DIGITAL Server 7310 With Microsoft Exchange 5.5 Performance Characterization

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Revision/Update Information:

Revision 1-1. This is an updated document reporting on new testing of the DIGITAL Server 7310 on Microsoft Exchange Server 5.5. It includes information on the number of disks used.

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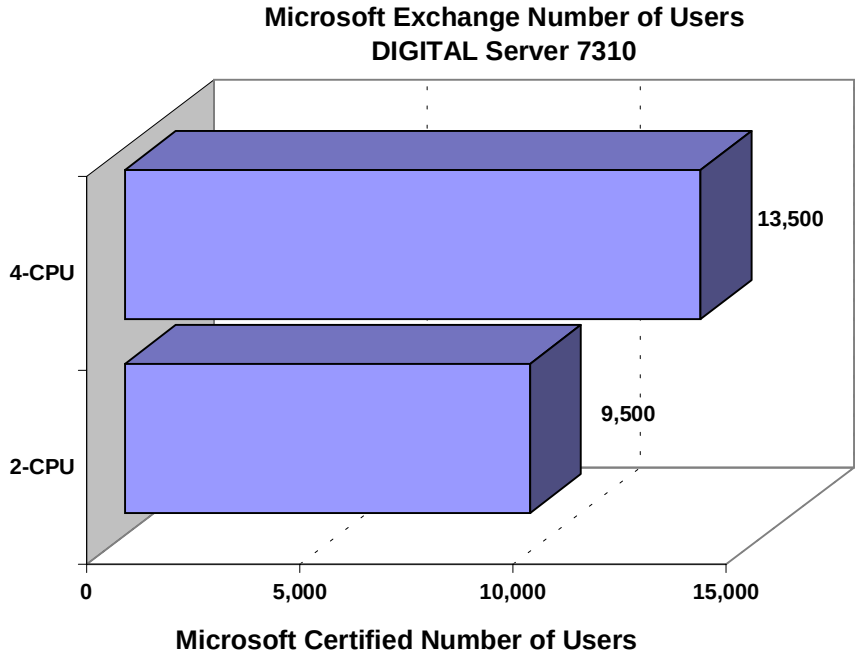
Overview

The Compaq DIGITAL Server 7310 is a system that employs four 600 Megahertz Alpha processors with 8-megabytes of secondary cache per processor. This member of the DIGITAL Server family set both two- and four-processor records, achieving 9,500 LoadSim users on a two-processor system and 13,500 LoadSim Medium users on four processors, based on the new Microsoft Exchange 5.5 UPS (Users Per Server) Policy Guidelines V1.0. Microsoft has verified these numbers. This document provides the guidelines for conducting benchmark UPS tests on Exchange server with the MAPI interface, and the main criteria Microsoft uses to validate these tests.

These new guidelines specify procedures to test the messaging throughput of a single server, single site topology. Its purpose is to measure the maximum throughput of a Microsoft Exchange Server. By standardizing the testing protocols, Microsoft has made it easier to compare performance testing on a fair and consistent basis among vendors. Compaq is, therefore, especially pleased to announce these record-setting results.

Executive Summary

These test results show the maximum number of users Exchange Server 5.5 can support using the Exchange MAPI / RPC protocol on a DIGITAL Server 7310 configured with two- and four-processors. (See APPENDIX A: DIGITAL Server 7310 Configuration). The tests were conducted using Microsoft's LoadSim Tool. (See APPENDIX B: Load Simulator Medium User Profile). Default settings were used for the LoadSim user profiles. The process adhered to the specific practices as described in the Load Simulator 5.5 User Guide for test setup, configuration, and monitoring. All testing was conducted using a steady state period of four hours.



Test Result Highlights	2-Processors	4-Processors
Max Users per server (UPS)	9,500	13,500
95th percentile response time (milliseconds)	337	300
Average CPU Utilization	79%	78%
Average Send Queue Size	2.6	3.6

The Exchange Server workload

Purpose

The purpose of this testing was to determine the maximum number of users that Exchange Server V 5.5 could support on a Compaq DIGITAL Server 7310 under the Exchange 5.5 UPS Policy Guidelines V1.0.

