

ESRP Storage Program EMC CLARiiON CX3-20c (500 User) Storage Solution for Microsoft Exchange Server

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This document contains information about the EMC CLARiiON CX3-20c Storage Solution for Microsoft Exchange Server.

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Overview

This document provides information on the EMC CLARiiON® CX3-20c storage solution based on the Microsoft Exchange Solution Reviewed Program (ESRP) - Storage program¹. For any questions or comment regarding the contents of this document, see the “contact information section.

Disclaimer

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Features

This document describes an approach that can be used to configure Exchange solutions around EMC's CLARiiON CX3-20c storage systems.

Built on the innovative EMC CLARiiON CX3 UltraScale architecture, the EMC CX3-20c offers exceptional performance, ease-of-use, and unmatched reliability. It meets the storage needs of a wide range of applications including:

- Mail/messaging
- Databases
- File, Print and Web Services
- Distributed Applications

1. The ESRP – Storage program was developed by Microsoft Corporation to provide a command storage testing framework for EMCs to provide information on its storage solution for Microsoft Exchange Server software. For more details on the Microsoft ESRP – Storage program, please go to <http://www.microsoftstoragepartners.com>.

- Remote Replication

In addition, the CX3-20c supports a wide range of server operating environments: Microsoft Windows, Linux, Solaris, AIX, HP-UX, and VMWare ESX Server.

The CLARiiON CX3-20c Fibre Channel (FC)/iSCSI array offers both 4 Gb/s FC and 1 Gb/s iSCSI ports fully integrated in the same array, enabling customer to leverage their networked storage investments over a broader range of servers and applications with complete flexibility and without additional hardware. A total of 8 iSCSI ports (4 per SP) and 4 Fibre Channel ports (2 per SP) are available on each CX3-20c array.

The CLARiiON CX3-20c Fibre Channel (FC)/iSCSI array gives customers an advantage, whether or not they currently have iSCSI or FC deployed. For customers who are implementing networked storage for the first time and are considering iSCSI, the CLARiiON CX3-20c Fibre Channel(FC)/iSCSI array provides scalable iSCSI storage as well as the flexibility and investment protection of integrated FC support, should the customers' business and application needs grow. For customers with existing FC deployments, the CLARiiON CX3-20c Fibre Channel (FC)/iSCSI array offers the opportunity to expand the reach of their networked storage environment economically with iSCSI, while maintaining complete flexibility with regard to how the incremental capacity is shared across server platforms and interconnects.

With the EMC CX3-20c, you can chose the drive options that meet your specific needs, thereby providing the flexibility to offer multiple levels of performance in on system. The CX3-20c supports both high-performance and high-capacity disk drives in the same system, can scale from 365GB to 59TB, and supports 128 high-availability hosts. It supports 4 Gb/s (15k RPM) FC drives for demanding applications requiring maximum performance. Choose 2 Gb/s FC (10k RPM) for applications that require balancing performance and costs. Or, choose low-cost 2 Gb/s FC drives (7.2k RPM) for Tier 2 applications requiring high capacities and low cost-such as disk-based backup.

The CX3-20c delivers tiered storage that enables you to provide the right level of performance to the right applications. The system also delivers exceptional 4 Gb/s performance throughout the entire system without compromises or bottlenecks. Performance boosting features include four front end and two backend 4 Gb/s ports, plus state-of-the art low latency, high bandwidth I/O interconnect technologies.

The performance results and best practices discussed in this document provide tested guidelines for configuring the EMC CX3-20c for a high-performance Exchange environment. For this solution, a CX3-20c

storage system was used and configured for 500 Exchange 2003 users. The Exchange cluster nodes were connected to the CX3-20c via iSCSI using dedicated NICs used for iSCSI with the Microsoft iSCSI software initiator (v2.0.2), and an iSCSI VLAN.

Each of the 500 users is profiled using a value of 1 IOPS per user and a 250-MB mailbox requirement.

Solution description

The solution described is for utilizing a single CX3-20c and a single disk enclosure (DAE) full using 146GB FC drives giving the customer the most performance and fault tolerance utilizing Raid 10 for the Exchange Databases, Raid 1 for the Exchange log files and Services(SMTP/MTA/Message Tracking), and Raid 5 for Backup to Disk Volumes.

Log files will be placed on the first two drives 0_0_0-0_0_1 in a Raid 1 configuration, Backup to Disk and Services (SMTP, MTA and Message Tracking) are placed on the next 4 drives 0_0_2-0_0_5.

Sizing and configuring storage for using with Microsoft Exchange server is a complicated process, driven by many variables and factors, which vary from organization to organization.

The method described in this ESRP submission is the “**Mid-Sized Enterprise Building Block**”. The Midsized Enterprise Building Block is used to simplify the sizing and configuration when using low number of disks to insure the highest performance while staying fault tolerant.

This unit of measure – or Mid-Sized Enterprise Building Block – is designed to be scalable in 500 user increments with the ability to grow and expand into the larger building block deployment model detailed in the EMC ESRP Submissions for greater than 4000 users. The Mid-Sized Enterprise Building Blocks help to simplify the design and configuration of a highly available, high performance configuration as a company grows and email requirements.

Solution description

Table 1 describes the characteristics of the Mid-Sized Enterprise Building Block.

Table 1 Mid-Sized Enterprise Building Block characteristics

Number of users	500
Number of Exchange Servers	1
IOPS per user	1.0
Mailbox size	250MB
Number of disks required for Logs and Database	6
Disk type	146GB/15/Fibre Channel
RAID type Logs	Raid 1
Raid type Databases	Raid 1/0
Number of storage groups	1

Using the performance characteristics of the CLARiiON CX3-20c architecture and the I/O capabilities of the 146GB disk drives, 6 spindles are required to provide the necessary performance to match the I/O requirements of 500, 1.0 IOPS users. The Exchange databases reside on 4 spindles in 1:2+2 RAID 10 RAID Group. To scale this configuration for a larger Exchange environment, this design can be duplicated for 500 more users utilizing a single DAE. As the number of users increase into the second DAE, please reference the 1500 and 2000 user ESRP submission by EMC. As a company grows and requires the 3rd DAE which would accommodate fully built out 4000, 1.0 user, please reference the release ESRP submission.

http://www.emc.com/techlib/pdf/20084_CX3-20c_iSCSI_4000_Users_Storage_Solution_for_Microsoft_Exchange_Server.pdf

See [Figure 1](#) for a view of the disk layout for the 500 user configuration.

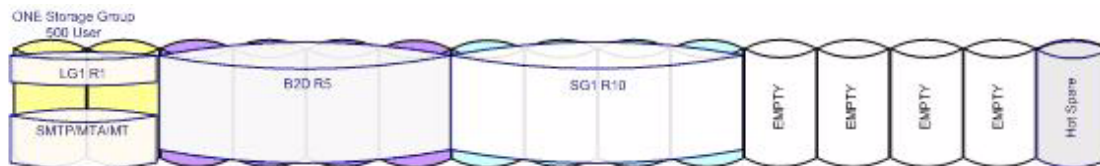


Figure 1 500 user disk layout

The iSCSI configuration is extremely important to insure the highest performance and best fault tolerance.

Utilizing Microsoft's iSCSI initiator 2.0.3, NaviSphere/NaviCli .22 and EMC's PowerPath 4.6 utilizing two Intel 1 Gb/s Network Interface Cards set in a Balanced Path configuration. The two iSCSI NICs were dedicated and used purely for iSCSI traffic. The first NIC targeted to SpA Path A0 and B3, and the second NIC targeted to SpB Path B0 and A3. The iSCSI Ethernet VLANs were used purely for iSCSI traffic.

See [Figure 2](#) for a view of the CX3-20c.

