

Benchmark brief for Microsoft Exchange Server 2003 on an HP ProLiant BL480c server



| | |
|---|----|
| Executive summary..... | 2 |
| ProLiant BL480c – the server blade behind the outstanding performance | 3 |
| Overview | 3 |
| ProLiant BL480c server blade key features and benefits | 3 |
| Performance | 3 |
| Expansion | 3 |
| Management | 4 |
| Options | 4 |
| HP StorageWorks 8000 Enterprise Virtual Array | 4 |
| Description | 4 |
| Features and benefits..... | 5 |
| Test methodology and workload..... | 6 |
| Test result highlights | 8 |
| Appendix A – Detailed test results..... | 9 |
| Descriptive terms..... | 9 |
| Test results | 10 |
| Response times | 17 |
| Message throughput..... | 17 |
| Test configuration | 18 |
| Load generator configuration..... | 20 |
| Additional configuration and tuning..... | 21 |
| Appendix B – LoadSim changes from previous version | 22 |
| Appendix C – MMB2 and MMB3 workload comparison..... | 23 |
| For more information..... | 31 |
| HP ActiveAnswers | 31 |
| HP Microsoft Exchange Solutions..... | 31 |

Executive summary

In January 2007, HP produced new Microsoft® Exchange MAPI Messaging Benchmark (MMB3) results using Microsoft Windows® Server 2003 and Microsoft Exchange Server 2003, on an HP ProLiant BL480c server blade powered by Dual-Core Intel® Xeon® 5160 3.0 GHz processors. The MMB3 benchmarking workload and methodology serves as the standard for Exchange Server 2003 MAPI server comparison. The MMB3 workload is characteristic of a medium-sized corporate mail environment. Using the Microsoft LoadSim utility, the ProLiant BL480c server blade was tested at the HP Performance Center in Nashua, New Hampshire.

HP achieved world-class Microsoft Exchange Server 2003 scalability results of 13,504 MMB3 on a ProLiant BL480c server blade equipped with:

- Two 64-bit Dual-Core Intel Xeon processors
- 336 – 36 GB 15K hard drives for the Exchange files
- 4 – 72 GB 10K hard disk drives for the operating systems and system logs

The ProLiant BL480c server blade achieved the following:

- Average CPU utilization rate of **84.6%** during the **13,504** MMB3 test
- Weighted 95th percentile response-time score was **256** milliseconds (ms)
- Average send-queue size for the four-hour steady-state period was **94.8** messages

ProLiant BL480c – the server blade behind the outstanding performance

Overview

The HP ProLiant BL480c server blade features two quad-core or dual-core Intel processors, up to 48GB of ECC 667 MHz DDR2 memory, four NICs, and your choice of four hot plug Serial Attached SCSI (SAS) or Serial ATA (SATA) drives. The HP ProLiant BL480c has more than you've come to expect from a 2P server blade, and can handle your most challenging applications.

Figure 1. HP ProLiant BL480c server blade



ProLiant BL480c server blade key features and benefits

Designed to keep pace with high computing demands, the HP ProLiant BL480c offers outstanding dual-core or quad-core processing power, impressive expansion, and management tools that make it easy to deploy and maintain.

Performance

- Up to two of the latest quad-core Intel Xeon 5300 Sequence processors
- Up to 48GB ECC 667MHz DDR2 via 12 DIMM slots
- High performance HP Smart Array P400i with 256MB (optional Battery-Backed Write Cache)

Expansion

- Four hot-plug serial attached SCSI (SAS) or serial ATA (SATA) drives.
- Four integrated Gigabit Ethernet NICs (two are multifunction)
- Three mezzanine expansion slots to support a wide variety of I/O mezzanine cards simultaneously

Management

- HP Integrated Lights-Out 2 (iLO 2) Standard Blade Edition for unprecedented, high-speed management. The Blade Edition includes virtual KVM and graphical remote console at no additional cost.
- Smart power and thermal management now available with HP Power Regulator for policy based power management providing energy. Also offering, new industry exclusive Power Meter reporting capability to log actual power usage.

Options

- Add a battery-backed write cache option to the HP Smart Array P400i Controller to protect against data loss
- Get even more out of HP ProLiant Essentials Integrated Lights-Out, upgrade to Integrated Lights-Out Select Pack for the following features: Power Regulator Reporting, Command line and scripted multi-server virtual media, and Enterprise security (includes directory services and two-factor authentication)
- Take advantage of the three mezzanine expansion slots by adding Fibre Channel and additional NICs.

HP StorageWorks 8000 Enterprise Virtual Array

Description

The HP StorageWorks 4000/6000/8000 Enterprise Virtual Arrays (EVAs) continue to offer customers in the mid-range to enterprise-sized market place leading, high performance, high capacity and high availability "virtual" array storage solutions. Not only do these solutions reduce IT costs and complexity, they save time, space and costs as compared to traditionally architected storage, and they are supported by a powerfully simple suite of management software making it easy for users to achieve highest level of productivity.

