

EQUALLOGIC PS Series 60,000-User Storage Solution for Microsoft[®] Exchange Server 2007

ESRP - Storage Version 2.0

PS Series Firmware Version 3.2



Tested with: ESRP – Storage Version 2.0

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Overview

This document provides information on EqualLogic's storage solution for Microsoft Exchange Server, based on the *Microsoft Exchange Solution Reviewed Program (ESRP) – Storage* program*. This solution supports 60,000 simulated Exchange users using EqualLogic PS3900XV arrays with Seagate Cheetah 15K.5 SAS drives. For any questions or comments regarding the contents of this document, please contact EqualLogic.

*The *ESRP – Storage* program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on their storage solutions for Microsoft Exchange Server software. For more details on the *Microsoft ESRP – Storage* program, see the following URL: <http://www.microsoft.com/technet/prodtechnol/exchange/2007/esrp.mspx>

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PS Series Storage Array Features

Using PS Series storage arrays, businesses can leverage their existing Ethernet infrastructure and deploy a complete, easy-to-manage iSCSI SAN, with enterprise-level features included at no extra cost. The revolutionary PS Series architecture was specifically designed to decrease the storage management burden on IT administrators and also alleviate CIO planning and budgetary concerns. EqualLogic chose the iSCSI protocol—with its networking and connectivity advantages—as the basis of the storage solution, and then built intelligence, automation, and redundancy into each PS Series storage array.

PS Series storage arrays use storage virtualization technology to mask the underlying complexity of the storage configuration. This virtualization occurs within and across multiple arrays that are logically grouped together, making management simple and efficient. Reliable hardware, intuitive graphical and command line user interfaces, and automated operations improve productivity and service levels, while RAID configuration, storage expansion, disk sparing, and performance optimization occur automatically.

An IP network is used not only to connect hosts and applications to storage volumes, but also to connect arrays to each other, providing a communication mechanism that the arrays use to share configuration data and collaborate during data provisioning and load balancing. With the self-managing capabilities of PS Series storage arrays, administrators can provision data on-demand and make configuration changes quickly and easily—without disrupting running applications.

The PS Series storage array is a true modular storage system. Each array contains redundant hot-swappable components for high availability; exceeding 99.999% reliability. An array does not act individually, but as part of a group of one or more arrays, accessed through a single IP address. Each array is configured with the RAID level of your choice. Performance load balancing enables volume data to be stored where the RAID configuration is optimal. When more capacity is needed, you simply add another member to the group—capacity and performance scale automatically and linearly. Whether you have one array or many, the group provides a single management view, and the administrative effort remains the same.

Using a PS Series group for disk storage, diverse operating systems and a wide range of applications can share a reliable and high-performance storage system that can scale from hundreds of gigabytes to more than 100 terabytes. Administrators can access the group through a web browser, network connection, or serial connection. The graphical and command line user interfaces present a unified view of the storage that makes provisioning quick and easy. You can instantly create, expand, and delete volumes. Group storage space can be organized into a single pool or multiple pools for increased control and optimal flexibility. In addition, volume snapshots and replicas can be created on demand or through a schedule, providing online backup and restore capabilities with unmatched performance.

Event notification mechanisms—including e-mail, syslog, and SNMP—ensure that any problems in the SAN can be quickly identified and resolved. Automatic controller failover and disk sparing means that failures are handled without requiring user intervention. Servicing the system (including replacing disks, controllers, fans, and power supplies) is all done online.

For a complete storage solution, EqualLogic also provides host-based utilities at no extra cost. The Host Integration Tools enable easy point-and-click array initialization and host configuration. In addition, multipath I/O support enables you to create a reliable and high-performance I/O path between servers and PS Series group data, while Auto-Snapshot Manager for Windows (VSS provider) enables you to create snapshots that are coordinated with Windows applications.

In order to provide a truly complete system, EqualLogic includes numerous advanced features as standard functionality in every PS Series storage array, so there are no hardware add-ons or software licenses to deal with:

- **Modular hardware.** A PS Series group can easily grow or shrink to accommodate workload changes, so administrators can purchase only the storage they need—when they need it. Future products will fully interoperate with first-generation arrays, protecting your initial investment.
 - **Fully-redundant, fault-tolerant storage array.** Each array includes redundant, hot-swappable components—disks, control modules, fans, and power supplies—for a no-single-point-of-failure configuration. Components fail over automatically, without user intervention or disrupting data availability. In addition, data in each array is protected with RAID technology.
 - **Support for RAID 10, RAID 5, and RAID 50.** You can choose to configure arrays with RAID 10, RAID 5, or RAID 50, depending on your capacity and application needs.
 - **Support for a variety of disk drives.** Serial ATA (SATA) and Serial-Attached SCSI (SAS) provide flexibility in capacity and performance to meet all needs.
 - **Automatic spare configuration and utilization.** Disk spares are automatically configured and used to replace failed disks - no user intervention is required.
 - **Auto-Stat Disk Monitoring System (ADMS).** By continually monitoring disk drive health within a PS Series storage array or across a PS Series group, ADMS ensures optimal data availability. ADMS automatically scans drives in the background to proactively detect and correct media anomalies.
 - **High performance control modules.** Dual control modules provide support for network interface and control module failover. Nonvolatile write-back caches are mirrored across the control modules to protect data. Each control module has three Gigabit Ethernet interfaces and copper-based network connectors.
 - **Simple hardware installation.** Only a single network connection on an array is required for operation. Additional network connections can be added at any time (up to a maximum of three on each array) for increased bandwidth and reliability.

- **Support for standard Ethernet networks.** Because PS Series storage arrays use standard Ethernet connections to provide access to storage, there is no need to train administrators in unfamiliar and complex technologies like Fibre Channel. Also, costs are reduced due to the high volumes and intense vendor competition among Ethernet hardware vendors.
- **Easy setup and management.** A simple setup utility lets you quickly configure an array on the network and create a PS Series group; in minutes, you have a functioning iSCSI SAN. By automating complex operations like RAID configuration, disk sparing, data provisioning, and load balancing, even novices can effectively manage the SAN.
 - **Graphical and command line user interfaces.** Password-protected management interfaces provide a single-system view of the storage. Administrators do not need multiple consoles to perform storage management tasks. Using the Group Manager GUI, creating and managing volumes and configuring security, networking, and event notification are point-and-click operations. Also available is an equivalent command line interface (CLI) that can be accessed through telnet, SSH, or a serial connection, or used in scripts.
 - **Automatic data provisioning.** There is no need for administrators to manually create RAIDsets or map data onto disks or individual controllers. Arrays in a group contribute space to a shared pool of storage, from which you create volumes. Each volume has a specific size and access controls. To increase a volume, just specify a new size. The group handles storage allocation and capacity balancing across the disks and arrays.
 - **Dynamic load balancing.** As the workload changes, data and network I/O are automatically load balanced within and across arrays in the group—with no impact on applications and no user intervention. Thus, “hot spots” can be quickly detected and eliminated.
- **Online and seamless scalability.** Increasing array capacity is as easy as installing additional drives or adding more network connections. You can seamlessly expand overall group capacity adding another array to a PS Series group. In all cases, performance scales automatically as disk data and network I/O are load balanced across the added resources. Processing power also increases due to the additional controllers and caches. Meanwhile, volumes remain available with no impact on hosts and applications. There is no need to open a server cabinet or reconfigure an operating system. The additional storage space and network bandwidth are immediately available for use.

More than 100 TB of storage can be configured in a single group. Notably, as the group expands, the management effort remains constant. A group with one array is as easy to manage as a multimember group.

Future EqualLogic products featuring the latest technology will fully interoperate with existing arrays, protecting your initial investment. In a PS Series group, there is no need for arrays to be the same model. The peer storage architecture ensures that all devices are utilized optimally—and automatically.

- **Robust security for both data and management access.** Security between an iSCSI initiator (host) and iSCSI target (volume) can be based on IP address, iSCSI initiator name, or CHAP user name, eliminating the need to understand complicated security technologies (such as Fibre Channel Switch Zoning or LUN Masking). CHAP authentication can be provided through the PS Series group itself or an external RADIUS server.

In addition, access to the group for management purposes requires an administrative account and password. Accounts can have either read-write or read-only privileges.

- **Advanced features are standard in all arrays.** A key PS Series design principle is to include advanced functionality in all arrays. The result is a complete solution with built-in intelligence and

advanced features. All the features described below are standard on each array and require no additional software, licenses, or cost.

- **Cloning.** A clone is an image copy of a volume. Cloning is commonly used in multiple server deployments; for example, a master image of a system can be created and then cloned for each server. Cloning can dramatically reduce overhead when deploying replicated servers, such as blade servers and web servers.
- **Snapshots.** A snapshot quickly captures a volume's contents at a specific point in time and can be used for backups, testing, and upgrades. Both instant and scheduled snapshots are supported. Snapshots greatly simplify and improve the performance of backup and recovery operations. Consistency groups can be created for simultaneous snapshots, maintaining application synchronization across multiple data volumes.
- **Volume Shadow Copy Service (VSS).** EqualLogic arrays are integrated with Microsoft's VSS framework, which is included with Windows Server 2003. This feature enables "turnkey" snapshot backups that can offload the backup process from application servers.
- **Virtual Disk Service (VDS).** The EqualLogic VDS provider enables you to use Microsoft Storage Manager for SANs to create and manage volumes in a PS Series group.
- **Replication.** Using two PS Series groups, you can replicate volumes across unlimited distances to protect your data. Replication enables you to set up a simple, yet robust disaster recovery plan that guards against catastrophic events.

A replica represents the contents of a volume at a specific point in time and is similar to a snapshot, except that it must be stored separately from the original volume. If the original volume is destroyed, you can recover data by cloning a replica. This creates a new volume containing the volume data that existed at the time the replica was created.