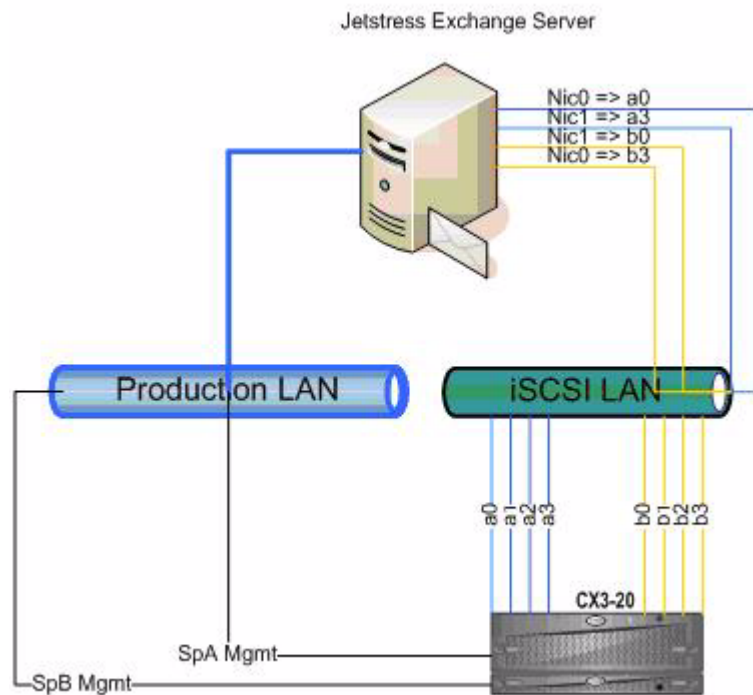


Figure 2 CX3-20c

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 scale up Exchange solution. Other factors which affect the server scalability are:

Targeted customer profile

- 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

Due to such variables, 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, please refer to Microsoft's *Troubleshooting Microsoft Exchange Server Performance*, available at: <http://go.microsoft.com/fwlink/?LinkId=23454>.

Targeted customer profile

Describe the suitable customer type for this solution.

This solution is designed for small to medium businesses with the target range of 500 mailbox users.

- 1 Exchange Server
- User IO profile tested was 1.0.
- User mailbox size 250MB
- Backup strategy. Backup to Disk.
- One storage group per server
- Five databases per storage group

Tested deployment

The following tables summarize the tested environment.

Simulated Exchange configuration

Table 2 lists the simulated Exchange configuration details.

Table 2 Simulated Exchange configuration

Item	Description
Number of Exchange mailboxes simulated	500
Number of hosts	1
Number of mailboxes/hosts	500
Number of storage groups/host	1
Number of mailbox stores/storage group	5
Number of mailboxes/mailbox store	100
Number of mailbox store LUNS/storage group	1 database LUN: 1 log file LUN
Simulated profile: I/Os per second per mailbox	1
Database LUN size	267GB
Log LUN size	25GB
Backup LUN size/storage group	300GB Raid 5

Hardware

Table 3 lists the hardware used in the environment.

Table 3 Hardware (list of all hardware used for the test)

Item	Description
Storage type (SAN,DAS, iSCSI, NAS)	iSCSI
Storage model and OS/firmware revision	CLARiiON CX3-20c
Storage cache	2GB Mirrored – 1GB per SP
Number of storage controllers	2
Number of storage ports	2 per SP
Maximum bandwidth of storage connectivity to host	4*1 Gb/s Ethernet
Switch type/model/firmware revision	Dell 5324 Version 2.21 Build No. 3.04
HBA model and firmware	Intel(R) PRO/1000 MT Dual Port Server Adapter
Number of HBAs/host	2

Table 3 Hardware (list of all hardware used for the test)

Item	Description
Host server type	Dell Computer Corporation PowerEdge 1850 System Type X86-based PC Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz Processor x86 Family 15 Model 4 Stepping 8 GenuineIntel ~2793 Mhz BIOS Version/Date Dell Computer Corporation A05, 1/9/2006 SMBIOS Version 2.3 Total Physical Memory 4,095.08 MB
Total number of disks tested in solution	1
Maximum number of spindles that can be hosted in the storage	15

Software

Table 4 lists the software used in the environment.

Item	Description
HBA driver	Driver: e1000325.sys (8.7.1.0 built by: WinDDK, 160.50 KB (164,352 bytes), 9/14/2006 7:42 AM)
HBA QueueTarget setting	
HBA QueueDepth setting	
Multipathing	Microsoft iSCSI Initiator 2.02, Powerpath 4.6
Host OS	Microsoft(R) Windows(R) Server 2003, Enterprise Edition Version 5.2.3790 Service Pack 1 Build 3790
ESE .dll file version	6.5.7638.2
Replication solution name/version	N/A

Disk configuration (mailbox store disks)

Table 5 lists the disk configuration (mailbox store disks) for the environment.

Item	Description
Disk type, speed and firmware revision	4Gbps FC SCSI 15,000 RPM – 60AC
Raw capacity per disk (GB)	146GB
Number of physical disks in test	4
Total raw storage capacity (GB)	584GB
Disk slice size	N/A
Number of slices per LUN or number of disks per LUN	N/A

Table 5 Disk configuration (mailbox store)

Item	Description
RAID level	1/0
Total formatted capacity	267GB
Storage capacity utilization	Formatted capacity/Total raw capacity 45%
Database capacity utilization	Database size / Total raw capacity 50.5%

Disk configuration (transactional log disks)

Table 6 lists the disk configuration (transactional log disks) for the environment.

Table 6 Disk configuration

Item	Description
Disk type, speed and firmware revision	4Gbps FC SCSI 15,000 RPM – R450
Raw capacity per disk (GB)	146GB
Number of spindles in test	2
Total raw storage capacity (GB)	292GB
Disk slice size	N/A
Number of slices per LUN or number of disks per LUN	N/A
RAID level	RAID 1
Total formatted capacity	25GB

Streaming backup

Backup to Disk

Disk configuration (streaming backup to disk)

Table 7 lists the disk configuration (streaming backup to disk) for the environment.

Table 7 Disk configuration (streaming backup to disk)

Item	Description
Disk type, speed and firmware revision	4Gbps FC SCSI 15,000 RPM – R450
Raw capacity per disk (GB)	146GB
Number of spindles in test	4
Total raw storage capacity (GB)	400GB
Disk slice size	N/A
Number of slices per LUN or number of disks per LUN	N/A
RAID level	RAID 5
Total formatted capacity	300GB

Replication

N/A

Table 8 Replication

Item	Description
Replication mechanism	N/A
Number of links	N/A
Simulated link distance	N/A
Link type	N/A
Link bandwidth	N/A

Best practices

Microsoft Exchange Server is a disk-intensive application. It is characterized as a very burst, mostly 4-KB random access, read/write operation to the database file, with a sequential, mostly 512 byte, write operation to the transaction logs. It is this random, burst workload, with periods of high peaks, that makes designing a well performing storage solution with Microsoft Exchange server a challenge. Different corporate environments have different user and storage requirements, so storage design cannot be based simply on generalizations.

Based on the testing run using ESRP framework, EMC recommends following these best practices to improve storage performance with Exchange solutions.

For Exchange best practices on storage design, please visit

<http://www.microsoft.com/technet/prodtechnol/exchange/2003/library/optimizestorage.msp>

Core storage/Replication

1. Use diskpart (in Microsoft Windows 2003 SP1) to align all disks used with Microsoft Exchange, using a value of 64 for CLARiiON. This aligns all of the Exchange related NTFS partitions on a 64KB boundary.
2. Isolate the Microsoft Exchange Database workload from other I/O intensive applications or workloads. This ensures the highest levels of performance from Microsoft Exchange and makes troubleshooting efforts easier in the event of a disk related Microsoft Exchange performance issue.
3. Size and configure the environment for spindle performance as a primary consideration, with storage capacity secondary.
4. Tuning the CX3-20c storage system parameters is important in obtaining best performance. The following list details the optimal parameters for Exchange:
 - Cache page size of 4KB
 - Maximized write cache size
 - Read and Write cache enabled for all LUNs
 - Read cache minimum of 50-100MB for prefetch
5. iSCSI configuration Using PowerPath 4.6 utilizing a balanced path approach. Logging into with NIC0 into the A0(Spa) and B3(Spb), and NIC1 into B0(Spb) and A3(Spa).