Designed for the data center where there is a critical need for improved storage utilization and scalability, the EVAs meet application-specific demands for consistently high transaction I/O for the customer, and provide easy capacity expansion, instantaneous replication, and simplified storage administration. With XCS v6.0 controller software and 4Gb Host Bus Adapters/switches support, the easy to deploy EVA4000 Starter Kits for small SAN use and the EVA4000, 6000, and 8000 provide a comprehensive solution, designed to simplify management and maximize performance. HP also brings integrated iSCSI connectivity to the EVA. Using the HP StorageWorks Command View EVA software to manage the iSCSI connectivity to the array offers a powerful solution providing iSCSI connectivity to an EVA utilizing the EVA's existing fibre channel (FC) infrastructure.

HP StorageWorks delivers easy-to-install, easy-to-manage, and easy-to-support proven server/storage/service solutions that help customers lower their TCO and minimize the complexity of their storage environment.

Figure 2. StorageWorks EVA8000



Features and benefits

- **Simplicity: Reduce costs and complexity** – The EVA4000/6000/8000, combined with HP StorageWorks Command View EVA software, offers simplicity, security and automation of any SAN and lowers TCO. The EVA provides online LUN growth, easy dynamic capacity expansion, instantaneous data replication and optimized performance.
- **Simplicity: Robust, affordable small SAN solution** – The EVA4000 Starter Kit is a robust, highly available small SAN solution that is easy to install, use and scale at an affordable price for SMB, and low-end enterprise IT that demand easy to manage, fast SAN deployment. The EVA4000 Starter Kit includes EVA hardware and software, eight 146GB 10k rpm FC disks, XCS firmware, and 4TBs Command View EVA licensing.
- **Agility: Adapts real time** – New controllers with 2Gb and 4Gb connectivity, double the cache mirroring ports (from early generations) for improved I/O performance. Outstanding virtualization ensures all the disks in the array are used more efficiently, with no stranded capacity, keeping them all busier and eliminating more bottlenecks that lower performance hardware.
- **Agility: Online expansion, tiered storage and online XCS upgrades.** Add physical disks online quickly to increase capacity without restrictions typically associated with capacity expansion on traditional arrays. Mix High Performance and Fibre Attached Technology Adapted (FATA) drives on the same enclosure for maximum efficiency and cost savings. Upgrade XCS online for the latest in features, functionality and availability enhancements.
- **Value: Investment protection** – State-of-the-art virtualization improves performance, disk usage, and allows for easy dynamic expansion. New disks are added to groups, and the controller automatically distributes the data and removes potential hot spots. This powerful solution combines integrated iSCSI connectivity with the features of an EVA and supports 2Gb and 4Gb infrastructures.
- **Virtually instantaneous: Snapclone and capacity-free Snapshot (Vsnap) and Delta Resync (Mirrorclone)** – Allows immediate use of the clone copy, saving significant time. And provides a very efficient, low-cost local data replication option. Saves disk space and improves disk efficiency and utilization.
- **High capacity** – Supports up to 84TB today in a single cabinet and up to 120TB with an expansion cabinet of versatile storage capacity, with any combination of high performance Fibre Channel and/or low cost (400/500GB) FATA drives while supporting all Vraid types. Can quickly and easily add physical disks online.

- Support – Ensures effectiveness of SAN deployment in multiple environments and delivers the proactive services required to help maintain a stable, highly available HP StorageWorks EVA solution.
- Comprehensive SAN Management: Service and Support Tools and Customer Self Repair – EVA includes SAN management tools to improve service levels and meet customer flexibility requirements.
- HP Systems Insight Manager (HP SIM) – server-storage management application
- HP Instant Support Enterprise Edition (ISEE) – proactive remote monitoring for high availability
- EVA Customer Self Repair for improved EVA customer flexibility

Test methodology and workload

For Microsoft Exchange Server 2003, the benchmarks were measured using the MAPI Messaging Benchmark 3 (MMB3).

The MMB3 workload, for LoadSim 2003, is a modification of the previous MMB2 workload. It is designed to include new features from Microsoft Exchange Server 2003 and Microsoft Office Outlook 2003. This workload achieves the following:

- Uses the Microsoft Office Outlook 2003 client
- Introduces Smart Folders
- Introduces the use of server-side rules
- Allows the message distribution to be composed of a larger message size than MMB2
- Increases the mailbox size to 100MB per user
- Removes journaling from the benchmark

For more detailed information regarding the differences between MMB2 and MMB3, please refer to *Appendix C – MMB2 and MMB3 workload comparison* in this document.

This test measures the messaging throughput of a single-server, single-site topology. Its purpose is to measure the maximum throughput of a Microsoft Exchange Server on this hardware configuration.

Note: This test 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, visit <http://www.hp.com/solutions/exchange>.