- **Multipath I/O.** A redundant network path eliminates any point of failure between hosts and disk storage and improves availability. For high performance, you can load balance I/O across multiple ports (HBAs or NICs).
- **SAN Boot.** Booting servers directly from the SAN is operationally identical to a traditional boot process, but can be accomplished easily and efficiently across hundreds of servers.
- **Storage Pools.** With PS Series storage, you can divide SAN space into multiple storage pools in a single PS Series group to build an efficient, flexible, easy-to-manage networked storage environment. Pools can be used for segregation or tiering of data online.
- **Wide-spread interoperability.** PS Series storage arrays are ideal for heterogeneous environments, with support for most major operating systems and cluster software.

Solution Description

The following sections outline the hardware and software environment that was used to run the ESRP tests.

Hardware and Software

The hardware environment is described in the following table.

Storage	Drives	Servers	Ethernet connections
12 PS3900XV* storage arrays Configured into a single PS Series group, with four storage pools (to allow physical separation of data and logs)	192 15K-RPM 300GB Serial Attached SCSI Seagate Cheetah 15K.5 disk drives	4 Dell PowerEdge 2950s, each with two Intel Xeon 3.73GHz Dual Core CPUs w/Hyper-threading and 8GB memory running VMware ESX Server v3.0.2 On each server, two Virtual Machines (VMs) and three Virtual Switches (vSwitches) were created. Each vSwitch is connected to an independent physical network adapter on the host.	4 gigabit Ethernet connections: <ul style="list-style-type: none">o Dual port Broadcom Gigabit Ethernet Adapter (model: BCM5708C, driver v 1.4.51b)o Dual port Intel Gigabit Ethernet Adapter (model: PRO/1000 PT, driver v7.3.15)

* The PS3900XV has been qualified for use with Microsoft products. See the following URL for more information:
<http://windowsservercatalog.com/item.aspx?idItem=112FDB39-F611-941F-9135-9A1B2FABD795>

Each VM was configured as follows:

- 4 virtual CPUs
- 3072MB Memory
- 3 virtual network adapters (each connected to an independent vSwitch)
- VMware Resource Allocation set to “Normal”
- No Scheduling Affinity

Each VM was running the following software:

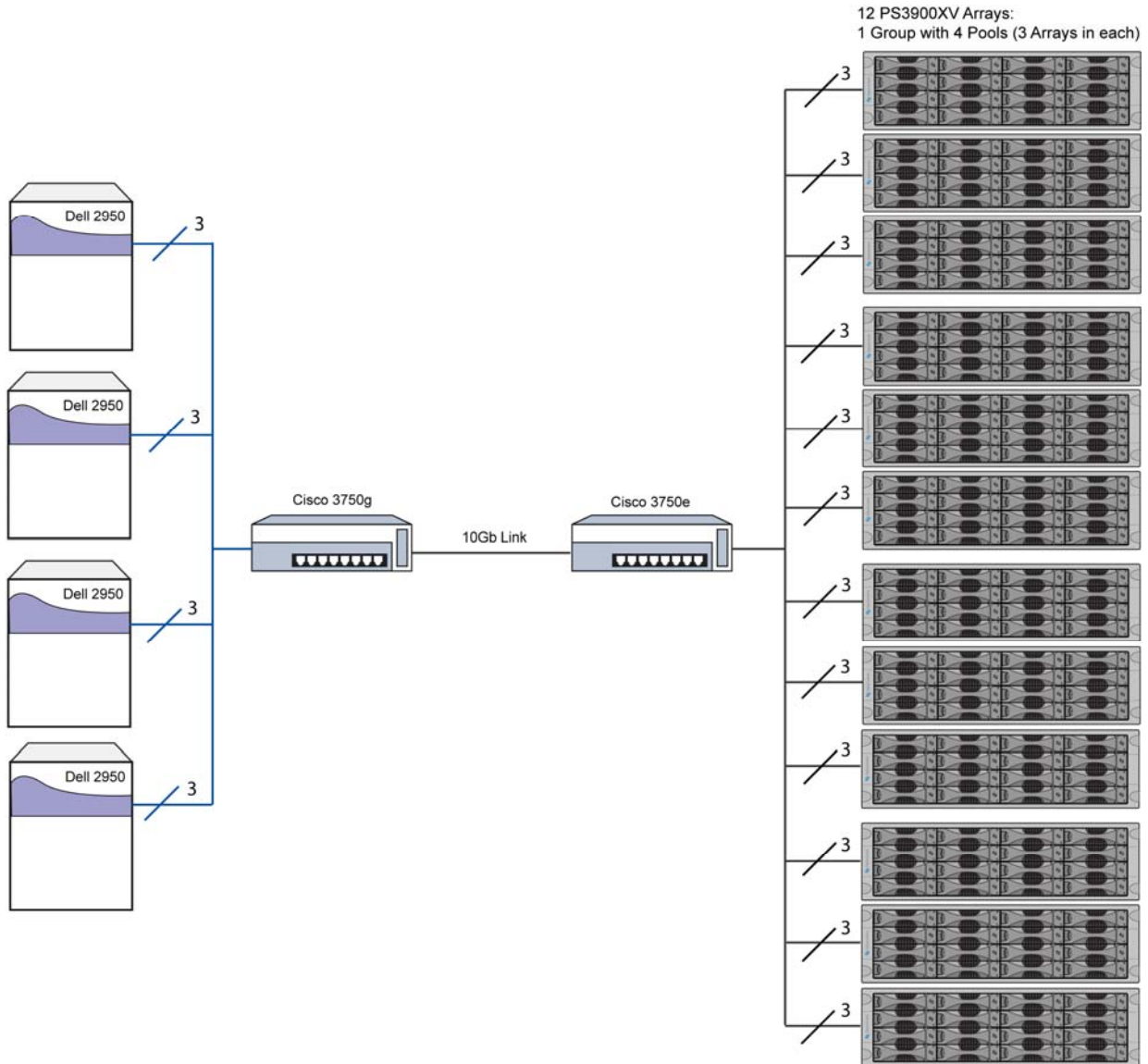
- Microsoft Windows 2003 R2 Standard x64 Edition
- Microsoft iSCSI software initiator v2.04
- EqualLogic Host Integration Toolkit v3.0
- Jetstress v08.01.0112

A virtualized server environment was chosen to simulate a larger number of servers connecting to the storage network. Microsoft’s support policy for running Exchange Server 2007 on a non-Microsoft virtualized environment is outlined at:

<http://support.microsoft.com/kb/897615/>

Cisco Catalyst 3750 Gigabit Ethernet Switches were used. All the storage arrays were connected to one switch, and all four servers were connected to the other switch. The network interconnect between the two switches was a single 10 Gigabit Ethernet link.

PS Series Solution for Exchange Server Test Configuration



Exchange Storage Group Layout

To perform the tests, the EqualLogic PS3900XV storage arrays were configured into a single PS Series group, consisting of four storage pools. In each storage pool, eight volumes were created: four volumes for data and four volumes for logs. In a PS Series group, multiple pools are required to provision Exchange databases and logs onto separate disks. Deploying an Exchange storage group using a single pool is also supported. There is no performance difference between using a single pool or multiple pools. In this report, multiple pools are utilized to meet the following Microsoft Exchange best practices recommendations:

<http://technet.microsoft.com/en-us/library/bb738147.aspx>

There are eight simulated Exchange servers in the test. Each Exchange server uses one data volume and one log volume from each storage pool, resulting in four data volumes and four log volumes per Exchange server.

The ESRP-Storage program focuses on storage solution testing to address performance and reliability issues with storage design. However, storage is not the only factor to take into consideration when designing a scalable Exchange solution.

Other factors that affect server scalability are:

- server processor utilization
- server physical and virtual memory limitations
- resource requirements for other applications
- directory and network service latencies
- network infrastructure limitations
- replication and recovery requirements
- client usage profiles

All these factors are beyond the scope of the ESRP-Storage test. Therefore, the number of mailboxes hosted per server as part of the tested configuration may not necessarily be viable for some customer deployments.

For more information on identifying and addressing performance bottlenecks in an Exchange system, refer to Microsoft's Troubleshooting Microsoft Exchange Server Performance, available at the following URL:

<http://go.microsoft.com/fwlink/?LinkId=23454>

Targeted Customer Profile

The PS Series storage solution is intended for medium-sized Exchange 2007 Server customers who want reliable, high-performance, and easy-to-manage disk storage. The tested configuration can support the following:

- 60,000 users
- 0.32 I/O per second per user (MS Exchange 2007 “heavy” profile: 0.40 IOPS per user including 20% headroom)
- 300MB mailbox size
- 24 storage groups, 5 databases each

Tested Deployment

The following tables summarize the testing environment.

Simulated Exchange Configuration

Number of Exchange mailboxes simulated	60,000
Number of hosts	8
Number of mailboxes/host	7,500
Number of storage groups/host	4
Number of mailbox stores/storage group	5

Number of mailboxes/mailbox store	375
Number of mailbox store LUNs/storage group	1
Simulated profile: I/Os per second per mailbox (IOPS, including 20% headroom)	0.32 (0.40 for tests including 20% headroom)
Database LUN size	768 GB
Log LUN size	30 GB
Backup LUN size/storage group	N/A
Total database size for performance testing	17,840GB
% storage capacity used by Exchange database	73%**

** Storage performance characteristics change based on the percentage utilization of the individual disks. Tests that use a small percentage of the storage (~25%) may exhibit reduced throughput if the storage capacity utilization is significantly increased beyond what is tested in this paper.