6. TcpAckFrequency = 1 per <http://support.microsoft.com/kb/328890> to improve iSCSI performance.

Note: In the event a performance problem cannot be resolved using common performance analysis, EMC Corporation strongly recommends that a case be opened with EMC Customer Service, so that the appropriate Customer Support resources may be engaged.

1. What is the best practice with regard to the number of replication links between enclosures?
2. What is the best practice with grouping Database and Log replication activity?
3. What is the best practice with regard to determining bandwidth and latency requirements between enclosures?
4. What is the best practice with regard to troubleshooting high latency on the database and log LUNs?
5. Recommending to add the following sentence in this section:

Microsoft Exchange has a whitepaper on *Deployment Guidelines for Data Replication*; for support policies on data replication, please refer to KB 895847.

Backup strategy

A well designed and implemented disaster recovery strategy should be a top priority for Exchange implementations. Proper planning must be done prior to configuration in order to meet required service-level agreements (SLAs) for server downtime. Various backup and restore strategies can be implemented, depending on the requirements of the environment. EMC offers multiple backup-to disk solutions that deliver all of the flexibility to tape and disk, and Replication Manager, which can manage snapshots or replicas of your Exchange environment, utilizing the ground breaking technology of Snapview®. Both Replication Manager and NetWorker can be used in conjunction with Exchange 2003 Volume Shadow Copy services (VSS). These solutions are proven, tested and blueprinted with leading backup software applications and can be deployed in existing SAN or LAN storage infrastructures. For example, EMC offers the CLARiiON® with either ATA or LCFC drives. EMC provides operationally simple disk libraries that easily integrate with existing backup environments through tape emulation. In this solution, the tested method for backup was a one

stage disk-to-disk backup. With this configuration, several best practice considerations must be understood in order to achieve optimal performance.

1. Disk-to-disk backup LUNs should be configured in a separate disk group. Workload isolation will optimize performance of the streaming backups and minimize the impact on the production workload.
2. Higher capacity Fibre Channel or FATA drives should be utilized if the environment requires additional backup copies of the data on the primary disks. FATA drives should not be utilized to host production Exchange traffic without careful consideration of the performance impact. FATA drives operate at a lower rotational speed and will provide much lower throughput than Fibre Channel drives. FATA drives are also designed for an 8*5 duty cycle and not meant to operate 24*7. This results in a shorter mean time between failure (MTBF) than Fibre Channel drives (which are rated for 24*7) if over utilized.
3. Maximize the number of Exchange databases and storage groups on the Exchange server in order to minimize the time required for disaster recovery operations. Exchange storage groups can be backed up in parallel, so having the maximum of four storage groups enables four parallel backup operations. Up to twenty databases can be created for Exchange 2003. By utilizing the maximum number of databases, this keeps the size of each database smaller and reduces the restore window. Best practices are to keep the database sizes in the 30-45GB range.

Contact for Additional Information

<http://www.emc.com>

Test Result Summary

This section provides a high level summary of the test data from ESRP and the link to the detailed html reports which are generated by ESRP testing framework. Please click on the underlined headings below to view the html report for each test.

Reliability

A number of tests in the framework are to check Reliability tests runs for 24 hours. The goal is to verify the storage can handle high IO load for a long period of time. Both log and database files will be analyzed for integrity after the stress test to ensure no database/log corruption.

Test Result Summary

The following list provides an overview: (click on the underlined word will show the html report after the reliability tests run)

- No errors were reported in the event logs for the storage reliability
- No errors were reported for the database and checksum.
- No errors were during the backup to disk process.

Performance

Performance testing is to exercise the storage with maximum sustainable Exchange type of IO for 2 hours. The test is to show how long it takes for the storage to respond to an IO under load. The data below is a sample taken from one of the host/s attached, and it is the average of all the logical disks in the 2 hours test duration.

Performance test results in Appendix A:

Table 9 Aggregate of all storage groups performance

Average of the database disks read latency (ms)	14 ms
Average of the database disks write latency (ms)	4 ms
Average of the log disks write latency (ms)	1 ms
Database disk reads/sec	351.27
Database disk writes/sec	196.35
Log disk writes/sec	47.63
Max database page fault stalls per sec	0

Streaming backup performance

For the Version 1.0 release, only streaming backup type is supported for testing in the framework. There are two tests in this section. First one is to measure the read IO performance metrics by running checksum on all the databases and log files. The second test is to measure the end to end performance when the databases are backed up to disks.

Database read-only performance

The test is to measure the maximum rate at which databases could be streaming backed up. The following table shows the average rate for a single database file.

MB read/sec per storage group	69.82
MB read/sec total	69.82
File size/seconds taken	124952 MB/1791 seconds

Log read-only performance

The test is to measure the maximum rate at which the log files can be played against the databases. The following table shows the average rate for 100 log files played in a single storage group. Each log file is 5 MB in size.

Average time to play one log file (sec)	6.58
Average log disks read bytes/sec	1559290

Backup to disk performance

This test run backs up on all the database files, and stores them on disks. The following table shows an average rate at which each storage group can be backed up at.

Total database size per storage group (GB)	124700.04
Time taken to backup each storage group	00:38:56.34
Average MB backed up/sec per storage group	53.37

Conclusion

This document is developed by storage solution providers, and reviewed by Microsoft Exchange Product team. The test results/data presented in this document is based on the tests introduced in the ESRP test framework. Customer should not quote the data directly for his/her pre-deployment verification. It is still necessary to go through the exercises to validate the storage design for a specific customer environment.

ESRP program is not designed to be a benchmarking program; tests are not designed to getting the maximum throughput for a giving solution. Rather, it is focused on producing recommendations from EMC for Exchange application. So the data presented in this document should not be used for direct comparisons among the solutions.

Appendix A: Performance Test Results

The following charts and data are from the Jetstress test report for the CX3-20c Jetstress 2 hour performance test.

Performance Results

Jetstress Test Result: 4BPSX91

The purpose of this test is to verify the storage configuration which the customer is planning to deploy. The test run has been successful, meaning the database read latency and log write latency are below 20 ms; Database page fault stalls/sec is 0. However, Microsoft strongly recommends that you perform further validation of this storage solution (additional tasks listed below):

1. You should refer to the table below to determine if the actual disk IO (achieved IO) has exceeded the targeted IO (expected IO). If not, you may want to increase the thread count to increase the load, provided that the disk latency will not exceed the threshold.
2. You need to confirm whether the storage solution has synchronous replication as part of the implementation. If the solution does not utilize synchronous replication, then you should check for the database write latency, the desired value should be under 20 ms. (Please refer to <http://support.microsoft.com/?kbid=895847> for synchronous replication definitions.)
3. Please check the status pane in the Jetstress window, to make sure that no errors were logged during the database checksum validation.

Planned disk subsystem profile:

Total test database size	Production data size	Total number of databases	Expected I/O	Achieved I/O
122.03 GB (based on the attached database)	N/A	5 (1 storage(s) * 5 database(s))	500.00 (500 mailboxes of 1.00 IOPS)	547.62

JetStress test parameter summary:

Instance	threadCount	logBufferSize	opInsert	opReplace	opDelete	lazyCommit
1	5	9000	20	68	4	90

Disk subsystem performance summary:

Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Data (C:\Exchange\SG1\db)	0.014	0.004	351.27	196.35	N/A
Log (C:\Exchange\SG1\lg)	0.000	0.001	0.000	47.63	6779.73

Processor/memory performance summary:

Counter	Average	Minimum	Maximum
% Processor Time	0.729	0.224	3.870
Available MBytes	2543.29	2528.00	3059.00
Free System Page Table Entries	183184.00	183184.00	183184.00
Pages/Sec	0.004	0.000	1.600
Pool Nonpaged Bytes	38761645.16	38739968.00	38780928.00
Pool Paged Bytes	31058386.04	30277632.00	31105024.00
Database Page Fault Stalls/sec	0.000	0.000	0.000

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\Performance_2006_12_9_18-8-0.blg is saved.