The MMB3 benchmark does not account for:

- Usage profiles not matching that of the LoadSim MMB3 profile
- Per-user storage and per-server backup requirements
- Fault tolerance requirements, such as protected storage (RAID 0+1, RAID 5) for the system/page file volume, information store and transaction logs
- Anti-virus and management processes and effects on the server
- UBE/UCE (spam) mail flow

- Workloads other than MAPI private folder access. This includes Public Folder, NNTP, POP3 and other e-mail interfaces
- Multiple Exchange Server deployments, where additional resources are required to forward mail intra-site
- Connectors, Links and Replication to remote Exchange sites
- Network topologies, bandwidth availability, latency requirement and SLA related factors like QOS (Quality of Service) and fail-over path issues
- Manageable database sizes and partitioning beyond the 2 Storage Group, 2 database/SG configuration

Test result highlights

| | |
|-----------------------------|---|
| Hewlett Packard | |
| Server: | HP ProLiant BL480c |
| Test results | |
| MMB3 score: | 13,504 |
| Response time: | 256 milliseconds (ms) |
| CPU utilization: | 84.6% |
| Avg. queue: | 94.8 |
| Msgs. Submitted | 588,521 (4-hour steady state period) |
| Msgs. Delivered | 1,439,577 (4-hour steady state period) |
| Msgs. Sent | 588,483 (4-hour steady state period) |
| Server configuration | |
| CPU: | Dual-Core Intel Xeon 5160 3.0 GHz processors |
| CPU count: | 2 Physical (4-cores) |
| RAM: | 4GB |
| Secondary cache: | 4MB |
| Operating system: | Microsoft Windows Server 2003 Enterprise Edition |
| Storage: | 336 – 36 GB 15K – Exchange files 4 – 72 GB 10K – Operating system and system logs |
| Controller: | HP Smart Array P400i controller Dual Port Fibre Channel Card (2Gb) |
| NIC: | Two embedded NC373i Multifunction Gigabit Network Adapters One embedded NC326i Dual Port Gigabit Network Adapter |

Appendix A – Detailed test results

Descriptive terms

Messages Submitted – Submitted calls made by clients. This equates to total messages sent by users.

Messages Sent – Messages that the Store sends to the categorizer in Inetinfo (SMTP Service in particular).

Note: All messages – even MAPI messages – are sent to the categorizer, as this replaces the MTA for all but communication via X.400, with a Microsoft Exchange 5.5 server.

Message Recipients Delivered – Separate mailboxes where messages have been delivered.

Message Opens/Sec – Messages accessed for reading per second.

Folder Opens/Sec – Folders opened for browsing per second.

RPC Read Bytes/Sec – Bytes read from clients, sent via RPCs.

RPC Write Bytes/Sec – Bytes written to clients, sent via RPCs.

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

Test results

The new MAPI Messaging Benchmark 3 (MMB3) measures throughput in terms of a specific profile of user actions, executed over an 8-hour working day.

This benchmark is different from the MMB2 setting that was used with Exchange 2000 in that the rate of client requests is significantly greater for the MMB3 profile.

Table 1. Test results

| Summary | |
|---|-----------------------------------|
| Supported Benchmark Load | 13,504 MMB3s |
| Benchmark Profile | MAPI Messaging Benchmark 3 (MMB3) |
| Protocol | Exchange MAPI |
| Length of Steady State | 4 Hours |
| Length of Test | 8 Hours |
| Transactions in Total | |
| Total Messages Submitted | 588,521 |
| Total Message Recipients Delivered | 1,439,577 |
| Total Messages Sent | 588,483 |
| Message Recipients Delivered / Messages Submitted | 2.45 |
| Total Messages Submitted | 588,521 |
| Transaction Load (per hour) | |
| Messages Submitted / hour | 147,130 |
| Message Recipients Delivered / hour | 359,894 |
| Messages Sent / hour | 147,121 |
| Transaction Load (per second) | |
| RPC Read Bytes / sec | 417,277 |
| RPC Write Bytes / sec | 7,773,129 |

(Table 1 continued next page)

Test results (continued)

| Processor | Average | Max | Min |
|--|----------------|---------------|--------------|
| % Processor Time | 80 | 92 | 0 |
| Database | Average | Max | Min |
| Database cache size | 1,224,806,954 | 1,241,513,984 | 4,538,368 |
| Table opens/sec | 2,235 | 2,916 | 0 |
| Memory Utilization | Average | Max | Min |
| Available Bytes | 677700369.07 | 735993856.00 | 639508480.00 |
| Cache Faults/sec | 1721.69 | 2524.88 | 1056.78 |
| Free System Page Table Entries | 17495.50 | 17627.00 | 17427.00 |
| Pages / sec | 1.17 | 30.45 | 0.00 |
| Pool Non-paged Bytes (Bytes) | 38248635.73 | 38617088.00 | 38047744.00 |
| Pool Paged Bytes (Bytes) | 40140885.33 | 40263680.00 | 39833600.00 |
| System Cache Resident Bytes | 53254263.47 | 64937984.00 | 44142592.00 |
| Transition Faults/sec | 3.41 | 29.32 | 1.05 |
| MSExchangeIS Mailbox | Average | Max | Min |
| Folder Opens / sec | 53.44 | 60.10 | 46.77 |
| Message Opens / sec | 161.53 | 189.72 | 122.50 |
| MSExchangeIS Send Queue Average Length | 94.87 | 489.00 | 0.00 |
| MSExchangeIS Receive Queue Average Length | 0.00 | 0.00 | 0.00 |