Primary Storage Hardware

Storage Connectivity	iSCSI
Storage model and OS/firmware revision	EqualLogic PS3900XV Firmware Rev: V3.2.0 http://www.equallogic.com/products/view.aspx?id=2509
Storage cache	12GB (1GB per array)
Number of storage controllers	24 (2 per array)
Number of storage ports	36 (3 per array)
Maximum bandwidth of storage connectivity to host	10Gb Ethernet
Switch type/model/firmware revision	Cisco Catalyst 3750 Gigabit Ethernet Switch Firmware Rev: V12.2
HBA model and firmware	<ul style="list-style-type: none"> o Broadcom BCM5708C NetXtreme II Gigabit Ethernet Adapters o Intel PRO/1000 PT Dual Port Gigabit Ethernet Adapters
Number of HBAs/host	4 (2 Broadcom, 2 Intel)
Host server type	<ul style="list-style-type: none"> o VMs: VMware Virtual Servers, 4x Intel x64 3.73GHZ CPUs, 3GB RAM o Hardware: Dell PowerEdge 2950, 2x Intel Xeon Dual Core 3.73GHZ, 8GB RAM
Total number of disks tested in solution	192 Seagate Cheetah 15K.5 300G 15,000 rpm SAS drives (16 per array)
Maximum number of spindles	192 (16 per array)

Primary Storage Software

NIC driver	Broadcom Driver Version: 2.6.14.0 Intel Driver Version: 9.2.24.1
Multipathing	EqualLogic HIT (Host Integration Toolkit) 3.0
Host OS	<ul style="list-style-type: none"> o VMs: Windows Server 2003 R2, Standard x64 Edition, Service Pack 2 o Hardware: VMware ESX Server v3.0.1
ESE.dll file version	08.00.0685.024
Replication solution name/version	N/A

Primary Storage Disk Configuration (Databases and Logs)

Disk type, speed and firmware revision	Seagate 15K SAS Model: ST3300655SS Firmware Revision: XRS0
Raw capacity per disk (GB)	300
Number of physical disks in test	192
Total raw storage capacity (GB)	57,600

Disk slice size (GB)	N/A
Number of slices per LUN or number of disks per LUN	48 disks per LUN
Raid level	RAID10
Total formatted capacity (GB)	25,536
Storage capacity utilization	44%
Database capacity utilization	30%

Best Practices

Exchange server is a disk-intensive application. Based on the tests using the ESRP framework, EqualLogic recommends the following best practices to improve storage performance:

- Use `diskpart` (in Windows Server 2003 RC2) to align all Exchange-related disks on a 128KB boundary. To do this, use the value of 128 for EqualLogic PS Series arrays.
- Allow the PS Series group to automatically balance the load across arrays, caches, and network links. Automatic load balancing reduces administrator effort as Exchange workloads change over time.
- In large Exchange deployments, isolate the Exchange workload from other application workloads by creating separate storage pools for Exchange-related volumes in a PS Series group and setting up separate VMs for Exchange and other applications.
- Depending on the desired level of availability, you can configure Exchange using multiple storage pools in a PS Series group to provide complete resource and hardware isolation between logs and databases. You can also deploy Exchange using a single pool, which provides a high level of availability and makes provisioning simple. Performance and reliability are similar in either a single pool group or multiple-pool group.
- Size and configure first for I/O performance, then for storage capacity.
- Enable EqualLogic Host Integration Tools V3.0 on Exchange servers to ensure highly-available SAN connections with Microsoft's MPIO.
- Use Microsoft iSCSI software initiators or the VMware ESX iSCSI initiators in Exchange configurations. In these tests, the Microsoft iSCSI software initiator was used.
- Use separate volumes for Exchange databases and transaction logs to improve backup and recovery operations.
- Place SAN infrastructure on VLANs or subnets that differ from other production network traffic.
- Use non-blocking Gigabit Ethernet switches.

For Exchange 2007 best practices on storage design, please visit the following URL:

<http://technet.microsoft.com/en-us/library/bb124518.aspx>

Additional Information

For more information, see the EqualLogic website (www.equallogic.com). In addition, EqualLogic technical documents may be useful: <http://www.equallogic.com/resources/technicaldocumentsview.aspx>

Test Result Summary

This section provides a high-level summary of the test data from ESRP–Storage. See *Appendix A* for detailed information about the test results.

Reliability Results

A number of tests in the framework check reliability. The goal is to verify the storage can handle high I/O load for a long period of time. Both log and database files are analyzed for integrity after the stress test to ensure no database or log corruption.

The following list provides an overview:

- There were errors in the saved event log file, but they were unrelated to the benchmark (for example, “printer driver unavailable” errors were recorded when Remote Desktop connections were established to the server during the benchmark run).
- No errors were reported by the database and log checksum process.

Performance Results

The Primary Storage performance testing is designed to exercise the storage with maximum sustainable Exchange I/O for 2 hours. The test shows how long it takes for the storage to respond to an I/O under load. The data below is the sum of all of the logical disk I/Os and the average of all the logical disks’ I/O latency during the test (two hours). Each server is listed separately and the aggregate numbers across all servers are also presented.

Individual Server Metrics

The sum of I/Os across storage groups and the average latency across all storage groups on a per server basis.

Table 1 EXCHANGE-VM1 Performance Results

Database I/O	
Average Database Disk Transfers/sec	3,746.38
Average Database Disk Reads/sec	2,090.37
Average Database Disk Writes/sec	1,656.01
Average Database Disk Read Latency (ms)	14.25
Average Database Disk Write Latency (ms)	13.00
Transaction Log I/O	
Average Log Disk Writes/sec	557.03
Average Log Disk Write Latency (ms)	2.00

Table 2 EXCHANGE-VM2 Performance Results

Database I/O	
Average Database Disk Transfers/sec	3,924.36
Average Database Disk Reads/sec	2,125.63
Average Database Disk Writes/sec	1,798.73
Average Database Disk Read Latency (ms)	14.25
Average Database Disk Write Latency (ms)	11.25
Transaction Log I/O	
Average Log Disk Writes/sec	562.88
Average Log Disk Write Latency (ms)	2.00

Table 3 EXCHANGE-VM3 Performance Results

Database I/O	
Average Database Disk Transfers/sec	3,395.37
Average Database Disk Reads/sec	1,898.00
Average Database Disk Writes/sec	1,497.37
Average Database Disk Read Latency (ms)	16.00
Average Database Disk Write Latency (ms)	14.00
Transaction Log I/O	
Average Log Disk Writes/sec	501.89
Average Log Disk Write Latency (ms)	3.00

Table 4 EXCHANGE-VM4 Performance Results

Database I/O	
Average Database Disk Transfers/sec	3,794.25
Average Database Disk Reads/sec	2,117.78
Average Database Disk Writes/sec	1,676.48
Average Database Disk Read Latency (ms)	14.00
Average Database Disk Write Latency (ms)	12.75
Transaction Log I/O	
Average Log Disk Writes/sec	562.83
Average Log Disk Write Latency (ms)	2.00

Table 5 EXCHANGE-VM5 Performance Results

Database I/O	
Average Database Disk Transfers/sec	3,859.22
Average Database Disk Reads/sec	2,151.34
Average Database Disk Writes/sec	1,707.87
Average Database Disk Read Latency (ms)	14.00
Average Database Disk Write Latency (ms)	11.75
Transaction Log I/O	
Average Log Disk Writes/sec	567.21
Average Log Disk Write Latency (ms)	2.00

Table 6 EXCHANGE-VM6 Performance Results

Database I/O	
Average Database Disk Transfers/sec	3,725.20
Average Database Disk Reads/sec	2,068.68
Average Database Disk Writes/sec	1,656.52
Average Database Disk Read Latency (ms)	14.75
Average Database Disk Write Latency (ms)	11.25
Transaction Log I/O	
Average Log Disk Writes/sec	549.71
Average Log Disk Write Latency (ms)	2.00

Table 7 EXCHANGE-VM7 Performance Results

Database I/O	
Average Database Disk Transfers/sec	3,657.68
Average Database Disk Reads/sec	2,032.60
Average Database Disk Writes/sec	1,625.08
Average Database Disk Read Latency (ms)	15.00
Average Database Disk Write Latency (ms)	12.00
Transaction Log I/O	
Average Log Disk Writes/sec	537.26
Average Log Disk Write Latency (ms)	2.00

Table 8 EXCHANGE-VM8 Performance Results

Database I/O	
Average Database Disk Transfers/sec	2,966.02
Average Database Disk Reads/sec	1,652.31
Average Database Disk Writes/sec	1,313.71
Average Database Disk Read Latency (ms)	18.25
Average Database Disk Write Latency (ms)	16.25
Transaction Log I/O	
Average Log Disk Writes/sec	438.19
Average Log Disk Write Latency (ms)	3.00

Aggregate Performance across All Servers

The sum of I/Os across all servers and the average latency across all servers.

Database I/O	
Average Database Disk Transfers/sec	29,068.47
Average Database Disk Reads/sec	16,136.70
Average Database Disk Writes/sec	12,931.78
Average Database Disk Read Latency (ms)	15.06
Average Database Disk Write Latency (ms)	12.78
Transaction Log I/O	
Average Log Disk Writes/sec	4,277.01
Average Log Disk Write Latency (ms)	2.25

Streaming Backup/Recovery Performance

The test measures the maximum rate at which multiple databases can be backed up in series.

Database Read-Only Performance

The following table shows the average rate for a single database file.

MB read/sec (avg. per storage group)	14.70
MB read/sec (avg. per VM)	58.81
MB read/sec (total)	470.46

Log Read-Only Performance

The test measures the maximum rate at which the log files can be played against the databases. The following table shows the average rate for 500 log files played in a single storage group. Each log file is 1 MB.

Average time to play one Log file (sec)	0.69
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Conclusion

This document was developed by EqualLogic, Inc., and reviewed by the Microsoft Exchange Product team. The test results and data presented in this document are based on the tests introduced in the ESRP v2.0 test framework. Customers should not quote the data directly for their pre-deployment verification. It is still necessary to go through the exercises to validate the storage design for a specific customer environment.

The ESRP Storage program is not designed to be a benchmarking program. Its tests are not designed for achieving the maximum throughput for a given solution. Rather, they are focused on producing recommendations from vendors for the Exchange application. Therefore, the data presented in this document should not be used for direct comparisons among the solutions.