12/9/2006 6:07:57 PM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 6:07:57 PM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are

Performance Results

saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 6:07:57 PM -- Validating input parameters, it may take a few minutes...

12/9/2006 6:07:57 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 6:08:00 PM -- Loading performance counters...

12/9/2006 6:08:00 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 6:08:00 PM -- Start Jetstress test...

12/9/2006 6:08:02 PM -- Performance logging started.

12/9/2006 6:08:02 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\Tuning_2006_12_9_18-8-0.blg.

12/9/2006 6:08:02 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 6:08:32 PM -- Volume C:\Exchange\SG1\db has 0.00005 for Read Latency Slope.

12/9/2006 6:10:32 PM -- Instance1: the value for Target disk transfer is 500.

12/9/2006 6:10:32 PM -- Instance1: the value for Actual disk transfer is 569.

12/9/2006 6:10:32 PM -- Volume C:\Exchange\SG1\db has 0.0099 for Database disk read latency.

12/9/2006 6:10:32 PM -- Volume C:\Exchange\SG1\db has 0.0016 for Database disk write latency.

12/9/2006 6:10:32 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 6:10:32 PM -- Performance logging stopped.

12/9/2006 6:10:32 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 6:10:32 PM -- Starting Performance test run...

12/9/2006 6:10:34 PM -- Performance logging started.

12/9/2006 6:10:34 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\Performance_2006_12_9_18-8-0.blg.

12/9/2006 8:10:19 PM -- Adding new data to the performance log file...

12/9/2006 8:10:34 PM -- Performance logging stopped.

12/9/2006 8:10:34 PM -- Stopping Jetstress...

12/9/2006 8:10:43 PM -- Creating test report ...

12/9/2006 8:10:45 PM -- Volume C:\Exchange\SG1\db has 0.0143 for Avg. Disk sec/Read.

12/9/2006 8:10:45 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

12/9/2006 8:10:45 PM -- Volume C:\Exchange\SG1\lg has 0.0000 for Avg. Disk sec/Read.

12/9/2006 8:10:45 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/9/2006 8:10:45 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

Database Checksum Results

Jetstress Test Result: 4BPSX91

The following table shows a quick overview of checksum statistics:

Database	Pages seen	Bad checksums	Correctable checksums	Wrong page numbers	MB read/sec (File size/Seconds taken)
C:\Exchange\SG1\db\Jetstress.edb	6426626	0	0	0	65.7 MB/sec (25104 MB/381 seconds)
C:\Exchange\SG1\db\Jetstress1.edb	6426370	0	0	0	68.9 MB/sec (25103 MB/364 seconds)
C:\Exchange\SG1\db\Jetstress2.edb	6426626	0	0	0	67.4 MB/sec (25104 MB/372 seconds)

Database Checksum Results

C:\Exchange\SG1\db\Jetstress3.edb	6426114	0	0	0	66.9 MB/sec (25102 MB/375 seconds)
C:\Exchange\SG1\db\Jetstress4.edb	6426882	0	0	0	71.3 MB/sec (25105 MB/352 seconds)
(sum)	32132618	0	0	0	8.0 MB/sec (125518 MB/1846 seconds)

The following table shows a quick overview of database and log performance counter sample data:

Storage Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Total Seconds
C:\Exchange\SG1\db	0.979	0.012	1049.16	0.018	382.04
C:\Exchange\SG1\db	0.956	0.006	1075.48	0.009	364.17
C:\Exchange\SG1\db	0.954	0.004	1076.24	0.006	372.76
C:\Exchange\SG1\db	0.954	0.003	1074.63	0.005	375.18
C:\Exchange\SG1\db	0.943	0.002	1087.49	0.004	352.15

The following table shows a quick overview of processor and memory performance counter sample data:

Counter	Average	Minimum	Maximum
% Processor Time	9.61	0.000	17.69
Available MBytes	3456.49	3348.00	3468.00
Free System Page Table Entries	183181.00	183184.00	183184.00
Pages/Sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40625200.00	38715390.00	41103360.00

Pool Paged Bytes	31173030.00	29736960.00	31211520.00
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Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\DatabaseChecksum_2006_12_9_20-10-45.blg is saved.

12/9/2006 6:07:57 PM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 6:07:57 PM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 6:07:57 PM -- Validating input parameters, it may take a few minutes...

12/9/2006 6:07:57 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 6:08:00 PM -- Loading performance counters...

12/9/2006 6:08:00 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 6:08:00 PM -- Start Jetstress test...

12/9/2006 6:08:02 PM -- Performance logging started.

12/9/2006 6:08:02 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\Tuning_2006_12_9_18-8-0.blg.

12/9/2006 6:08:02 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 6:08:32 PM -- Volume C:\Exchange\SG1\db has 0.00005 for Read Latency Slope.

12/9/2006 6:10:32 PM -- Instance1: the value for Target disk transfer is 500.

Database Checksum Results

12/9/2006 6:10:32 PM -- Instance1: the value for Actual disk transfer is 569.

12/9/2006 6:10:32 PM -- Volume C:\Exchange\SG1\db has 0.0099 for Database disk read latency.

12/9/2006 6:10:32 PM -- Volume C:\Exchange\SG1\db has 0.0016 for Database disk write latency.

12/9/2006 6:10:32 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 6:10:32 PM -- Performance logging stopped.

12/9/2006 6:10:32 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 6:10:32 PM -- Starting Performance test run...

12/9/2006 6:10:34 PM -- Performance logging started.

12/9/2006 6:10:34 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\Performance_2006_12_9_18-8-0.blg.

12/9/2006 8:10:19 PM -- Adding new data to the performance log file...

12/9/2006 8:10:34 PM -- Performance logging stopped.

12/9/2006 8:10:34 PM -- Stopping Jetstress...

12/9/2006 8:10:43 PM -- Creating test report ...

12/9/2006 8:10:45 PM -- Volume C:\Exchange\SG1\db has 0.0143 for Avg. Disk sec/Read.

12/9/2006 8:10:45 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

12/9/2006 8:10:45 PM -- Volume C:\Exchange\SG1\lg has 0.0000 for Avg. Disk sec/Read.

12/9/2006 8:10:45 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/9/2006 8:10:45 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

12/9/2006 8:10:46 PM -- Performance logging started.

12/9/2006 8:10:46 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\DatabaseChecksum_2006_12_9_20-10-45.blg.

12/9/2006 8:10:46 PM -- Checksum validation may take a while depending on the file sizes.

12/9/2006 8:41:33 PM -- Database checksum in progress:

Storage Group #1 (100%).

12/9/2006 8:41:33 PM -- Performance logging stopped.

12/9/2006 8:41:33 PM -- Checksum is completed, please open C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\b2d\DatabaseChecksum_2006_12_9_20-10-45.html for checksum result.

Appendix B: Streaming Back: Backup to Disk Results

The following charts and data are from the Jetstress test report for the CX3-20c Jetstress Streaming Backup: Backup to Disk test.

Performance Log Generation Results

Jetstress Test Result: 4BPSX91

The purpose of this test is to verify the storage configuration which the customer is planning to deploy. The test run has been successful, meaning the database read latency and log write latency are below 20 ms; Database page fault stalls/sec is 0. However, Microsoft strongly recommends that you perform further validation of this storage solution (additional tasks listed below):

1. You should refer to the table below to determine if the actual disk IO (achieved IO) has exceeded the targeted IO (expected IO). If not, you may want to increase the thread count to increase the load, provided that the disk latency will not exceed the threshold.
2. You need to confirm whether the storage solution has synchronous replication as part of the implementation. If the solution does not utilize synchronous replication, then you should check for the database write latency, the desired value should be under 20 ms. (Please refer to <http://support.microsoft.com/?kbid=895847> for synchronous replication definitions.)
3. Please check the status pane in the Jetstress window, to make sure that no errors were logged during the database checksum validation.