Overview

The DIGITAL Server 7310 was tested as a single-server configuration using Exchange Server 5.5 software. Microsoft's Load Simulator, was used to generate the workload and was configured with a medium-user definition.

Load Simulator

Load Simulator (LoadSim) is a tool that can simulate multiple Exchange users performing common actions such as log on, send, and read messages. Each instance of LoadSim uses a mix of multiple processes and threads to emulate hundreds of users on a single client machine. A collection of several dozen-client machines can generate a workload equivalent to tens of thousands of real Exchange users on a server machine running the Exchange Server application. An Exchange Server's performance can be determined by how responsive it is to a user's requests and how efficiently it handles the workload.

The Medium user definition is suggested for use by Microsoft and is believed to be the closest to an average user. Microsoft and the Exchange Server community use this definition to benchmark servers. Default settings were used for the LoadSim user profiles. The process adhered to the specific practices as described in the Load Simulator 5.5 User Guide for test setup, configuration, and monitoring. All testing was conducted using a steady state period of four hours.

Performing a successful test

Under the Exchange 5.5 UPS Policy Guidelines, a successful Loadsim test requires the following items to be met.

Physical Disk

Average Disk Queue Length should be less than the number of spindles in the physical device. If an array has been configured as multiple physical drives with hardware striping then the sum of all physical drives in the array is used in this calculation.

Current Disk Queue Length should drop to zero periodically throughout the test.

MSExchangeISPrivate

Send Queue Size average should be less than 1% of the number of users in the simulation.

MSExchangeMTA

Work Queue Length average should be less than 1% of the number of users in the simulation.

Client Response Times The weighted-average score must not exceed 1,000 milliseconds.

Message Traffic

The performance monitor data should match the LoadSim's predicted value for Total Messages Submitted. The error margin for Messages Submitted per user per day and Average Recipients per Messages is less than or equal to plus or minus 5%.

Evaluating the results

CPU

With Microsoft Exchange V5.5, CPU utilization can be the bottleneck. On high-end system, it may be necessary to add to the number of threads used by various queues in Exchange to get the maximum amount of CPU utilization out of the system.

Memory configurations

To operate at peak efficiency, Microsoft Exchange V5.5 requires 100 kilobytes of memory per user. Thus, a 1,000-user system requires 100 megabytes of memory.

Disk I/O

Disk I/O bandwidth is the single most important consideration for supporting the maximum number of Exchange users on a system. Disks running at 10,000 RPMs were used in all of these tests. For best results you can configure up to 850 users per disk. In the initial tests, fewer users per disk were used, but later tests were done and proved the 850 users per disk test point. The 850 users per disk is for I/O bandwidth, your storage requirements may require more disks. The 850 users per disk for I/O is the same for the 4-, 9-, and 18-gigabyte disks.

For the four-processor, 13,500-user test, a single 4-gigabyte drive was used for the system disk and a 2-gigabyte page file was installed on a separate disk. Three 4-gigabyte drives were hardware striped for the log disk that contained the store logs and the directory logs. A two-disk set was used for the directory. The public and private databases were contained on 40 disks, using both hardware and software striping. Four sets of ten disks were hardware striped using RAID 0. The four sets of disks were then software striped together. (Note: Subsequent tests showed that the same number of users could actually be supported when using a total of only 16 disks)

The dual-processor, 9,500-user test used two disks for the log disk and the pagefile was placed on the system disk. A total of 24 disks were used for the public and private databases. (Note: Subsequent tests showed that the same number of users could actually be supported when using a total of only 12 disks.)

Networks: minimal impact on results

The two-processor test had a network configuration made up of a private LAN segment using Ethernet Twisted Pair (10 megabit). The LAN connected the server and load simulator clients. In none of the testing was the network a limiting factor.

The 4-processor test had two 10BaseT adapters in the DIGITAL Server 7310. Additional tests were run utilizing a 100-megabit LAN and the results were similar.