Appendix A

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM1

Stress Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM1
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spares 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/23/2007 9:09:13 AM
Test End Time	8/24/2007 9:14:33 AM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Stress_2007_8_23_9_9_16.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_24_9_14_33.blg

Database Sizing and Throughput

Achieved I/O per Second	3730.563
Planned I/O per Second	3000
Initial database size	2395937243136
Final database size	2649625526272
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%

Lazy commits	80%
--------------	-----

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.015	0.011	528.902	403.773	(n/a)
Database (S:)	0.015	0.011	528.216	403.851	(n/a)
Database (T:)	0.015	0.010	528.735	403.921	(n/a)
Database (U:)	0.015	0.010	528.659	404.506	(n/a)
Log (N:)	0.000	0.002	0.000	139.254	18132.759
Log (O:)	0.000	0.002	0.000	139.000	18165.071
Log (L:)	0.000	0.002	0.000	139.236	18117.524
Log (M:)	0.000	0.002	0.000	139.313	18149.080

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	53.401	33.299	83.342
Available MBytes	1441.393	1419.000	1554.000
Free System Page Table Entries	3130776.000	3130776.000	3130776.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	44177264.419	43909120.000	44474368.000
Pool Paged Bytes	41293256.103	40570880.000	41943040.000
Database Page Fault Stalls/sec	0.000	0.000	1.091

```

Test Log 8/23/2007 9:09:13 AM -- Jetstress testing begins ...
8/23/2007 9:09:13 AM -- Prepare testing begins ...
8/23/2007 9:09:15 AM -- Attaching databases ...
8/23/2007 9:09:15 AM -- Prepare testing ends.
8/23/2007 9:09:15 AM -- Dispatching transactions begins ...
8/23/2007 9:09:15 AM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/23/2007 9:09:15 AM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/23/2007 9:09:16 AM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.1 seconds/read).
8/23/2007 9:09:16 AM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.1 seconds/write).
8/23/2007 9:09:26 AM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/23/2007 9:09:26 AM -- Performance logging begins (interval: 15000 ms).
8/23/2007 9:09:26 AM -- Attaining prerequisites:
8/23/2007 9:14:17 AM -- \Database(JetstressWin)\Database Cache Size, Last:
967704600.0 (lower bound: 966367600.0, upper bound: none)
8/24/2007 9:14:18 AM -- Performance logging ends.
8/24/2007 9:14:19 AM -- JetInterop batch transaction stats: 1532408, 1531406,
1533519, and 1532563.

```

8/24/2007 9:14:20 AM -- Dispatching transactions ends.
8/24/2007 9:14:20 AM -- Shutting down databases ...
8/24/2007 9:14:33 AM -- Instance944.1 (complete), Instance944.2 (complete), Instance944.3 (complete), and Instance944.4 (complete)
8/24/2007 9:14:36 AM -- Performance logging begins (interval: 30000 ms).
8/24/2007 9:14:36 AM -- Verifying database checksums ...
8/24/2007 6:17:29 PM -- R: (100% processed), S: (100% processed), T: (100% processed), and U: (100% processed)
8/24/2007 6:17:30 PM -- Performance logging ends.
8/24/2007 6:17:30 PM -- E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_24_9_14_33.blg has 1068 samples.
8/24/2007 6:18:33 PM -- E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_24_9_14_33.html is saved.
8/24/2007 6:18:33 PM -- Verifying log checksums ...
8/24/2007 6:19:14 PM -- N:\ (44 logs passed), O:\ (46 logs passed), L:\ (49 logs passed), and M:\ (35 logs passed)
8/24/2007 6:19:14 PM -- E:\Jetstress Test Results\8VM-4Grps-Config\Stress_2007_8_23_9_9_16.blg has 5752 samples.
8/24/2007 6:19:14 PM -- Creating test report ...
8/24/2007 6:22:59 PM -- Volume R: has 0.0152 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Volume S: has 0.0148 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Volume T: has 0.0147 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Volume U: has 0.0147 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Volume N: has 0.0022 for Avg. Disk sec/Write.
8/24/2007 6:22:59 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Volume O: has 0.0022 for Avg. Disk sec/Write.
8/24/2007 6:22:59 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Volume L: has 0.0022 for Avg. Disk sec/Write.
8/24/2007 6:22:59 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Volume M: has 0.0022 for Avg. Disk sec/Write.
8/24/2007 6:22:59 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/24/2007 6:22:59 PM -- Test has 1.09108787346449 Maximum Database Page Fault Stalls/sec.
8/24/2007 6:22:59 PM -- Test has 11 Database Page Fault Stalls/sec samples higher than 0.
8/24/2007 6:22:59 PM -- E:\Jetstress Test Results\8VM-4Grps-Config\Stress_2007_8_23_9_9_16.xml has 5733 samples queried.

Database Checksum Report

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
R:\Jetstress1.edb	16156274	0	0	0	126220 MBytes / 7213 seconds
R:\Jetstress2.edb	16178802	0	0	0	126396 MBytes / 7525 seconds
R:\Jetstress3.edb	16152946	0	0	0	126194 MBytes / 7596 seconds
R:\Jetstress4.edb	16188018	0	0	0	126468 MBytes / 7368 seconds
R:\Jetstress5.edb	16158322	0	0	0	126236 MBytes / 2801 seconds

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
S:\Jetstress1.edb	16184178	0	0	0	126438 MBytes / 5900 seconds
S:\Jetstress2.edb	16186226	0	0	0	126454 MBytes / 5500 seconds
S:\Jetstress3.edb	16169074	0	0	0	126320 MBytes / 5815 seconds
S:\Jetstress4.edb	16154994	0	0	0	126210 MBytes / 5806 seconds
S:\Jetstress5.edb	16184434	0	0	0	126440 MBytes / 5757 seconds
T:\Jetstress1.edb	16166258	0	0	0	126298 MBytes / 6817 seconds
T:\Jetstress2.edb	16166770	0	0	0	126302 MBytes / 6376 seconds
T:\Jetstress3.edb	16179058	0	0	0	126398 MBytes / 6553 seconds
T:\Jetstress4.edb	16175730	0	0	0	126372 MBytes / 6517 seconds
T:\Jetstress5.edb	16163442	0	0	0	126276 MBytes / 4986 seconds
U:\Jetstress1.edb	16167538	0	0	0	126308 MBytes / 6613 seconds
U:\Jetstress2.edb	16175474	0	0	0	126370 MBytes / 6199 seconds
U:\Jetstress3.edb	16181874	0	0	0	126420 MBytes / 6426 seconds
U:\Jetstress4.edb	16173170	0	0	0	126352 MBytes / 6434 seconds
U:\Jetstress5.edb	16178034	0	0	0	126390 MBytes / 5220 seconds
(Sum)	323440616	0	0	0	2526879 MBytes / 32573 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
R:	2.289	0.006	394.400	0.001
S:	1.887	0.014	445.785	0.002
T:	2.024	0.003	409.951	0.002
U:	2.002	0.006	415.214	0.002

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	45.959	35.355	83.034
Available MBytes	2269.562	2244.000	2448.000
Free System Page Table Entries	3130586.712	3130586.000	3130776.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	54667191.131	50671616.000	55894016.000
Pool Paged Bytes	42666559.281	42520576.000	43888640.000

Test Log 8/23/2007 9:09:13 AM -- Jetstress testing begins ...
 8/23/2007 9:09:13 AM -- Prepare testing begins ...
 8/23/2007 9:09:15 AM -- Attaching databases ...
 8/23/2007 9:09:15 AM -- Prepare testing ends.
 8/23/2007 9:09:15 AM -- Dispatching transactions begins ...
 8/23/2007 9:09:15 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 8/23/2007 9:09:15 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 8/23/2007 9:09:16 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).
 8/23/2007 9:09:16 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).
 8/23/2007 9:09:26 AM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.
 8/23/2007 9:09:26 AM -- Performance logging begins (interval: 15000 ms).
 8/23/2007 9:09:26 AM -- Attaining prerequisites:
 8/23/2007 9:14:17 AM -- \Database(JetstressWin)\Database Cache Size, Last: 967704600.0 (lower bound: 966367600.0, upper bound: none)
 8/24/2007 9:14:18 AM -- Performance logging ends.
 8/24/2007 9:14:19 AM -- JetInterop batch transaction stats: 1532408, 1531406, 1533519, and 1532563.
 8/24/2007 9:14:20 AM -- Dispatching transactions ends.
 8/24/2007 9:14:20 AM -- Shutting down databases ...
 8/24/2007 9:14:33 AM -- Instance944.1 (complete), Instance944.2 (complete), Instance944.3 (complete), and Instance944.4 (complete)
 8/24/2007 9:14:36 AM -- Performance logging begins (interval: 30000 ms).
 8/24/2007 9:14:36 AM -- Verifying database checksums ...
 8/24/2007 6:17:29 PM -- R: (100% processed), S: (100% processed), T: (100% processed), and U: (100% processed)
 8/24/2007 6:17:30 PM -- Performance logging ends.
 8/24/2007 6:17:30 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_24_9_14_33.blg](#) has 1068 samples.