Planned disk subsystem profile:

Total test database size	Production data size	Total number of databases	Expected I/O	Achieved I/O
121.78 GB (based on the attached database)	(n/a)	5 (1 storage(s) * 5 database(s))	500.00 (500 mailboxes of 1.00 IOPS)	550.06

JetStress test parameter summary:

Instance	threadCount	logBufferSize	opInsert	opReplace	opDelete	lazyCommit
1	5	9000	20	68	4	90

Disk subsystem performance summary:

Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Data (C:\Exchange\SG 1\db)	0.014	0.004	353.04	197.02	(n/a)
Log (C:\Exchange\SG 1\lg)	0.000	0.001	0.007	49.67	6605.51

Performance Log Generation Results

Processor/memory performance summary:

Counter	Average	Minimum	Maximum
% Processor Time	0.743	0.419	1.669
Available MBytes	2682.16	2654.00	3182.00
Free System Page Table Entries	183184.00	183184.00	183184.00
Pages/Sec	0.008	0.000	0.133
Pool Nonpaged Bytes	38255886.49	38223872.00	38543360.00
Pool Paged Bytes	30642291.92	29786112.00	30662656.00
Database Page Fault Stalls/sec	0.000	0.000	0.000

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Performance_LogGeneration_2006_12_9_12-15-9.blg is saved.

12/9/2006 10:48:08 AM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 10:48:08 AM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 10:48:08 AM -- Validating input parameters, it may take a few minutes...

12/9/2006 12:15:09 PM -- Duplicating 5 databases: 24.36 GB of 24.36 GB is duplicated (100.00% complete).

12/9/2006 12:15:09 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 12:15:09 PM -- Loading performance counters...

12/9/2006 12:15:09 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:15:09 PM -- Start Jetstress test...

12/9/2006 12:15:11 PM -- Performance logging started.

12/9/2006 12:15:11 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Tuning_2006_12_9_12-15-10.blg.

12/9/2006 12:15:11 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 12:15:41 PM -- Volume C:\Exchange\SG1\db has 0.00008 for Read Latency Slope.

12/9/2006 12:17:41 PM -- Instance1: the value for Target disk transfer is 500.

12/9/2006 12:17:41 PM -- Instance1: the value for Actual disk transfer is 577.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0098 for Database disk read latency.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0017 for Database disk write latency.

12/9/2006 12:17:41 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:17:41 PM -- Performance logging stopped.

12/9/2006 12:17:41 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 12:17:41 PM -- Starting StreamingBackup test run...

12/9/2006 12:17:43 PM -- Performance logging started.

12/9/2006 12:17:43 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Performance_LogGeneration_2006_12_9_12-15-9.blg.

12/9/2006 1:10:43 PM -- Adding new data to the performance log file...

12/9/2006 1:10:58 PM -- Performance logging stopped.

12/9/2006 1:10:58 PM -- Stopping Jetstress...

Backup Database Read Only Results

12/9/2006 1:11:07 PM -- Creating test report ...

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\db has 0.0142 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0001 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/9/2006 1:11:08 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

Backup Database Read Only Results

Jetstress Test Result: 4BPSX91

The following table shows a quick overview of checksum statistics:

Database	Pages seen	Bad checksums	Correctable checksums	Wrong page numbers	MB read/sec (File size/Seconds taken)
C:\Exchange\SG1\db\Jetstress.edb	6397698	0	0	0	72.1 MB/sec (24991 MB/346 seconds)
C:\Exchange\SG1\db\Jetstress1.edb	6397442	0	0	0	70.5 MB/sec (24990 MB/354 seconds)
C:\Exchange\SG1\db\Jetstress2.edb	6397698	0	0	0	68.9 MB/sec (24991 MB/362 seconds)
C:\Exchange\SG1\db\Jetstress3.edb	6397186	0	0	0	66.4 MB/sec (24989 MB/376 seconds)
C:\Exchange\SG1\db\Jetstress4.edb	6397698	0	0	0	71.2 MB/sec (24991 MB/350 seconds)
(sum)	31987722	0	0	0	69.8 MB/sec (124952 MB/1791 seconds)

The following table shows a quick overview of database and log performance counter sample data:

Storage Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Total Seconds
C:\Exchange\SG1\db	0.889	0.037	1149.35	0.049	346.84
C:\Exchange\SG1\db	0.900	0.018	1138.05	0.024	354.51
C:\Exchange\SG1\db	0.911	0.012	1125.62	0.016	362.88
C:\Exchange\SG1\db	0.925	0.009	1108.79	0.012	376.29
C:\Exchange\SG1\db	0.920	0.007	1114.76	0.009	351.01

Backup Database Read Only Results

The following table shows a quick overview of processor and memory performance counter sample data:

Counter	Average	Minimum	Maximum
% Processor Time	9.88	0.000	18.66
Available MBytes	3477.31	3436.00	3479.00
Free System Page Table Entries	183181.40	183184.00	183184.00
Pages/Sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40489100.00	39428100.00	40902660.00
Pool Paged Bytes	30699420.00	29253630.00	30732290.00

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\DatabaseChecksum_2006_12_9_13-22-8.blg is saved.

12/9/2006 10:48:08 AM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 10:48:08 AM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 10:48:08 AM -- Validating input parameters, it may take a few minutes...

12/9/2006 12:15:09 PM -- Duplicating 5 databases: 24.36 GB of 24.36 GB is duplicated (100.00% complete).

12/9/2006 12:15:09 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 12:15:09 PM -- Loading performance counters...

12/9/2006 12:15:09 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:15:09 PM -- Start Jetstress test...

12/9/2006 12:15:11 PM -- Performance logging started.

12/9/2006 12:15:11 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Tuning_2006_12_9_12-15-10.blg.

12/9/2006 12:15:11 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 12:15:41 PM -- Volume C:\Exchange\SG1\db has 0.00008 for Read Latency Slope.

12/9/2006 12:17:41 PM -- Instance1: the value for Target disk transfer is 500.

12/9/2006 12:17:41 PM -- Instance1: the value for Actual disk transfer is 577.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0098 for Database disk read latency.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0017 for Database disk write latency.

12/9/2006 12:17:41 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:17:41 PM -- Performance logging stopped.

12/9/2006 12:17:41 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 12:17:41 PM -- Starting StreamingBackup test run...

12/9/2006 12:17:43 PM -- Performance logging started.

12/9/2006 12:17:43 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Performance_LogGeneration_2006_12_9_12-15-9.blg.

12/9/2006 1:10:43 PM -- Adding new data to the performance log file...

12/9/2006 1:10:58 PM -- Performance logging stopped.

12/9/2006 1:10:58 PM -- Stopping Jetstress...

12/9/2006 1:11:07 PM -- Creating test report ...

Backup Database Read Only Results

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\db has 0.0142 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0001 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/9/2006 1:11:08 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

12/9/2006 1:11:08 PM -- Soft recovery may take a while depending on the number of log files.

12/9/2006 1:11:09 PM -- Performance logging started.

12/9/2006 1:11:09 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\SoftRecovery_2006_12_9_13-11-8.blg.

12/9/2006 1:22:06 PM -- Adding new data to the performance log file...

12/9/2006 1:22:08 PM -- Performance logging stopped.

12/9/2006 1:22:08 PM -- Soft recovery is completed, please open C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\SoftRecovery_2006_12_9_13-11-8.html for soft recovery result.

12/9/2006 1:22:10 PM -- Performance logging started.

12/9/2006 1:22:10 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\DatabaseChecksum_2006_12_9_13-22-8.blg.

12/9/2006 1:22:10 PM -- Checksum validation may take a while depending on the file sizes.