(Table 1 continued next page)

Test results (continued)

| MSExchangeIS | Average | Max | Min |
|--|----------------|--------------|--------------|
| Active User Count | 85.53 | 125.00 | 65.00 |
| RPC Average Latency (ms) | 11.63 | 26.00 | 5.00 |
| RPC Num. of Slow Packets | 0.49 | 3.00 | 0.00 |
| RPC Packets/sec | 1944.34 | 2223.31 | 1749.52 |
| RPC Read bytes/sec | 455385.23 | 599457.32 | 344523.82 |
| RPC Requests | 21.97 | 39.00 | 10.00 |
| RPC Operations/sec | 3336.14 | 3835.92 | 2938.30 |
| RPC Write bytes/sec | 8734482.27 | 10346528.80 | 7218044.87 |
| TempTable Current | 15.31 | 38.00 | 4.00 |
| MSExchangeIS VM Largest Block Size | 529019699.20 | 530776064.00 | 527630336.00 |
| MSExchangeIS VM Total 16MB Free Blocks | 2.00 | 2.00 | 2.00 |
| MSExchangeIS VM Total Free Blocks | 290.85 | 302.00 | 277.00 |
| MSExchangeIS VM Large Free Block Bytes | 557306675.20 | 559063040.00 | 555917312.00 |
| Paging File | Average | Max | Min |
| % Usage (_Total) | 2.71 | 2.72 | 2.70 |
| Processor Utilization | Average | Max | Min |
| System Processor Utilization (%) | 84.62 | 91.93 | 75.49 |
| System Processor Interrupts/sec (Total) | 25409.17 | 27041.32 | 22170.11 |
| Process % CPU Time – Store | 281.07 | 308.85 | 248.26 |
| Process % CPU Time – Inetinfo | 9.67 | 11.33 | 8.23 |
| Exchange server is also domain controller? (yes/no) | | | Y |
| Process % CPU Time – LSASS (on domain controller) | 7.41 | 8.98 | 5.94 |

(Table 1 continued next page)

Test results (continued)

| | | | |
|---|----------------|---------------|---------------|
| Handle Count (STORE) | 23617.40 | 25099.00 | 16016.00 |
| Private Bytes (STORE) | 2046696448.00 | 2070413312.00 | 2001526784.00 |
| Virtual Bytes (STORE) | 2477771161.60 | 2487152640.00 | 2469130240.00 |
| Working Set (STORE) | 2184559872.00 | 2208178176.00 | 2139463680.00 |
| Handle Count (Inetinfo) | 4345.25 | 4389.00 | 4292.00 |
| Private Bytes (Inetinfo) | 44070417.07 | 47976448.00 | 40624128.00 |
| Virtual Bytes (Inetinfo) | 484838058.67 | 491413504.00 | 482762752.00 |
| Working Set (Inetinfo) | 175615641.60 | 181280768.00 | 170037248.00 |
| SMTP Server | Average | Max | Min |
| Cat: Address lookups completions/sec | 145.14 | 173.95 | 114.45 |
| Cat: LDAP searches/sec | 10.87 | 12.57 | 9.77 |
| SMTP Categorizer Queue | 0.21 | 4.00 | 0.00 |
| DNS Queries/sec | 0.00 | 0.00 | 0.00 |
| SMTP Local Queue | 131.90 | 519.00 | 62.00 |
| Messages Currently Undeliverable | 0.00 | 0.00 | 0.00 |
| Messages Delivered/sec | 44.48 | 53.12 | 36.12 |
| Messages Received/sec | 0.00 | 0.00 | 0.00 |
| Messages Sent/sec | 0.00 | 0.00 | 0.00 |
| NDRs Generated | 0.00 | 0.00 | 0.00 |
| Remote Queue Length | 0.00 | 0.00 | 0.00 |
| System | Average | Max | Min |
| System Processor Queue Length | 10.20 | 65.00 | 0.00 |
| System Context Switches/Sec | 42553.78 | 47277.86 | 37529.53 |

(Table 1 continued next page)

Test results (continued)