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM1

Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spare 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:37:58 PM
Test End Time	8/20/2007 2:41:28 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_1.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_28.blg

Database Sizing and Throughput

Achieved I/O per Second	3746.376
Planned I/O per Second	3000
Initial database size	2371576725504
Final database size	2394307756032
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.015	0.013	522.563	413.243	(n/a)
Database (S:)	0.014	0.013	522.487	413.770	(n/a)
Database (T:)	0.014	0.013	522.810	414.486	(n/a)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (U:)	0.014	0.013	522.507	414.511	(n/a)
Log (N:)	0.000	0.002	0.000	138.833	18772.999
Log (O:)	0.000	0.002	0.000	138.516	18873.253
Log (L:)	0.000	0.002	0.000	139.851	18718.298
Log (M:)	0.000	0.002	0.000	139.833	18701.165

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	54.316	47.027	72.642
Available MBytes	1460.568	1456.000	1491.000
Free System Page Table Entries	3131807.000	3131807.000	3131807.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40149627.438	39817216.000	40398848.000
Pool Paged Bytes	37940749.954	37838848.000	38453248.000
Database Page Fault Stalls/sec	0.001	0.000	0.168

```

Test Log 8/20/2007 12:37:58 PM -- Jetstress testing begins ...
8/20/2007 12:37:58 PM -- Prepare testing begins ...
8/20/2007 12:37:59 PM -- Attaching databases ...
8/20/2007 12:37:59 PM -- Prepare testing ends.
8/20/2007 12:37:59 PM -- Dispatching transactions begins ...
8/20/2007 12:38:00 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:38:00 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:38:01 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:38:01 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:38:06 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:38:06 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:38:07 PM -- Attaining prerequisites:
8/20/2007 12:41:10 PM -- \Database(JetstressWin)\Database Cache Size, Last:
968622100.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:41:12 PM -- Performance logging ends.
8/20/2007 2:41:13 PM -- JetInterop batch transaction stats: 134024, 134250,
134149, and 134207.
8/20/2007 2:41:14 PM -- Dispatching transactions ends.
8/20/2007 2:41:14 PM -- Shutting down databases ...
8/20/2007 2:41:28 PM -- Instance2268.1 (complete), Instance2268.2 (complete),
Instance2268.3 (complete), and Instance2268.4 (complete)
8/20/2007 2:41:30 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:41:30 PM -- Verifying database checksums ...
8/20/2007 10:53:17 PM -- R: (100% processed), S: (100% processed), T: (100%
processed), and U: (100% processed)
8/20/2007 10:53:18 PM -- Performance logging ends.

```

8/20/2007 10:53:18 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_28.blg](#) has 966 samples.
8/20/2007 10:54:19 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_28.html](#) is saved.
8/20/2007 10:54:19 PM -- Verifying log checksums ...
8/20/2007 10:54:50 PM -- N:\ (36 logs passed), O:\ (36 logs passed), L:\ (38 logs passed), and M:\ (36 logs passed)
8/20/2007 10:54:50 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_1.blg](#) has 489 samples.
8/20/2007 10:54:50 PM -- Creating test report ...
8/20/2007 10:55:07 PM -- Volume R: has 0.0149 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Volume S: has 0.0145 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Volume T: has 0.0144 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Volume U: has 0.0145 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Volume N: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:55:07 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Volume O: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:55:07 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Volume L: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:55:07 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Volume M: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:55:07 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:55:07 PM -- Test has 0.16838400921213 Maximum Database Page Fault Stalls/sec.
8/20/2007 10:55:07 PM -- Test has 4 Database Page Fault Stalls/sec samples higher than 0.
8/20/2007 10:55:07 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_1.xml](#) has 476 samples queried.

Streaming Backup Test Report

Streaming Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance2284.1	570736.49	10:59:30	14.42
Instance2284.2	570904.49	10:53:23	14.56
Instance2284.3	570922.49	10:46:16	14.72
Instance2284.4	570786.49	11:07:20	14.26

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.006	8.47884443841904E-06	144.879	0.004	(n/a)
Database (S:)	0.005	9.12970962798563E-06	144.901	0.004	(n/a)
Database (T:)	0.005	1.31257769171926E-05	144.910	0.004	(n/a)
Database (U:)	0.006	1.51462994836489E-05	144.747	0.001	(n/a)
Log (N:)	0.000	7.9585583714167E-07	0.000	0.002	15.761
Log (O:)	0.000	1.35048390282441E-06	0.000	0.002	15.137
Log (L:)	0.000	3.53471338771234E-06	0.000	0.002	22.018
Log (M:)	0.000	0.000	0.000	0.000	0.000

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	36.859	16.450	79.561
Available MBytes	2551.549	2538.000	2553.000
Free System Page Table Entries	3131087.000	3131087.000	3131087.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	45146561.974	45027328.000	46395392.000
Pool Paged Bytes	39656168.307	39583744.000	40804352.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

```

Test Log 8/21/2007 9:42:04 AM -- Jetstress testing begins ...
8/21/2007 9:42:04 AM -- Prepare testing begins ...
8/21/2007 9:42:06 AM -- Attaching databases ...
8/21/2007 9:42:06 AM -- Prepare testing ends.
8/21/2007 9:42:11 AM -- Performance logging begins (interval: 30000 ms).
8/21/2007 9:42:11 AM -- Streaming backup databases ...
8/21/2007 8:49:33 PM -- Performance logging ends.
8/21/2007 8:49:33 PM -- Instance2284.1 (100% processed), Instance2284.2 (100%
processed), Instance2284.3 (100% processed), and Instance2284.4 (100%
processed)
8/21/2007 8:49:33 PM -- E:\Jetstress Test Results\8VM-4Grps-Config\StreamingBackup\_2007\_8\_21\_9\_42\_6.blg has 1329 samples.
8/21/2007 8:49:33 PM -- Creating test report ...

```

Soft Recovery Test Report

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance4024.1	509	276.28125
Instance4024.2	517	285.78125
Instance4024.3	502	271.53125
Instance4024.4	509	275.03125

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.020	0.002	795.916	46.604	(n/a)
Database (S:)	0.032	0.002	813.467	47.043	(n/a)
Database (T:)	0.027	0.002	738.139	46.018	(n/a)
Database (U:)	0.021	0.002	764.800	46.650	(n/a)
Log (N:)	0.004	0.002	76.432	3.750	3853.390
Log (O:)	0.003	0.002	77.754	3.607	3829.304
Log (L:)	0.003	0.002	75.376	3.666	3935.789
Log (M:)	0.003	0.002	76.555	3.668	3828.911

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	60.999	30.682	95.467
Available MBytes	1715.575	1455.000	2509.000
Free System Page Table Entries	3130760.657	3130757.000	3130827.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	47171003.224	46358528.000	53686272.000
Pool Paged Bytes	41709690.269	41410560.000	42024960.000
Database Page Fault Stalls/sec	0.014	0.000	1.230

```

Test Log 8/22/2007 9:43:24 AM -- Jetstress testing begins ...
8/22/2007 9:43:24 AM -- Prepare testing begins ...
8/22/2007 9:43:26 AM -- Attaching databases ...
8/22/2007 9:43:26 AM -- Prepare testing ends.
8/22/2007 9:43:26 AM -- Dispatching transactions begins ...
8/22/2007 9:43:26 AM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/22/2007 9:43:26 AM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/22/2007 9:43:27 AM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/22/2007 9:43:27 AM -- Log write latency thresholds: (average: 0.01

```

seconds/write, maximum: 0.05 seconds/write).

8/22/2007 9:43:36 AM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

8/22/2007 9:43:36 AM -- Performance logging begins (interval: 15000 ms).

8/22/2007 9:43:36 AM -- Generating log files ...

8/22/2007 9:56:03 AM -- N:\ (101.6% generated), O:\ (103.0% generated), L:\ (100.2% generated), and M:\ (101.8% generated)

8/22/2007 9:56:04 AM -- Performance logging ends.

8/22/2007 9:56:05 AM -- JetInterop batch transaction stats: 10059, 9964, 9913, and 9915.

8/22/2007 9:56:06 AM -- Dispatching transactions ends.

8/22/2007 9:56:06 AM -- Shutting down databases ...

8/22/2007 9:56:19 AM -- Instance4024.1 (complete), Instance4024.2 (complete), Instance4024.3 (complete), and Instance4024.4 (complete)

8/22/2007 9:56:21 AM -- Performance logging begins (interval: 30000 ms).

8/22/2007 9:56:21 AM -- Verifying database checksums ...

8/22/2007 6:08:30 PM -- R: (100% processed), S: (100% processed), T: (100% processed), and U: (100% processed)

8/22/2007 6:08:31 PM -- Performance logging ends.

8/22/2007 6:08:31 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_22_9_56_19.blg](#) has 958 samples.

8/22/2007 6:09:22 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_22_9_56_19.html](#) is saved.

8/22/2007 6:09:22 PM -- Verifying log checksums ...

8/22/2007 6:10:28 PM -- N:\ (100 logs passed), O:\ (100 logs passed), L:\ (100 logs passed), and M:\ (100 logs passed)

8/22/2007 6:10:28 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_22_9_43_27.blg](#) has 48 samples.

8/22/2007 6:10:28 PM -- Creating test report ...

8/22/2007 6:10:29 PM -- Volume R: has 0.0148 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Volume S: has 0.0145 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Volume T: has 0.0143 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Volume U: has 0.0142 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Volume N: has 0.0027 for Avg. Disk sec/Write.

8/22/2007 6:10:29 PM -- Volume N: has 0.0015 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Volume O: has 0.0026 for Avg. Disk sec/Write.

8/22/2007 6:10:29 PM -- Volume O: has 0.0032 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Volume L: has 0.0026 for Avg. Disk sec/Write.

8/22/2007 6:10:29 PM -- Volume L: has 0.0032 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Volume M: has 0.0026 for Avg. Disk sec/Write.

8/22/2007 6:10:29 PM -- Volume M: has 0.0019 for Avg. Disk sec/Read.

8/22/2007 6:10:29 PM -- Test has 1.71680585946261 Maximum Database Page Fault Stalls/sec.

8/22/2007 6:10:29 PM -- Test has 4 Database Page Fault Stalls/sec samples higher than 0.

8/22/2007 6:10:29 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_22_9_43_27.xml](#) has 47 samples queried.

8/22/2007 6:10:30 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_22_9_43_27.html](#) is saved.

8/22/2007 6:10:32 PM -- Performance logging begins (interval: 2000 ms).

8/22/2007 6:10:32 PM -- Recovering databases ...