12/9/2006 1:52:01 PM -- Database checksum in progress:

Storage Group #1 (100%).

12/9/2006 1:52:01 PM -- Performance logging stopped.

12/9/2006 1:52:01 PM -- Checksum is completed, please open C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\DatabaseChecksum_2006_12_9_13-22-8.html for checksum result.

Backup to Disk Results

Jetstress Test Result: 4BPSX91

This test is to verify the storage configuration for a streaming backup operation.

This table reports the performance metrics of streaming backup for each storage group backed up.

Storage Group	Storage Group Size (MB)	Backup Time (hh:mm:ss.msec)	Average MB Backed Per Second
1	124700.04	00:38:56.34	53.37

This table reports the performance metrics of streaming backup for each database backed up.

Storage Group	Database Name	Database Size (MB)
1	C:\Exchange\SG1\db\Jetstress.edb	24991.01
	C:\Exchange\SG1\db\Jetstress1.edb	24990.01
	C:\Exchange\SG1\db\Jetstress2.edb	24991.01
	C:\Exchange\SG1\db\Jetstress3.edb	24989.01
	C:\Exchange\SG1\db\Jetstress4.edb	24991.01

Planned disk subsystem profile:

Total test database size	Production data size	Total number of databases	Expected I/O	Achieved I/O
121.78 GB(based on the backup database)	(n/a)	5 (1 storage(s) * 5 database(s))	500.00 (500 mailboxes of 1.00 IOPS)	854.14

JetStress test parameter summary:

Instance	threadCount	logBufferSize	opInsert	opReplace	opDelete	lazyCommit
1	5	9000	20	68	4	90

Backup to Disk Results

Disk subsystem performance summary:

Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Data (C:\Exchange\SG 1\db)	0.004	0.000	854.06	0.083	(n/a)
Log (C:\Exchange\SG 1\lg)	0.000	0.000	0.034	0.370	103.75

Processor/memory performance summary:

Counter	Average	Minimum	Maximum
% Processor Time	4.242	3.596	5.041
Available MBytes	2619.11	2565.00	3529.00
Free System Page Table Entries	183184.00	183184.00	183184.00
Pages/Sec	0.001	0.000	0.067
Pool Nonpaged Bytes	39234244.92	38989824.00	39419904.00
Pool Paged Bytes	30936930.46	30076928.00	31010816.00
Database Page Fault Stalls/sec	0.000	0.000	0.000

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Backup_To_Disk_2006_12_9_13-52-40.blg is saved.

12/9/2006 10:48:08 AM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 10:48:08 AM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 10:48:08 AM -- Validating input parameters, it may take a few minutes...

12/9/2006 12:15:09 PM -- Duplicating 5 databases: 24.36 GB of 24.36 GB is duplicated (100.00% complete).

12/9/2006 12:15:09 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 12:15:09 PM -- Loading performance counters...

Backup to Disk Results

12/9/2006 12:15:09 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:15:09 PM -- Start Jetstress test...

12/9/2006 12:15:11 PM -- Performance logging started.

12/9/2006 12:15:11 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Tuning_2006_12_9_12-15-10.blg.

12/9/2006 12:15:11 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 12:15:41 PM -- Volume C:\Exchange\SG1\db has 0.00008 for Read Latency Slope.

12/9/2006 12:17:41 PM -- Instance1: the value for Target disk transfer is 500.

12/9/2006 12:17:41 PM -- Instance1: the value for Actual disk transfer is 577.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0098 for Database disk read latency.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0017 for Database disk write latency.

12/9/2006 12:17:41 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:17:41 PM -- Performance logging stopped.

12/9/2006 12:17:41 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 12:17:41 PM -- Starting StreamingBackup test run...

12/9/2006 12:17:43 PM -- Performance logging started.

12/9/2006 12:17:43 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Performance_LogGeneration_2006_12_9_12-15-9.blg.

12/9/2006 1:10:43 PM -- Adding new data to the performance log file...

12/9/2006 1:10:58 PM -- Performance logging stopped.

12/9/2006 1:10:58 PM -- Stopping Jetstress...

12/9/2006 1:11:07 PM -- Creating test report ...

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\db has 0.0142 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0001 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/9/2006 1:11:08 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

12/9/2006 1:11:08 PM -- Soft recovery may take a while depending on the number of log files.

12/9/2006 1:11:09 PM -- Performance logging started.

12/9/2006 1:11:09 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\SoftRecovery_2006_12_9_13-11-8.blg.

12/9/2006 1:22:06 PM -- Adding new data to the performance log file...

12/9/2006 1:22:08 PM -- Performance logging stopped.

12/9/2006 1:22:08 PM -- Soft recovery is completed, please open C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\SoftRecovery_2006_12_9_13-11-8.html for soft recovery result.

12/9/2006 1:22:10 PM -- Performance logging started.

12/9/2006 1:22:10 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\DatabaseChecksum_2006_12_9_13-22-8.blg.

12/9/2006 1:22:10 PM -- Checksum validation may take a while depending on the file sizes.

12/9/2006 1:52:01 PM -- Database checksum in progress:

Storage Group #1 (100%).

12/9/2006 1:52:01 PM -- Performance logging stopped.

12/9/2006 1:52:01 PM -- Checksum is completed, please open C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\DatabaseChecksum_2006_12_9_13-22-8.html for checksum result.

Soft Recovery Results

12/9/2006 1:52:03 PM -- Performance logging started.

12/9/2006 1:52:03 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\LogChecksum_2006_12_9_13-52-1.blg.

12/9/2006 1:52:03 PM -- Checksum validation may take a while depending on the file sizes.

12/9/2006 1:52:40 PM -- Log checksum in progress:
C:\Exchange\SG1 (100 files(s) passed).

12/9/2006 1:52:40 PM -- Performance logging stopped.

12/9/2006 1:52:40 PM -- Storage Groups being Backed up... The Backup Time may take hours depending on the size of the Storage Group.

12/9/2006 2:03:59 PM -- Performance logging started.

12/9/2006 2:03:59 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Backup_To_Disk_2006_12_9_13-52-40.blg.

12/9/2006 2:03:59 PM -- Loading performance counters...

12/9/2006 2:43:00 PM -- Adding new data to the performance log file...

12/9/2006 2:43:02 PM -- Backup Complete!

12/9/2006 2:43:04 PM -- Performance logging stopped.

12/9/2006 2:43:04 PM -- Creating test report ...

Soft Recovery Results

**Jetstress Test Result:
4BPSX91**

The following table shows a quick overview of log replay statistics for 100 log files per storage group:

Storage Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Disk Read Bytes/sec	Total Seconds
Log (C:\Exchange\SG1\lg)	0.000	0.000	23.95	0.014	1559290.00	658.53

The following table shows a quick overview of processor and memory performance counter sample data:

Counter	Average	Minimum	Maximum
% Processor Time	9.75	0.000	15.63
Available MBytes	2814.17	2620.00	3495.00
Free System Page Table Entries	183184.00	183184.00	183184.00
Pages/Sec	0.000	0.000	0.000
Pool Nonpaged Bytes	38176180.00	38133760.00	39333890.00
Pool Paged Bytes	30707450.00	29204480.00	30736380.00

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\SoftRecovery_2006_12_9_13-11-8.blg is saved.

12/9/2006 10:48:08 AM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 10:48:08 AM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 10:48:08 AM -- Validating input parameters, it may take a few minutes...

12/9/2006 12:15:09 PM -- Duplicating 5 databases: 24.36 GB of 24.36 GB is duplicated (100.00% complete).

12/9/2006 12:15:09 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 12:15:09 PM -- Loading performance counters...

Soft Recovery Results

12/9/2006 12:15:09 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:15:09 PM -- Start Jetstress test...

12/9/2006 12:15:11 PM -- Performance logging started.

12/9/2006 12:15:11 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Tuning_2006_12_9_12-15-10.blg.

