, (2) Pentium III 733-MHz)

MAPI Messaging Benchmark (MMB)	15,500
Response Time (milliseconds)	176
Messages Submitted (4-hour steady-state period)	112,082
Message Recipients Delivered (4-hour steady-state period)	621,442
Messages Sent (4-hour steady-state period)	30,324

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

Table 2: Tested Configuration

COMPAQ PROLIANT ML370 TESTED CONFIGURATION
Two (2) Pentium III 733-MHz Processors – 512 KB L2 cache per processor
2 GB RAM
One (1) Compaq SMART 4200 Array Controller with 64 MB Cache; one (1) Compaq HSG80 Fibre Controller OS/Exchange DS/MTA Files: Two (1 + 1) 9.2-GB Drives – RAID 1 Pagefile: Partition of System Disk Exchange Log Files: Four (2 + 2) 9.2-GB Drives – RAID 0+1 Exchange Information Store Files: Twenty-four (24) 9.2-GB Drives – RAID 0
Compaq NC3131 64 bit dual-port 10/100 Controller – 2 ports
Windows NT 2000 Advanced Server – Build 2195 Exchange Server Version 5.5 – Enterprise Edition with Service Pack 3

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 ML370 server can successfully scale to 15,500 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 Microsoft homepage at http://www.microsoft.com/.

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	30 clients with 256 MB RAM (1000 users for 10; 500 users for 8; 250 users for 2; 100 users for 10 systems)
Network Topology (100Base T, Token Ring, etc.)	100 Base-TX
Network Controllers	Compaq NC3131
Client network software name and version	Microsoft Windows NT Workstation 4.0 with SP-5
LoadSim version	5.5 (Build 2187)

Performance Data

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

Table A-2: 15,500 MMB (Measured During Test Run at Steady State)

Summary	
Supported Benchmark Load	15,500 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	28020.5
Message Recipients Delivered	155360.5
Messages Sent	7581

continued

Table A-2 *(continued)*

Transaction Load (per Second)	
Message Opens/Sec	57.5
Folder Opens/Sec	14.6
RPC Read Bytes/Sec	50945
RPC Write Bytes/Sec	340510
Transaction Queues	
IS Send Queue Average Length	19.1
MTA Work Queue Average Length	1.54
Processor Utilization	
System Processor Utilization (%)	61.7
System Processor Queue Length	4.9
System Context Switches/Sec	4571
Process % CPU Time - Store	101.35%
Process % CPU Time - DS	6.39%
Process % CPU Time - MTA	8.18%
Memory Utilization	
Available Bytes	3.25GB
Pages/Sec	0.248
Process Working Set Bytes - Store	1.65GB
Process Virtual Bytes - Store	2.15GB
Logical Drive Utilization	
IS Database Disk Reads/Sec	443
IS Database Disk Writes/Sec	250
IS Database Average Disk Queue Length	5.4
IS Log Disk Reads/Sec	0.0
IS Log Disk Writes/Sec	115.6
IS Log Average Disk Queue Length	0

Note: Performance Results were measured using Microsoft Windows NT Performance Monitor. Measurements were obtained by measuring averages for the period of steady-state activity (i.e. after 15,500 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/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	120
Send	300
Delete	240
Move	320
Submit	240

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 key documents and locations provide a wealth of information regarding successful deployment of Microsoft Exchange Server on Compaq platforms.

Compaq ActiveAnswers

www.compaq.com/activeanswers

Managing and Monitoring Microsoft Exchange Server

Microsoft Exchange Server Backup and Restore Performance using Compaq 35/70 DLT Arrays

Microsoft Exchange Server Performance and Tuning Guide

Implementing High Availability for Microsoft Exchange Server

Compaq White Paper Index

www.compaq.com/support/techpubs/whitepapers

Compaq TechNote Index

www.compaq.com/support/techpubs

RAID Technology for Database Servers

Microsoft Exchange Server Web site

www.microsoft.com/exchange