| Disk Utilization (Aggregate for Database Logical Disks) | Average | Max | Min |
|--|----------------|-------------|-------------|
| Logical Drive Utilization (%) - Disk F | 1390.98 | 1824.77 | 1073.48 |
| Logical Drive Utilization (%) - Disk G | 1323.75 | 1687.02 | 1018.94 |
| Logical Drive Utilization (%) - Disk H | 1293.23 | 1632.62 | 1040.60 |
| Logical Drive Utilization (%) - Disk I | 1215.43 | 1528.08 | 922.13 |
| Disk Reads/Sec - Disk F | 3677.76 | 4417.20 | 3085.06 |
| Disk Reads/Sec - Disk G | 3623.87 | 4302.77 | 3113.74 |
| Disk Reads/Sec - Disk H | 3648.24 | 4296.26 | 2990.64 |
| Disk Reads/Sec - Disk I | 3650.29 | 4218.71 | 2967.84 |
| Disk Read Bytes/Sec - Disk F | 16937346.60 | 20341062.40 | 14099758.81 |
| Disk Read Bytes/Sec - Disk G | 16728154.81 | 20206558.53 | 14301144.90 |
| Disk Read Bytes/Sec - Disk H | 16857859.45 | 20124044.00 | 13377099.56 |
| Disk Read Bytes/Sec - Disk I | 16860605.15 | 19936335.27 | 13497925.67 |
| Disk Writes/Sec - Disk F | 1035.40 | 1182.71 | 870.23 |
| Disk Writes/Sec - Disk G | 988.39 | 1140.76 | 831.85 |
| Disk Writes/Sec - Disk H | 1000.72 | 1143.10 | 850.50 |
| Disk Writes/Sec - Disk I | 998.85 | 1170.36 | 823.46 |
| Disk Write Bytes/Sec - Disk F | 6349063.95 | 7384863.87 | 5206233.78 |
| Disk Write Bytes/Sec - Disk G | 6133954.96 | 7350866.39 | 4759511.67 |
| Disk Write Bytes/Sec - Disk H | 6241317.94 | 7296089.44 | 4825428.19 |
| Disk Write Bytes/Sec - Disk I | 6209225.19 | 7262602.51 | 5110874.01 |

(Table 1 continued next page)

Test results (continued)

| | | | |
|---|----------------|------------|------------|
| Disk Avg. Disk sec / Read - Disk F | 0.003 | 0.004 | 0.003 |
| Disk Avg. Disk sec / Read - Disk G | 0.003 | 0.004 | 0.003 |
| Disk Avg. Disk sec / Read - Disk H | 0.003 | 0.004 | 0.003 |
| Disk Avg. Disk sec / Read - Disk I | 0.003 | 0.004 | 0.003 |
| Disk Avg. Disk sec / Write - Disk F | 0.002 | 0.002 | 0.001 |
| Disk Avg. Disk sec / Write - Disk G | 0.002 | 0.002 | 0.001 |
| Disk Avg. Disk sec / Write - Disk H | 0.002 | 0.002 | 0.001 |
| Disk Avg. Disk sec / Write - Disk I | 0.002 | 0.002 | 0.001 |
| Average Disk Queue Length - Disk F | 13.91 | 18.25 | 10.73 |
| Average Disk Queue Length - Disk G | 13.24 | 16.87 | 10.19 |
| Average Disk Queue Length - Disk H | 12.93 | 16.33 | 10.41 |
| Average Disk Queue Length - Disk I | 12.15 | 15.28 | 9.22 |
| Disk Utilization (Aggregate for Transaction Log Logical Disks) | Average | Max | Min |
| Logical Drive Utilization (%) - Disk O | 24.86 | 28.02 | 20.79 |
| Logical Drive Utilization (%) - Disk P | 25.04 | 28.18 | 19.95 |
| Disk Reads/Sec - Disk O | 0.00 | 0.02 | 0.00 |
| Disk Reads/Sec - Disk P | 0.00 | 0.00 | 0.00 |
| Disk Read Bytes/Sec - Disk O | 5.40 | 68.27 | 0.00 |
| Disk Read Bytes/Sec - Disk P | 0.00 | 0.00 | 0.00 |
| Disk Writes/Sec - Disk O | 488.74 | 554.08 | 373.75 |
| Disk Writes/Sec - Disk P | 489.39 | 560.02 | 384.70 |
| Disk Write Bytes/Sec - Disk O | 5272265.60 | 6742082.62 | 3902281.26 |
| Disk Write Bytes/Sec - Disk P | 5267734.93 | 6909801.53 | 3966609.64 |

(Table 1 continued next page)

Test results (continued)

| | | | |
|--|----------------|------------|------------|
| Disk Avg. Disk sec / Read - Disk O | 0.000 | 0.014 | 0.000 |
| Disk Avg. Disk sec / Read - Disk P | 0.000 | 0.000 | 0.000 |
| Disk Avg. Disk sec / Write - Disk O | 0.001 | 0.001 | 0.000 |
| Disk Avg. Disk sec / Write - Disk P | 0.001 | 0.001 | 0.000 |
| Average Disk Queue Length - Disk O | 0.25 | 0.28 | 0.21 |
| Average Disk Queue Length - Disk P | 0.25 | 0.28 | 0.20 |
| Network Utilization | Average | Max | Min |
| Packets Sent/sec | 2416.01 | 3071.87 | 0.00 |
| Packets Received/sec | 2910.21 | 3745.11 | 0.00 |
| Bytes Sent/sec | 3313640.75 | 4661848.93 | 0.00 |
| Bytes Received/sec | 785800.58 | 1055111.01 | 0.00 |

Response times

Table 2. Response times (latencies)

| Client Actions | 95 th Percentile Response Time (in milliseconds) |
|-----------------------|--|
| Send | 621 |
| Read | 131 |
| Reply | 70 |
| Reply All | 80 |
| Forward | 81 |
| Move | 190 |
| Delete | 120 |
| Permanently Delete | 150 |
| S+ Free/Busy | 141 |
| Browse Calendar | 170 |
| Make Appointment | 571 |
| Request Meeting | 1022 |
| Create Smart Folder | 220 |
| Delete Smart Folder | 471 |
| Create Rule | 161 |
| Delete Rule | 211 |
| Apply View/Sort | 5378 |
| Weighted Total | 256 |

Message throughput

Table 3. Summary of the MMB3 profile for an 8 hour day

| | Expected | Measured |
|--------------------------------|----------|----------|
| Messages Submitted/MMB3/Day | 85 | 87.2 |
| Messages Delivered/MMB3/Day | 210 | 213.2 |
| Average Recipients per Message | 2.47 | 2.45 |

Test configuration

Table 4 describes the configuration of the Exchange Server machines (physical) used for this test.