12/9/2006 12:15:11 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 12:15:41 PM -- Volume C:\Exchange\SG1\db has 0.00008 for Read Latency Slope.

12/9/2006 12:17:41 PM -- Instance1: the value for Target disk transfer is 500.

12/9/2006 12:17:41 PM -- Instance1: the value for Actual disk transfer is 577.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0098 for Database disk read latency.

12/9/2006 12:17:41 PM -- Volume C:\Exchange\SG1\db has 0.0017 for Database disk write latency.

12/9/2006 12:17:41 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 12:17:41 PM -- Performance logging stopped.

12/9/2006 12:17:41 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 12:17:41 PM -- Starting StreamingBackup test run...

12/9/2006 12:17:43 PM -- Performance logging started.

12/9/2006 12:17:43 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\Performance_LogGeneration_2006_12_9_12-15-9.blg.

12/9/2006 1:10:43 PM -- Adding new data to the performance log file...

12/9/2006 1:10:58 PM -- Performance logging stopped.

12/9/2006 1:10:58 PM -- Stopping Jetstress...

12/9/2006 1:11:07 PM -- Creating test report ...

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\db has 0.0142 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

12/9/2006 1:11:08 PM -- Volume C:\Exchange\SG1\lg has 0.0001 for Avg. Disk sec/Read.

12/9/2006 1:11:08 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/9/2006 1:11:08 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

12/9/2006 1:11:08 PM -- Soft recovery may take a while depending on the number of log files.

12/9/2006 1:11:09 PM -- Performance logging started.

12/9/2006 1:11:09 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\SoftRecovery_2006_12_9_13-11-8.blg.

12/9/2006 1:22:06 PM -- Adding new data to the performance log file...

12/9/2006 1:22:08 PM -- Performance logging stopped.

12/9/2006 1:22:08 PM -- Soft recovery is completed, please open C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\perf\SoftRecovery_2006_12_9_13-11-8.html for soft recovery result.

Appendix C: Stress

The following charts and data are from the Jetstress test report for the CX3-20c Jetstress 2 hour performance test.

Stress Test Results

Jetstress Test Result: 4BPSX91

The purpose of this test is to verify the storage configuration which the customer is planning to deploy. The test run has been successful, meaning the database read latency and log write latency are below 20ms; Database page fault stalls/sec is 0. However, Microsoft strongly recommends that you perform further validation of this storage solution (additional tasks listed below):

1. You should refer to the table below to determine if the actual disk IO (achieved IO) has exceeded the targeted IO (expected IO). If not, you may want to increase the thread count to increase the load, provided that the disk latency will not exceed the threshold.
2. You need to confirm whether the storage solution has synchronous replication as part of the implementation. If the solution does not utilize synchronous replication, then you should check for the database write latency, the desired value should be under 20 ms. (Please refer to <http://support.microsoft.com/?kbid=895847> for synchronous replication definitions.)
3. Please check the status pane in the Jetstress window, to make sure that no errors were logged during the database checksum validation.

Planned disk subsystem profile:

Total test database size	Production data size	Total number of databases	Expected I/O	Achieved I/O
122.58 GB (based on the attached database)	(n/a)	5 (1 storage(s) * 5 database(s))	500.00 (500 mailboxes of 1.00 IOPS)	542.74

JetStress test parameter summary:

Instance	threadCount	logBufferSize	opInsert	opReplace	opDelete	lazyCommit
1	5	9000	20	68	4	90

Disk subsystem performance summary:

Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Data (C:\Exchange\SG 1\db)	0.014	0.004	350.27	192.46	(n/a)
Log (C:\Exchange\SG 1\lg)	0.000	0.001	0.000	46.68	6676.75

Stress Test Results

Processor/memory performance summary:

Counter	Average	Minimum	Maximum
% Processor Time	0.726	0.516	1.942
Available MBytes	2559.93	2503.00	3522.00
Free System Page Table Entries	183127.34	183104.00	183144.00
Pages/Sec	3.138	0.000	4438.57
Pool Nonpaged Bytes	38885301.94	29392896.00	39723008.00
Pool Paged Bytes	31558406.76	27557888.00	32374784.00
Database Page Fault Stalls/sec	0.000	0.000	0.000

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\Stress_2006_12_9_21-9-49.blg is saved.

12/9/2006 9:09:46 PM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 9:09:46 PM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 9:09:46 PM -- Validating input parameters, it may take a few minutes...

12/9/2006 9:09:46 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 9:09:49 PM -- Loading performance counters...

12/9/2006 9:09:49 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 9:09:49 PM -- Start Jetstress test...

12/9/2006 9:09:52 PM -- Performance logging started.

12/9/2006 9:09:52 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\Tuning_2006_12_9_21-9-50.blg.

12/9/2006 9:09:52 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 9:10:22 PM -- Volume C:\Exchange\SG1\db has 0.00004 for Read Latency Slope.

12/9/2006 9:12:22 PM -- Instance1: the value for Target disk transfer is 500.

12/9/2006 9:12:22 PM -- Instance1: the value for Actual disk transfer is 574.

12/9/2006 9:12:22 PM -- Volume C:\Exchange\SG1\db has 0.0099 for Database disk read latency.

12/9/2006 9:12:22 PM -- Volume C:\Exchange\SG1\db has 0.0021 for Database disk write latency.

12/9/2006 9:12:22 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 9:12:22 PM -- Performance logging stopped.

12/9/2006 9:12:22 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 9:12:22 PM -- Starting Stress test run...

12/9/2006 9:12:24 PM -- Performance logging started.

12/9/2006 9:12:24 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\Stress_2006_12_9_21-9-49.blg.

12/10/2006 9:11:30 PM -- Adding new data to the performance log file...

12/10/2006 9:12:28 PM -- Performance logging stopped.

12/10/2006 9:12:28 PM -- Stopping Jetstress...

12/10/2006 9:12:36 PM -- Creating test report ...

12/10/2006 9:12:56 PM -- Volume C:\Exchange\SG1\db has 0.0143 for Avg. Disk sec/Read.

12/10/2006 9:12:56 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

Database Checksum Results

12/10/2006 9:12:56 PM -- Volume C:\Exchange\SG1\lg has 0.0000 for Avg. Disk sec/Read.

12/10/2006 9:12:56 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/10/2006 9:12:56 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

Database Checksum Results

Jetstress Test Result: 4BPSX91

The following table shows a quick overview of checksum statistics:

Database	Pages seen	Bad checksums	Correctable checksums	Wrong page numbers	MB read/sec (File size/Seconds taken)
C:\Exchange\SG1\db\Jetstress.edb	6770946	0	0	0	67.8 MB/sec (26449 MB/390 seconds)
C:\Exchange\SG1\db\Jetstress1.edb	6768386	0	0	0	67.9 MB/sec (26439 MB/389 seconds)
C:\Exchange\SG1\db\Jetstress2.edb	6770178	0	0	0	66.5 MB/sec (26446 MB/397 seconds)
C:\Exchange\SG1\db\Jetstress3.edb	6769154	0	0	0	65.2 MB/sec (26442 MB/405 seconds)
C:\Exchange\SG1\db\Jetstress4.edb	6768130	0	0	0	70.3 MB/sec (26438 MB/376 seconds)
(sum)	33846794	0	0	0	67.5 MB/sec (132214 MB/1959 seconds)

The following table shows a quick overview of database and log performance counter sample data:

Storage Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Total Seconds
C:\Exchange\SG1\db	0.949	0.017	1080.91	0.020	390.36
C:\Exchange\SG1\db	0.949	0.009	1083.68	0.010	389.33
C:\Exchange\SG1\db	0.956	0.006	1076.91	0.007	397.80
C:\Exchange\SG1\db	0.964	0.004	1068.02	0.005	405.82
C:\Exchange\SG1\db	0.955	0.003	1078.88	0.004	376.10

The following table shows a quick overview of processor and memory performance counter sample data:

Counter	Average	Minimum	Maximum
% Processor Time	9.69	0.000	18.30
Available MBytes	3581.62	3573.00	3591.00
Free System Page Table Entries	183091.20	183064.00	183104.00
Pages/Sec	0.019	0.000	21.33
Pool Nonpaged Bytes	40777260.00	38805500.00	41017340.00
Pool Paged Bytes	32774700.00	31260670.00	33099780.00

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\DatabaseChecksum_2006_12_10_21-12-56.blg is saved.