8/22/2007 6:15:20 PM -- Performance logging ends.

8/22/2007 6:15:20 PM -- Instance4024.1 (276.28125), Instance4024.2 (285.78125), Instance4024.3 (271.53125), and Instance4024.4 (275.03125)

8/22/2007 6:15:20 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\SoftRecovery_2007_8_22_18_10_30.blg](#) has 134 samples.

8/22/2007 6:15:20 PM -- Creating test report ...

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM2

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM2
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spare 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:38:45 PM
Test End Time	8/20/2007 2:41:42 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_47.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_42.blg

Database Sizing and Throughput

Achieved I/O per Second	3815.354
Planned I/O per Second	3000
Initial database size	2373640323072
Final database size	2394452459520
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.015	0.012	530.358	425.329	(n/a)
Database (S:)	0.014	0.011	530.570	421.215	(n/a)
Database (T:)	0.014	0.011	536.289	423.330	(n/a)
Database (U:)	0.014	0.011	528.409	419.855	(n/a)
Log (N:)	0.000	0.002	0.000	141.610	18893.815
Log (O:)	0.000	0.002	0.000	141.049	18693.926
Log (L:)	0.000	0.002	0.000	140.829	18761.983
Log (M:)	0.000	0.002	0.000	139.389	18885.991

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	55.205	47.173	65.751
Available MBytes	1469.237	1464.000	1518.000
Free System Page Table Entries	3131737.000	3131737.000	3131737.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	38484375.883	38080512.000	38850560.000
Pool Paged Bytes	38019982.222	37904384.000	38526976.000
Database Page Fault Stalls/sec	0.000	0.000	0.085

```

Test Log 8/20/2007 12:38:45 PM -- Jetstress testing begins ...
8/20/2007 12:38:45 PM -- Prepare testing begins ...
8/20/2007 12:38:46 PM -- Attaching databases ...
8/20/2007 12:38:46 PM -- Prepare testing ends.
8/20/2007 12:38:46 PM -- Dispatching transactions begins ...
8/20/2007 12:38:46 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:38:46 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:38:47 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:38:47 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:38:50 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:38:50 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:38:50 PM -- Attaining prerequisites:
8/20/2007 12:41:26 PM -- \Database(JetstressWin)\Database Cache Size, Last:
972226600.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:41:28 PM -- Performance logging ends.
8/20/2007 2:41:29 PM -- JetInterop batch transaction stats: 134964, 134144,
134797, and 134173.
8/20/2007 2:41:30 PM -- Dispatching transactions ends.
8/20/2007 2:41:30 PM -- Shutting down databases ...

```

8/20/2007 2:41:42 PM -- Instance2712.1 (complete), Instance2712.2 (complete), Instance2712.3 (complete), and Instance2712.4 (complete)
8/20/2007 2:41:45 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:41:45 PM -- Verifying database checksums ...
8/20/2007 10:49:14 PM -- R: (100% processed), S: (100% processed), T: (100% processed), and U: (100% processed)
8/20/2007 10:49:14 PM -- U:\Jetstress3.edb has 1 bad checksum page(s).
8/20/2007 10:49:15 PM -- Performance logging ends.
8/20/2007 10:49:15 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_42.blg](#) has 962 samples.
8/20/2007 10:50:15 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_42.html](#) is saved.
8/20/2007 10:50:15 PM -- Verifying log checksums ...
8/20/2007 10:50:59 PM -- N:\ (58 logs passed), O:\ (34 logs passed), L:\ (34 logs passed), and M:\ (43 logs passed)
8/20/2007 10:50:59 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_47.blg](#) has 487 samples.
8/20/2007 10:50:59 PM -- Creating test report ...
8/20/2007 10:51:17 PM -- Volume R: has 0.0145 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Volume S: has 0.0141 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Volume T: has 0.0141 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Volume U: has 0.0142 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Volume N: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:51:17 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Volume O: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:51:17 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Volume L: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:51:17 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Volume M: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:51:17 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:51:17 PM -- Test has 0.0852175127134545 Maximum Database Page Fault Stalls/sec.
8/20/2007 10:51:17 PM -- Test has 1 Database Page Fault Stalls/sec samples higher than 0.
8/20/2007 10:51:17 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_47.xml](#) has 476 samples queried.

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM3

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM3
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spare 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:38:37 PM
Test End Time	8/20/2007 2:41:58 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_40.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_58.blg

Database Sizing and Throughput

Achieved I/O per Second	3395.373
Planned I/O per Second	3000
Initial database size	2371775954944
Final database size	2393942851584
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.016	0.014	474.106	374.494	(n/a)
Database (S:)	0.016	0.014	475.920	376.420	(n/a)
Database (T:)	0.016	0.014	471.195	373.655	(n/a)
Database (U:)	0.016	0.014	476.778	372.805	(n/a)
Log (N:)	0.000	0.003	0.000	125.685	18626.722
Log (O:)	0.000	0.003	0.000	126.375	18605.031
Log (L:)	0.000	0.003	0.000	125.182	18673.917
Log (M:)	0.000	0.003	0.000	124.650	18622.298

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	54.489	43.069	70.436
Available MBytes	1471.582	1467.000	1562.000
Free System Page Table Entries	3131687.000	3131687.000	3131687.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	38018412.184	37531648.000	38244352.000
Pool Paged Bytes	37882610.075	37773312.000	38371328.000
Database Page Fault Stalls/sec	0.005	0.000	1.532

```

Test Log 8/20/2007 12:38:37 PM -- Jetstress testing begins ...
8/20/2007 12:38:37 PM -- Prepare testing begins ...
8/20/2007 12:38:39 PM -- Attaching databases ...
8/20/2007 12:38:39 PM -- Prepare testing ends.
8/20/2007 12:38:39 PM -- Dispatching transactions begins ...
8/20/2007 12:38:39 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:38:39 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:38:40 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:38:40 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:38:43 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:38:43 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:38:43 PM -- Attaining prerequisites:
8/20/2007 12:41:42 PM -- \Database(JetstressWin)\Database Cache Size, Last:
967598100.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:41:45 PM -- Performance logging ends.
8/20/2007 2:41:45 PM -- JetInterop batch transaction stats: 132728, 132783,
132266, and 132666.

```

8/20/2007 2:41:46 PM -- Dispatching transactions ends.
8/20/2007 2:41:46 PM -- Shutting down databases ...
8/20/2007 2:41:58 PM -- Instance2416.1 (complete), Instance2416.2 (complete),
Instance2416.3 (complete), and Instance2416.4 (complete)
8/20/2007 2:42:00 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:42:00 PM -- Verifying database checksums ...
8/20/2007 10:38:33 PM -- R: (100% processed), S: (100% processed), T: (100%
processed), and U: (100% processed)
8/20/2007 10:38:34 PM -- Performance logging ends.
8/20/2007 10:38:34 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\DBChecksum_2007_8_20_14_41_58.blg](#) has 937 samples.
8/20/2007 10:39:31 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\DBChecksum_2007_8_20_14_41_58.html](#) is saved.
8/20/2007 10:39:31 PM -- Verifying log checksums ...
8/20/2007 10:40:13 PM -- N:\ (36 logs passed), O:\ (36 logs passed), L:\ (31
logs passed), and M:\ (33 logs passed)
8/20/2007 10:40:13 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\Performance_2007_8_20_12_38_40.blg](#) has 489 samples.
8/20/2007 10:40:13 PM -- Creating test report ...
8/20/2007 10:40:30 PM -- Volume R: has 0.0163 for Avg. Disk sec/Read.
8/20/2007 10:40:30 PM -- Volume S: has 0.0160 for Avg. Disk sec/Read.
8/20/2007 10:40:30 PM -- Volume T: has 0.0160 for Avg. Disk sec/Read.
8/20/2007 10:40:30 PM -- Volume U: has 0.0160 for Avg. Disk sec/Read.
8/20/2007 10:40:30 PM -- Volume N: has 0.0026 for Avg. Disk sec/Write.
8/20/2007 10:40:30 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:40:30 PM -- Volume O: has 0.0026 for Avg. Disk sec/Write.
8/20/2007 10:40:30 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:40:30 PM -- Volume L: has 0.0026 for Avg. Disk sec/Write.
8/20/2007 10:40:30 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:40:30 PM -- Volume M: has 0.0026 for Avg. Disk sec/Write.
8/20/2007 10:40:30 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:40:31 PM -- Test has 1.5320673906118 Maximum Database Page Fault
Stalls/sec.
8/20/2007 10:40:31 PM -- Test has 6 Database Page Fault Stalls/sec samples
higher than 0.
8/20/2007 10:40:31 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\Performance_2007_8_20_12_38_40.xml](#) has 477 samples queried.

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM4

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM4
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spares 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:38:05 PM
Test End Time	8/20/2007 2:41:33 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_8.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_33.blg

Database Sizing and Throughput

Achieved I/O per Second	3794.25
Planned I/O per Second	3000
Initial database size	2371759177728
Final database size	2394332921856
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (S:)	0.014	0.013	530.281	418.824	(n/a)
Database (T:)	0.014	0.013	527.809	418.911	(n/a)
Database (U:)	0.014	0.012	532.535	420.185	(n/a)
Database (R:)	0.014	0.013	527.150	418.555	(n/a)
Log (O:)	0.000	0.002	0.000	140.563	18771.352
Log (L:)	0.000	0.002	0.000	139.752	18910.389
Log (M:)	0.000	0.002	0.000	141.106	18732.385
Log (N:)	0.000	0.002	0.000	141.408	18675.617

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	54.328	44.361	76.973
Available MBytes	1456.063	1452.000	1514.000
Free System Page Table Entries	3132067.000	3132067.000	3132067.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	39364036.964	39018496.000	39542784.000
Pool Paged Bytes	37101095.715	36995072.000	37588992.000
Database Page Fault Stalls/sec	0.001	0.000	0.171

```

Test Log 8/20/2007 12:38:05 PM -- Jetstress testing begins ...
8/20/2007 12:38:05 PM -- Prepare testing begins ...
8/20/2007 12:38:07 PM -- Attaching databases ...
8/20/2007 12:38:07 PM -- Prepare testing ends.
8/20/2007 12:38:07 PM -- Dispatching transactions begins ...
8/20/2007 12:38:07 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:38:07 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:38:08 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:38:08 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:38:10 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:38:10 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:38:10 PM -- Attaining prerequisites:
8/20/2007 12:41:17 PM -- \Database(JetstressWin)\Database Cache Size, Last:
967147500.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:41:19 PM -- Performance logging ends.
8/20/2007 2:41:20 PM -- JetInterop batch transaction stats: 132463, 132660,
132862, and 132982.
8/20/2007 2:41:21 PM -- Dispatching transactions ends.
8/20/2007 2:41:21 PM -- Shutting down databases ...