Table 4. Test configuration

| Hardware | Exchange Server | Domain Controller (if remote) |
|----------------------------|--|-------------------------------|
| Vendor | Hewlett-Packard | |
| Model | ProLiant BL480c | |
| Processor | 5160 Dual-Core Intel Xeon 3.0GHz | |
| # of Processors (Physical) | 2 | |
| # of Processors (Logical) | 4 | |
| Hyper-Threading enabled? | N/A | |
| Primary Cache | | |
| Secondary Cache | 4 MB | |
| Other Cache | | |
| Memory | 4 GB | |
| Disk Subsystem | 336 – 36 GB 15K Exchange files 4 – 72 GB 10K Operating system and system logs | |
| Disk Controllers | HP Smart Array P400i Controller Dual Port Fibre Channel Card (2Gb) | |
| Other Hardware | | |

(Table 4 continued next page)

Test configuration (continued)

| Mail Software | Exchange Server | Domain Controller (if remote) |
|--------------------------------|---|--------------------------------------|
| Vendor | Microsoft Corporation | n/a |
| Mail Server | Exchange Server | n/a |
| Release Version | Exchange Server 2003 Enterprise Edition Version 6.5 (Build 6.5.7638.2) SP2 | n/a |
| Operating System | Exchange Server | Domain Controller (if remote) |
| OS Version | Windows Server 2003 Enterprise Edition Version 5.2 SP1 | |
| Service Pack | SP1 | |
| OS Hot-fixes/patches | None | |
| File System Type | NTFS | |
| Network | Exchange Server | Domain Controller (if remote) |
| Type of Network | Gigabit Network | |
| Network Speed | 1Gb | |
| TCP/IP Offload/Checksum | Yes | |
| PCI Flow Control? | No | |
| Interrupt Coalescing? | No | |

Load generator configuration

Table 5. Load generator configuration

| | |
|-----------------------------------|--|
| # of Load Generators (LG) | 24 |
| Total # of LG processes | 1 |
| Simulated users/process | 1-100,1-204, 22-600 |
| Models | ProLiant BL10e |
| Processor | 700 MHz and 900MHz |
| # of Processors (Physical) | 1 |
| # of Processors (Logical) | 0 |
| Hyper-Threading enabled? | No |
| Memory | 1GB |
| Network Controller | NC3163 |
| Network Bandwidth | 10/100 Mb |
| Operating System | Windows Server 2003 Enterprise Edition |

Additional configuration and tuning

The following are Microsoft approved modifications made to the Exchange Server and the server/client operating systems:

Exchange Server settings

Enabled Show Counters=1

HeapDeCommitFreeBlockThreshold=40000

/Userva=3030

/3GB

msExchESEParamCacheSizeMax=303104

Appendix B – LoadSim changes from previous version

- New user profile – In the Test Properties dialog box of LoadSim 2003, there is a “Cached Mode” profile. The “Cached Mode” profile is an example of which tasks should be enabled to simulate a cached mode user.
- RPC/HTTP – LoadSim 2003 allows simulation of RPC/HTTP deployments in entirety. You can use the Test/Logon tab to configure your RPC/HTTP settings, including SSL encryption.
- Outlook 2003 specific tasks – In LoadSim 2003, you can use the new “Smart Folders,” “Offline Address Book,” and “Synchronize Folders” tasks to better simulate real-life users.
- Dynamic Distribution Lists – In the Topology Properties dialog box of LoadSim 2003, there is a “Dynamic Distribution List” (DDL, also known as Query-Based Distribution Group) group of settings that allow the creation of DDLs. The “Send Mail” task also allows sending mail to DDLs with a desired frequency.
- Rules – In LoadSim 2003, you can populate users with server-side rules and simulate how users create and delete them over time. All LoadSim-created rules are visible and capable of being manipulated by Outlook.
- Profile improvements – The medium and heavy profiles have enhanced simulation capabilities that are disabled by default in MMB2. These improvements include keeping messages open and loading message properties in a consistent manner with Outlook 2003.