Additional Information Sources

For additional information on configuring and sizing of Exchange systems on DIGITAL Servers, please see the document, *Microsoft Exchange V5.5 on DIGITAL Server System: Performance Report, Revision 2.0*, 6 March 1998 available at:
http://www.digital.com/info/lists/performance_WN.HTM

APPENDIX A: DIGITAL Server 7310 Configurations

SYSTEM	DS7310	DS7310
MS Exchange Build	V5.5	V5.5
Loadsim Version	5.5.2.187	5.5.2.187
Operating System	NTSE V4.0 SP3	NTSE V4.0 SP3
# of CPUs	4	2
Number of Users	13,500	9,500
RAM (set by Optimizer)	1350	950
CPU Cache	8 Megabyte	8 Megabyte
DISKS (Total)	47 **(19)***	27 (**15)***
KZPSC-BA	System	System & log
System Disk Type	DS-RZ1CB-VW	DS-RZ1CB-VW
Number of Log Disks	3 (2)*	2
Log Disk Type	DS-RZ1CD-VW	DS-RZ1CB-VW
Controller for IS (wide)	2 KZPBA-CB with 2 HSZ./70 & RA7000	1 KZPBA-CB with HSZ/70 & RA7000
Number of IS Disks	40 **(16)***	24 **(12)***
IS Disks Type	DS-RZ1CD-VW	DS-RZ1CD-VW
External Enclosures	RA7000	RA7000
Ethernet	Two x 10 Megabit	10 Megabit
CPU Utilization	78%	79%
* Later tests decreased the number of disks to 16 Store disks for the 13,500 user test and 12 disks for the 9,500 user test.		

APPENDIX B: Load Simulator Medium User Profile

Microsoft Exchange Server

Overview

This document defines the default medium user profile as defined by Load Simulator. This profile includes messaging and Schedule+ activity and is designed to simulate an average corporate MAPI user.

All frequencies are based on an 8-hour day.

There are several issues to keep in mind when using or referring to Load Simulator profiles:

1) This standard user profile provides a basis for benchmarking the messaging throughput of different hardware and software configurations.
2) To maintain a consistent benchmark, this profile has not been updated over the years. Trends in user behavior such as larger message and attachment sizes have not been incorporated.
3) Load Simulator cannot exactly simulate the profile of your company's user population. You can tune the default profile with data from research and live server monitoring, but it is important to note that a simulation tool has a finite amount of complexity and accuracy.

Summary

Message Traffic (Per User, Per Day)

Logon/Logoff	0*
Total Messages Sent	14.2
Average Recipients per Message	4.68
Messages Received	66.3
Messages Read	81.3
Messages Deleted	33.1
Messages Moved	16.6
*User stays logged on the entire day	

Details

Test Initialization (Per User)

Number of Messages in Inbox	4
Number of Messages in Deleted Items	1
Number of Private Folders	40
Messages per Private Folder	5

Configuration

Public Folder Post	No
Public Folder Browse	No
Logoff	No
Update Free/Busy Information	No

Schedule+ File Size (kb)	
Avg	22
Min	5
Max	40
Use Distribution Lists	Yes
DLs per Site	30
Minimum DL size	2
Average DL size	10.3
Maximum DL size	20
Recipients per Message	3
Add DL to message	30%
Save copy in Sent Items Folder	Yes
Message Priority	Normal
Delivery Receipts	No
Read Receipts	No

Message Actions (Per User, Per Day)

Send New Mail	4
Browse Mail (in Private Folders)	15
Check Inbox	12
Reply	3.8 (7% of all reads)
Reply All	2.7 (5% of all reads)
Forward	3.8 (7% of all reads)
Delete	33.1 (40% of all reads)
Move	16.6 (20% of all reads)
Copy	0 (20% of all reads)
Load Message Attachments	2.6 (25% of messages with attachments)
Update Schedule	5

Message Mix

Body	Attachment	Weighting
1 kilobyte RTF		60
2 kilobyte RTF		16
4 kilobyte RTF		4
1 kilobyte RTF	10k text file	6
1 kilobyte RTF	43k Embedded Bitmap Object	2
1 kilobyte RTF	16k Word document	4
1 kilobyte RTF	15k Excel spreadsheet	4
1 kilobyte RTF	17k Embedded Excel Object	4