```

8/20/2007 2:41:33 PM -- Instance2612.1 (complete), Instance2612.2 (complete), Instance2612.3 (complete), and Instance2612.4 (complete)
8/20/2007 2:41:36 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:41:36 PM -- Verifying database checksums ...
8/20/2007 10:52:06 PM -- S: (100% processed), T: (100% processed), U: (100% processed), and R: (100% processed)
8/20/2007 10:52:07 PM -- Performance logging ends.
8/20/2007 10:52:07 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_33.blg](#) has 968 samples.
8/20/2007 10:53:00 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_33.html](#) is saved.
8/20/2007 10:53:00 PM -- Verifying log checksums ...
8/20/2007 10:53:42 PM -- O:\ (63 logs passed), L:\ (46 logs passed), M:\ (46 logs passed), and N:\ (50 logs passed)
8/20/2007 10:53:42 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_8.blg](#) has 489 samples.
8/20/2007 10:53:42 PM -- Creating test report ...
8/20/2007 10:53:59 PM -- Volume S: has 0.0145 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Volume T: has 0.0143 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Volume U: has 0.0143 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Volume R: has 0.0143 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Volume O: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:59 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Volume L: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:59 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Volume M: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:59 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Volume N: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:59 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:59 PM -- Test has 0.171494823676954 Maximum Database Page Fault Stalls/sec.
8/20/2007 10:53:59 PM -- Test has 2 Database Page Fault Stalls/sec samples higher than 0.
8/20/2007 10:53:59 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_8.xml](#) has 476 samples queried.

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM5

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM5
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spares 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:39:02 PM
Test End Time	8/20/2007 2:42:35 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_39_5.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_42_35.blg

Database Sizing and Throughput

Achieved I/O per Second	3859.218
Planned I/O per Second	3000
Initial database size	2371715137536
Final database size	2394641203200
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.014	0.012	537.564	427.470	(n/a)
Database (S:)	0.014	0.012	538.749	427.855	(n/a)
Database (T:)	0.014	0.011	537.916	426.392	(n/a)
Database (U:)	0.014	0.012	537.114	426.157	(n/a)
Log (N:)	0.000	0.002	0.000	142.101	18855.199
Log (O:)	0.000	0.002	0.000	141.765	18888.926
Log (L:)	0.000	0.002	0.000	141.755	18845.251
Log (M:)	0.000	0.002	0.000	141.589	18845.974

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	53.448	45.369	76.804
Available MBytes	1453.478	1449.000	1511.000
Free System Page Table Entries	3131877.000	3131877.000	3131877.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	39025975.279	38731776.000	39223296.000
Pool Paged Bytes	37895814.172	37801984.000	38400000.000
Database Page Fault Stalls/sec	0.002	0.000	0.759

```

Test Log 8/20/2007 12:39:02 PM -- Jetstress testing begins ...
8/20/2007 12:39:02 PM -- Prepare testing begins ...
8/20/2007 12:39:04 PM -- Attaching databases ...
8/20/2007 12:39:04 PM -- Prepare testing ends.
8/20/2007 12:39:04 PM -- Dispatching transactions begins ...
8/20/2007 12:39:04 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:39:04 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:39:05 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:39:05 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:39:09 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:39:09 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:39:09 PM -- Attaining prerequisites:
8/20/2007 12:42:19 PM -- \Database(JetstressWin)\Database Cache Size, Last:
968007700.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:42:21 PM -- Performance logging ends.
8/20/2007 2:42:22 PM -- JetInterop batch transaction stats: 135589, 136029,
135672, and 135002.
8/20/2007 2:42:22 PM -- Dispatching transactions ends.
8/20/2007 2:42:22 PM -- Shutting down databases ...
8/20/2007 2:42:35 PM -- Instance1996.1 (complete), Instance1996.2 (complete),

```

Instance1996.3 (complete), and Instance1996.4 (complete)
8/20/2007 2:42:37 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:42:37 PM -- Verifying database checksums ...
8/20/2007 10:52:00 PM -- R: (100% processed), S: (100% processed), T: (100% processed), and U: (100% processed)
8/20/2007 10:52:01 PM -- Performance logging ends.
8/20/2007 10:52:01 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_42_35.blg](#) has 959 samples.
8/20/2007 10:52:53 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_42_35.html](#) is saved.
8/20/2007 10:52:53 PM -- Verifying log checksums ...
8/20/2007 10:53:34 PM -- N:\ (37 logs passed), O:\ (41 logs passed), L:\ (43 logs passed), and M:\ (40 logs passed)
8/20/2007 10:53:34 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_39_5.blg](#) has 489 samples.
8/20/2007 10:53:34 PM -- Creating test report ...
8/20/2007 10:53:48 PM -- Volume R: has 0.0144 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Volume S: has 0.0142 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Volume T: has 0.0143 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Volume U: has 0.0143 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Volume N: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:48 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Volume O: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:48 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Volume L: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:48 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Volume M: has 0.0023 for Avg. Disk sec/Write.
8/20/2007 10:53:48 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:53:48 PM -- Test has 0.759465121247118 Maximum Database Page Fault Stalls/sec.
8/20/2007 10:53:48 PM -- Test has 1 Database Page Fault Stalls/sec samples higher than 0.
8/20/2007 10:53:48 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_39_5.xml](#) has 476 samples queried.

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM6

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM6
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spare 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:38:47 PM
Test End Time	8/20/2007 2:42:21 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_50.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_42_21.blg

Database Sizing and Throughput

Achieved I/O per Second	3725.197
Planned I/O per Second	3000
Initial database size	2371744497664
Final database size	2394871889920
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.015	0.012	518.134	415.481	(n/a)
Database (S:)	0.015	0.011	516.203	412.520	(n/a)
Database (T:)	0.015	0.011	515.848	413.342	(n/a)
Database (U:)	0.014	0.011	518.492	415.178	(n/a)
Log (N:)	0.000	0.002	0.000	137.243	19041.052
Log (O:)	0.000	0.002	0.000	137.526	18825.165
Log (L:)	0.000	0.002	0.000	137.519	18888.923
Log (M:)	0.000	0.002	0.000	137.421	18932.250

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	54.626	46.054	78.034
Available MBytes	1454.667	1450.000	1537.000
Free System Page Table Entries	3132067.586	3132067.000	3132137.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	38563325.858	38199296.000	38789120.000
Pool Paged Bytes	37611194.377	37515264.000	38121472.000
Database Page Fault Stalls/sec	0.001	0.000	0.167

```

Test Log 8/20/2007 12:38:47 PM -- Jetstress testing begins ...
8/20/2007 12:38:47 PM -- Prepare testing begins ...
8/20/2007 12:38:49 PM -- Attaching databases ...
8/20/2007 12:38:49 PM -- Prepare testing ends.
8/20/2007 12:38:49 PM -- Dispatching transactions begins ...
8/20/2007 12:38:49 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:38:49 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:38:50 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:38:50 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:38:53 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:38:53 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:38:54 PM -- Attaining prerequisites:
8/20/2007 12:42:07 PM -- \Database(JetstressWin)\Database Cache Size, Last:
971456500.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:42:08 PM -- Performance logging ends.
8/20/2007 2:42:09 PM -- JetInterop batch transaction stats: 135186, 134760,
134608, and 134467.
8/20/2007 2:42:09 PM -- Dispatching transactions ends.

```

8/20/2007 2:42:09 PM -- Shutting down databases ...
8/20/2007 2:42:21 PM -- Instance2168.1 (complete), Instance2168.2 (complete),
Instance2168.3 (complete), and Instance2168.4 (complete)
8/20/2007 2:42:24 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:42:24 PM -- Verifying database checksums ...
8/20/2007 10:31:40 PM -- R: (100% processed), S: (100% processed), T: (100%
processed), and U: (100% processed)
8/20/2007 10:31:42 PM -- Performance logging ends.
8/20/2007 10:31:42 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\DBChecksum_2007_8_20_14_42_21.blg](#) has 914 samples.
8/20/2007 10:32:39 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\DBChecksum_2007_8_20_14_42_21.html](#) is saved.
8/20/2007 10:32:39 PM -- Verifying log checksums ...
8/20/2007 10:33:45 PM -- N:\ (44 logs passed), O:\ (40 logs passed), L:\ (36
logs passed), and M:\ (40 logs passed)
8/20/2007 10:33:45 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\Performance_2007_8_20_12_38_50.blg](#) has 490 samples.
8/20/2007 10:33:45 PM -- Creating test report ...
8/20/2007 10:34:04 PM -- Volume R: has 0.0147 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Volume S: has 0.0146 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Volume T: has 0.0145 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Volume U: has 0.0145 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Volume N: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:34:04 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Volume O: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:34:04 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Volume L: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:34:04 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Volume M: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:34:04 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:34:04 PM -- Test has 0.166947300755271 Maximum Database Page
Fault Stalls/sec.
8/20/2007 10:34:04 PM -- Test has 2 Database Page Fault Stalls/sec samples
higher than 0.
8/20/2007 10:34:04 PM -- [E:\Jetstress Test Results\8VM-4Grps-
Config\Performance_2007_8_20_12_38_50.xml](#) has 477 samples queried.