Appendix C – MMB2 and MMB3 workload comparison

Table 6. Topology properties

| Topology properties | MMB2 | MMB3 |
|--|---------|------------|
| Security | | |
| Use a separate account for each Exchange user | No | Yes |
| Use one account for all Exchange users | Yes | Not Tested |
| Credentials | | |
| Logon to users using their respective accounts | No | No |
| Distribution Lists | | |
| Use Distribution Lists | Yes | Yes |
| Number of Distribution Lists per site | 100 | 1000 |
| Distribution List minimum/average/maximum | 2/10/20 | 2/10/20 |
| Dynamic Distribution Lists (DDLs) | | |
| Use DDLs | No | No |
| Create one for all LoadSim Users | No | No |
| Create one per MDB | No | No |

Table 7. Test Properties

| Test Properties | MMB2 | MMB3 |
|-----------------------------------|------|------|
| Tasks | | |
| Send Mail | | |
| Number of times per day | 7 | 8 |
| Priority percent high | 1 | 15 |
| Priority percent low | 0 | 15 |
| Request receipts percent delivery | 0 | 0 |
| Request receipts percent read | 0 | 0 |
| Request receipts percent both | 0 | 0 |

(Table 7 continued next page)

Test properties (continued)

| Test Properties | MMB2 | MMB3 |
|--|------------|------------|
| Filename (Weight) | | |
| Oups1k.msg ¹ | 37 | 15 |
| Oups2k.msg ¹ | 18 | 18 |
| Oups4k.msg ¹ | 14 | 16 |
| Oups10kat.msg ¹ | 0 | 0 |
| OupsWDatt.msg ¹ | 7 | 20 |
| OupsXLatt.msg ¹ | 7 | 17 |
| OupsBMobj.msg ¹ | 10 | 5 |
| OupsXLobj.msg ¹ | 0 | 0 |
| McPP1Matt.msg ¹ | 1 | 2 |
| McPP100katt.msg ¹ | 5 | 5 |
| McWD2Matt.msg ¹ | 1 | 2 |
| Recipients per message | 1-5, avg 3 | 1-5, avg 3 |
| Add a Distribution List to percent message sent | 30 | 30 |
| Add a DDL to percent message sent | 0 | 0 |
| Save a copy in Sent Items | Yes | Yes |
| Process Inbox | | |
| Read new mail per day | Yes | Yes |
| Load MAPI Properties as Outlook 2003 does | No | Yes |
| Apply Random views to Inbox % of the time | Not Tested | 75 |
| Message Actions | | |
| Reply | 20 | 45 |
| Reply All | 7 | 5 |
| Forward | 10 | 5 |
| Delete | 100 | 25 |
| Copy | 0 | 0 |
| Move | 0 | 10 |

¹ All messages were converted to have HTML bodies in LoadSim 2003.

Test properties (continued)

| Test Properties | MMB2 | MMB3 |
|---|-------------|-------------|
| Message Actions | | |
| Permanently Delete | 0 | 10 |
| Read note delay minimum/average/maximum | 1.0/1.0/1.0 | 0.0/0.0/0.0 |
| Load percent of attachments | 75 | 95 |
| Accept percent of meeting requests | 70 | 70 |
| Open Messages | | |
| Keep up to messages open after browsing | 0 | 0 |
| Leave messages open % of the time | 0 | 0 |
| Maximum Messages in Folders | | |
| No Limit | No | No |
| Limit number of messages | 125 | 125 |
| Browse Mail | | |
| Browse mail per day | 15 | 15 |
| Apply Random views to Folders % of the time | Not Tested | 75 |
| Open Messages | | |
| Keep up to messages open after browsing | Not Tested | 0 |
| Leave messages open % of the time | Not Tested | 0 |
| Maximum Messages in Folders | | |
| No Limit | Yes | Yes |
| Limit number of messages | | |
| Public Folder Post | Not Tested | Not Tested |
| Browse Public Folders | Not Tested | Not Tested |
| Free/Busy | | |
| Update schedule times per day | 4 | 4 |
| Update Free/Busy information | No | Yes |
| Schedule size (KB) minimum/maximum/average | 5/40/22 | 5/40/22 |

(Table 7 continued next page)

Test properties (continued)

| Test Properties | MMB2 | MMB3 |
|--|------------|------------|
| Request Meetings | | |
| Make new meetings per day | 2 | 2 |
| Meeting Length (in hours) minimum/average/ maximum | 1/2/7 | 1/2/7 |
| Attendees minimum/average/maximum | 1/5/40 | 1/5/40 |
| Add a Distribution List percent of the time | 20 | 20 |
| Make Appointments | | |
| New appointments per day | 4 | 4 |
| Appt length minimum/average/maximum | 1/3/9 | 1/3/9 |
| Percent recurring appointments | 15 | 15 |
| Percent all day events | 5 | 5 |
| Browse Calendar | | |
| Number of times per day | 6 | 6 |
| Journal Mail Items | | |
| Number of times per day | Not Tested | Not Tested |
| Journal Applications | | |
| Activity Number of times per day | 3 | Not Tested |
| Logoff | | |
| Number of times per day to log off | 3 | 3 |
| Always keep connection | No | No |
| Empty Deleted Items | Yes | Yes |
| Browse Contacts | | |
| Number of times per day | 10 | 10 |
| Create contact | | |
| Number times/day to make new contact | 1.4 | 1.4 |
| Smart Folders | | |
| Number of times per day | Not tested | 3 |

(Table 7 continued next page)

Test properties (continued)

| Test Properties | MMB2 | MMB3 |
|---|------------|------|
| Actions | | |
| Delete | Not tested | 40 |
| Create | Not tested | 60 |
| Browse | Not tested | 0 |
| Number of Smart Folders (min/max) | Not tested | 3/10 |
| Criteria for mail in Smart Folders | | |
| Unread | Not tested | 20 |
| Important | Not tested | 5 |
| Old Mail | Not tested | 5 |
| For follow up | Not tested | 10 |
| Conversation with random person or DL | Not tested | 5 |
| Unread or for follow up | Not tested | 5 |
| Received this week | Not tested | 5 |
| From random person or DL | Not tested | 20 |
| Large (size) | Not tested | 10 |
| Sent to random DL | Not tested | 5 |
| With specific word | Not tested | 10 |
| Rules | | |
| Number of times per day | Not tested | 3 |
| Activities with Rules | | |
| Delete | Not tested | 40 |
| Create | Not tested | 50 |
| Number of Rules (min/max) | Not tested | 0/10 |
| Conditions | | |
| From DL | Not tested | 20 |
| From person | Not tested | 45 |
| Sent only to me | Not tested | 0 |

(Table 7 continued next page)

Test properties (continued)

| Test Properties | MMB2 | MMB3 |
|--|------------|-------|
| Conditions | | |
| With word in Subject or body | Not tested | 5 |
| Name in To/CC box | Not tested | 0 |
| With attachment | Not tested | 10 |
| Name not in To Box | Not tested | 0 |
| With word in subject | Not tested | 20 |
| Actions | | |
| Delete | Not tested | 0 |
| Move to Folder | Not tested | 100 |
| Copy to Folder | Not tested | 0 |
| Forward to Person | Not tested | 0 |
| Forward to DL | Not tested | 0 |
| Permanently Delete | Not tested | 0 |
| Stop processing more rules | Not tested | 100 |
| Test/Logon | | |
| Logging on immediately at the very beginning of the test | Yes | Yes |
| Logging off at the end of each simulated day | Yes | Yes |
| Empty Deleted Items folder while logging off | Yes | Yes |
| Test Report: Approximate Message Traffic, per User, per Day | | |
| Total received | 185 | 205 |
| Reply | 20.56 | 46.61 |
| Reply All | 6.48 | 4.78 |
| Forward | 10.08 | 4.78 |
| Total submitted | 51 | 84 |
| Average Number of Recipients per Message (All Messages) | 3.63 | 2.44 |
| Approximate receipts requested, per user, per day | | |
| Read receipts | 0 | 0 |
| Delivery receipts | 0 | 0 |

Table 8. Initialization properties

| Initialization Properties | MMB2 | MMB3 |
|-------------------------------------|------|------|
| Mailbox Setup | | |
| Number of messages in Inbox | 55 | 250 |
| Number of messages in Deleted Items | 1 | 1 |
| Number of new folders | 10 | 5 |
| Messages per new folder | 55 | 200 |
| Number of smart folders | 0 | 3 |
| Number of rules in inbox | 0 | 5 |
| Initialize Free/Busy Information | No | No |
| Calendar Setup | | |
| Number of appointments | 25 | 25 |
| Contacts Setup | | |
| Number of contacts | 64 | 64 |

Table 9. Action Weights

| Action Weights (for calculating response times) | MMB2 | MMB3 |
|---|------|------|
| Mailbox Setup | | |
| Send | 1 | 1 |
| Read | 10 | 25 |
| Reply | 1 | 3 |
| Reply All | 1 | 3 |
| Forward | 1 | 3 |
| Move | 1 | 5 |
| Delete | 3 | 5 |
| Permanently Delete | 0 | 5 |
| S+ Free/Busy | 0 | 2 |

(Table 9 continued next page)

Action Weights *(continued)*

| | | |
|----------------------------|---|---|
| Browse Calendar | 1 | 1 |
| Make Appointment | 1 | 1 |
| Request Meeting | 1 | 1 |
| Create Smart Folder | 0 | 1 |
| Delete Smart Folder | 0 | 1 |
| Create Rule | 0 | 1 |
| Delete Rule | 0 | 1 |
| Apply View/Sort | 0 | 1 |

For more information

The following Internet resources provide a wealth of information regarding successful deployment of Microsoft Exchange Server on HP platforms.

For additional information on the HP ProLiant server products, please see HP Server & Enterprise Systems products,

<http://www.hp.com/go/servers>

For additional information on HP StorageWorks products including the EVA8000, please see HP StorageWorks - Enterprise Class Storage Products,

<http://h18006.www1.hp.com/storage/enterprisestorage.html>

HP ActiveAnswers

For additional technical information on Exchange sizing and best practices, there are several white papers and planning tools that are free to download from HP ActiveAnswers,

<http://www.hp.com/solutions/activeanswers/exchange>

HP Microsoft Exchange Solutions

For information on HP Microsoft Exchange solutions, go to,

<http://www.hp.com/solutions/exchange>

To help us improve our documents, please provide feedback at www.hp.com/solutions/feedback

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