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM7

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM7
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spares 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:38:28 PM
Test End Time	8/20/2007 2:41:55 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_31.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBCchecksum_2007_8_20_14_41_55.blg

Database Sizing and Throughput

Achieved I/O per Second	3657.681
Planned I/O per Second	3000
Initial database size	2371652222976
Final database size	2394521665536
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.015	0.012	509.398	408.994	(n/a)
Database (S:)	0.015	0.012	508.884	405.928	(n/a)
Database (T:)	0.015	0.012	507.183	405.309	(n/a)
Database (U:)	0.015	0.012	507.133	404.852	(n/a)
Log (L:)	0.000	0.002	0.000	134.312	19024.146
Log (M:)	0.000	0.002	0.000	134.727	18807.667
Log (N:)	0.000	0.002	0.000	133.815	18877.971
Log (O:)	0.000	0.002	0.000	134.410	18791.432

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	55.050	47.095	80.240
Available MBytes	1464.178	1461.000	1507.000
Free System Page Table Entries	3132067.000	3132067.000	3132067.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	38516110.460	38195200.000	38731776.000
Pool Paged Bytes	36985911.699	36884480.000	37482496.000
Database Page Fault Stalls/sec	0.000	0.000	0.164

```

Test Log 8/20/2007 12:38:28 PM -- Jetstress testing begins ...
8/20/2007 12:38:28 PM -- Prepare testing begins ...
8/20/2007 12:38:29 PM -- Attaching databases ...
8/20/2007 12:38:29 PM -- Prepare testing ends.
8/20/2007 12:38:29 PM -- Dispatching transactions begins ...
8/20/2007 12:38:30 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:38:30 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:38:31 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:38:31 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:38:33 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:38:33 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:38:33 PM -- Attaining prerequisites:
8/20/2007 12:41:39 PM -- \Database(JetstressWin)\Database Cache Size, Last:
971350000.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:41:41 PM -- Performance logging ends.
8/20/2007 2:41:43 PM -- JetInterop batch transaction stats: 134368, 134278,
133710, and 133925.
8/20/2007 2:41:44 PM -- Dispatching transactions ends.
8/20/2007 2:41:44 PM -- Shutting down databases ...

```

8/20/2007 2:41:55 PM -- Instance1932.1 (complete), Instance1932.2 (complete), Instance1932.3 (complete), and Instance1932.4 (complete)
8/20/2007 2:41:57 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:41:57 PM -- Verifying database checksums ...
8/20/2007 10:39:53 PM -- R: (100% processed), S: (100% processed), T: (100% processed), and U: (100% processed)
8/20/2007 10:39:54 PM -- Performance logging ends.
8/20/2007 10:39:54 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_55.blg](#) has 934 samples.
8/20/2007 10:40:58 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_55.html](#) is saved.
8/20/2007 10:40:59 PM -- Verifying log checksums ...
8/20/2007 10:41:41 PM -- L:\ (45 logs passed), M:\ (33 logs passed), N:\ (42 logs passed), and O:\ (33 logs passed)
8/20/2007 10:41:41 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_31.blg](#) has 490 samples.
8/20/2007 10:41:42 PM -- Creating test report ...
8/20/2007 10:41:59 PM -- Volume R: has 0.0151 for Avg. Disk sec/Read.
8/20/2007 10:41:59 PM -- Volume S: has 0.0150 for Avg. Disk sec/Read.
8/20/2007 10:41:59 PM -- Volume T: has 0.0148 for Avg. Disk sec/Read.
8/20/2007 10:41:59 PM -- Volume U: has 0.0149 for Avg. Disk sec/Read.
8/20/2007 10:41:59 PM -- Volume L: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:41:59 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:42:00 PM -- Volume M: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:42:00 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:42:00 PM -- Volume N: has 0.0024 for Avg. Disk sec/Write.
8/20/2007 10:42:00 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:42:00 PM -- Volume O: has 0.0025 for Avg. Disk sec/Write.
8/20/2007 10:42:00 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:42:00 PM -- Test has 0.163906836835997 Maximum Database Page Fault Stalls/sec.
8/20/2007 10:42:00 PM -- Test has 1 Database Page Fault Stalls/sec samples higher than 0.
8/20/2007 10:42:00 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_31.xml](#) has 477 samples queried.

Microsoft Exchange Server Jetstress Results for EXCHANGE-VM8

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	JETSTRESS-VM8
Test Description	60,000 User Configuration 8 Virtual Machines 12 PS3900 disk arrays, 300GB drives, RAID10, no-spares 4 Storage Pools 60,000 Users (7,500 per VM) 300MB mailbox size 0.4 Target IOPS
Test Start Time	8/20/2007 12:38:15 PM
Test End Time	8/20/2007 2:41:40 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 R2 Service Pack 2 (5.2.3790.131072)
Performance Log	E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_18.blg E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_40.blg

Database Sizing and Throughput

Achieved I/O per Second	2966.021
Planned I/O per Second	3000
Initial database size	2371845160960
Final database size	2394525859840
Database files (count)	20

Jetstress System Parameters

Thread count	25 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (R:)	0.019	0.016	414.588	329.847	(n/a)
Database (S:)	0.018	0.017	413.820	328.462	(n/a)
Database (T:)	0.018	0.016	413.525	326.954	(n/a)
Database (U:)	0.018	0.016	410.380	328.447	(n/a)
Log (N:)	0.000	0.003	0.000	109.729	18815.625
Log (O:)	0.000	0.003	0.000	109.490	18725.509
Log (L:)	0.000	0.003	0.000	109.371	18594.173
Log (M:)	0.000	0.003	0.000	109.601	18790.514

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	54.162	47.326	80.239
Available MBytes	1455.115	1452.000	1507.000
Free System Page Table Entries	3131687.000	3131687.000	3131687.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40511363.488	40394752.000	40611840.000
Pool Paged Bytes	37746039.681	37646336.000	38240256.000
Database Page Fault Stalls/sec	0.000	0.000	0.133

```

Test Log 8/20/2007 12:38:15 PM -- Jetstress testing begins ...
8/20/2007 12:38:15 PM -- Prepare testing begins ...
8/20/2007 12:38:16 PM -- Attaching databases ...
8/20/2007 12:38:16 PM -- Prepare testing ends.
8/20/2007 12:38:17 PM -- Dispatching transactions begins ...
8/20/2007 12:38:17 PM -- Database cache settings: (minimum: 128.0 MB, maximum:
1.0 GB)
8/20/2007 12:38:17 PM -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
8/20/2007 12:38:18 PM -- Database read latency thresholds: (average: 0.02
seconds/read, maximum: 0.05 seconds/read).
8/20/2007 12:38:18 PM -- Log write latency thresholds: (average: 0.01
seconds/write, maximum: 0.05 seconds/write).
8/20/2007 12:38:22 PM -- Operation mix: Sessions 25, Inserts 25%, Deletes 10%,
Replaces 50%, Reads 15%, Lazy Commits 80%.
8/20/2007 12:38:22 PM -- Performance logging begins (interval: 15000 ms).
8/20/2007 12:38:22 PM -- Attaining prerequisites:
8/20/2007 12:41:25 PM -- \Database(JetstressWin)\Database Cache Size, Last:
966377500.0 (lower bound: 966367600.0, upper bound: none)
8/20/2007 2:41:27 PM -- Performance logging ends.
8/20/2007 2:41:28 PM -- JetInterop batch transaction stats: 134245, 133962,
133585, and 133891.
8/20/2007 2:41:28 PM -- Dispatching transactions ends.
8/20/2007 2:41:28 PM -- Shutting down databases ...

```

8/20/2007 2:41:40 PM -- Instance3028.1 (complete), Instance3028.2 (complete), Instance3028.3 (complete), and Instance3028.4 (complete)
8/20/2007 2:41:42 PM -- Performance logging begins (interval: 30000 ms).
8/20/2007 2:41:42 PM -- Verifying database checksums ...
8/20/2007 10:45:29 PM -- R: (100% processed), S: (100% processed), T: (100% processed), and U: (100% processed)
8/20/2007 10:45:30 PM -- Performance logging ends.
8/20/2007 10:45:30 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_40.blg](#) has 940 samples.
8/20/2007 10:46:21 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\DBChecksum_2007_8_20_14_41_40.html](#) is saved.
8/20/2007 10:46:21 PM -- Verifying log checksums ...
8/20/2007 10:46:58 PM -- N:\ (41 logs passed), O:\ (38 logs passed), L:\ (40 logs passed), and M:\ (36 logs passed)
8/20/2007 10:46:58 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_18.blg](#) has 489 samples.
8/20/2007 10:46:58 PM -- Creating test report ...
8/20/2007 10:47:13 PM -- Volume R: has 0.0189 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Volume S: has 0.0183 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Volume T: has 0.0182 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Volume U: has 0.0184 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Volume N: has 0.0030 for Avg. Disk sec/Write.
8/20/2007 10:47:13 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Volume O: has 0.0030 for Avg. Disk sec/Write.
8/20/2007 10:47:13 PM -- Volume O: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Volume L: has 0.0030 for Avg. Disk sec/Write.
8/20/2007 10:47:13 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Volume M: has 0.0030 for Avg. Disk sec/Write.
8/20/2007 10:47:13 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.
8/20/2007 10:47:13 PM -- Test has 0.132915356513374 Maximum Database Page Fault Stalls/sec.
8/20/2007 10:47:13 PM -- Test has 2 Database Page Fault Stalls/sec samples higher than 0.
8/20/2007 10:47:13 PM -- [E:\Jetstress Test Results\8VM-4Grps-Config\Performance_2007_8_20_12_38_18.xml](#) has 476 samples queried.