12/9/2006 9:09:46 PM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Database Checksum Results

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/9/2006 9:09:46 PM -- Warning: One or more storage groups are starting the tuning process with non-default tuning parameters. One of the reasons is that this server had a successful test run previously, and the parameters are saved in the JS_config.xml file. If you would like to use the default tuning parameters, please stop the test, then select the "Test Run Info" tab page, and click the "Restore Defaults" button. The test will use the default parameters.

12/9/2006 9:09:46 PM -- Validating input parameters, it may take a few minutes...

12/9/2006 9:09:46 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/9/2006 9:09:49 PM -- Loading performance counters...

12/9/2006 9:09:49 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 9:09:49 PM -- Start Jetstress test...

12/9/2006 9:09:52 PM -- Performance logging started.

12/9/2006 9:09:52 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\Tuning_2006_12_9_21-9-50.blg.

12/9/2006 9:09:52 PM -- Start tuning process, this may take an hour depending on the testing environment...

12/9/2006 9:10:22 PM -- Volume C:\Exchange\SG1\db has 0.00004 for Read Latency Slope.

12/9/2006 9:12:22 PM -- Instance1: the value for Target disk transfer is 500.

12/9/2006 9:12:22 PM -- Instance1: the value for Actual disk transfer is 574.

12/9/2006 9:12:22 PM -- Volume C:\Exchange\SG1\db has 0.0099 for Database disk read latency.

12/9/2006 9:12:22 PM -- Volume C:\Exchange\SG1\db has 0.0021 for Database disk write latency.

12/9/2006 9:12:22 PM -- Instance2564.1: IO parameters are thread (5), insert (20), replace (68), delete (4), and lazy commit (90)

12/9/2006 9:12:22 PM -- Performance logging stopped.

12/9/2006 9:12:22 PM -- Tuning process has completed. Jetstress test will be started.

12/9/2006 9:12:22 PM -- Starting Stress test run...

12/9/2006 9:12:24 PM -- Performance logging started.

12/9/2006 9:12:24 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\Stress_2006_12_9_21-9-49.blg.

12/10/2006 9:11:30 PM -- Adding new data to the performance log file...

12/10/2006 9:12:28 PM -- Performance logging stopped.

12/10/2006 9:12:28 PM -- Stopping Jetstress...

12/10/2006 9:12:36 PM -- Creating test report ...

12/10/2006 9:12:56 PM -- Volume C:\Exchange\SG1\db has 0.0143 for Avg. Disk sec/Read.

12/10/2006 9:12:56 PM -- Volume C:\Exchange\SG1\lg has 0.0009 for Avg. Disk sec/Write.

12/10/2006 9:12:56 PM -- Volume C:\Exchange\SG1\lg has 0.0000 for Avg. Disk sec/Read.

12/10/2006 9:12:56 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/10/2006 9:12:56 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

12/10/2006 9:12:57 PM -- Performance logging started.

12/10/2006 9:12:57 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\DatabaseChecksum_2006_12_10_21-12-56.blg.

12/10/2006 9:12:57 PM -- Checksum validation may take a while depending on the file sizes.

12/10/2006 9:45:36 PM -- Database checksum in progress:

Storage Group #1 (100%).

12/10/2006 9:45:36 PM -- Performance logging stopped.

12/10/2006 9:45:36 PM -- Checksum is completed, please open C:\Documents and Settings\Administrator.EXCHANGE\Desktop\Target IO CX320\500\stress\DatabaseChecksum_2006_12_10_21-12-56.html for checksum result.

Appendix D: Performance Test Results

Tuning for Maximum I/O Throughput

The configuration of the Mid-Sized Enterprise Building Block is the EMC recommended configuration for the 500 user workload at 1.0 IOPS per user. The results shown in Appendix A illustrate that this configuration achieved excellent results, with considerable room for growth.

Often the observed user workloads at customers are greater than expected, including use of Blackberry, or MAPI journaling- both of which increase the IO workload generated by a set of users. EMC prides itself on focusing on delivering solutions that meet and exceed customer requirements, so configurations are designed with safety margins.

After showing that the configuration could perform considerably better than the ESRP pass criteria, subsequent tests were run to determine the upper limits of the configuration. The number of Jetstress threads was increased gradually from 5 to 9 with no other configuration changes. The achieved IOPS increased from 547.62 to 762.16 – a 39% increase, while still providing latency results that beat the ESRP Pass criteria. While this workload is not recommended for customers, as it is close to ESRP Fail criteria, it highlights the headroom in the recommended Mid-Sized Enterprise building block for 500 users at 1.0 IOPS.

Performance Results

Jetstress Test Result: 4BPSX91

The purpose of this test is to verify the storage configuration which the customer is planning to deploy. The test run has been successful, meaning the database read latency and log write latency are below 20ms; Database page fault stalls/sec is 0. However, Microsoft strongly recommends that you perform further validation of this storage solution (additional tasks listed below):

1. You should refer to the table below to determine if the actual disk IO (achieved IO) has exceeded the targeted IO (expected IO). If not, you may want to increase the thread count to increase the load, provided that the disk latency will not exceed the threshold.

2. You need to confirm whether the storage solution has synchronous replication as part of the implementation. If the solution does not utilize synchronous replication, then you should check for the database write latency, the desired value should be under 20 ms. (Please refer to <http://support.microsoft.com/?kbid=895847> for synchronous replication definitions.)
3. Please check the status pane in the Jetstress window, to make sure that no errors were logged during the database checksum validation.

Planned disk subsystem profile:

Total test database size	Production data size	Total number of databases	Expected I/O	Achieved I/O
130.30 GB (based on the attached database)	(n/a)	5 (1 storage(s) * 5 database(s))	500.00 (500 mailboxes of 1.00 IOPS)	762.16

JetStress test parameter summary:

Instance	threadCount	logBufferSize	opInsert	opReplace	opDelete	lazyCommit
1	9	9000	17	70	5	90

Disk subsystem performance summary:

Volume	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Data (C:\Exchange\SG2\db)	0.018	0.005	508.57	253.59	(n/a)
Log (C:\Exchange\SG2\lg)	0.000	0.001	0.000	62.74	6383.35

Performance Results

Processor/memory performance summary:

Counter	Average	Minimum	Maximum
% Processor Time	1.045	0.467	1.938
Available MBytes	2602.28	2580.00	3432.00
Free System Page Table Entries	182630.00	182630.00	182630.00
Pages/Sec	0.000	0.000	0.067
Pool Nonpaged Bytes	40669483.29	40656896.00	40730624.00
Pool Paged Bytes	33081630.46	32190464.00	33099776.00
Database Page Fault Stalls/sec	0.000	0.000	0.000

Performance log C:\Documents and Settings\Administrator.EXCHANGE\Desktop\j2k3\1sgby24r10\new memory 9 thread\perf\Performance_2006_12_4_15-45-49.blg is saved.

12/4/2006 3:45:45 PM -- Environment validation results:

Detected JetstressUI version: 6.5.7830.0

Detected operating system: Microsoft Windows Server 2003 (5.2.3790.0) Service Pack 1

Detected ESE.dll version: 6.5.7638.2

Detected ESEPERF.dll version: 6.5.7638.1

12/4/2006 3:45:47 PM -- Validating input parameters, it may take a few minutes...

12/4/2006 3:45:47 PM -- Attaching databases ... (it may take a few minutes if the databases are in dirty shutdown state)

12/4/2006 3:45:49 PM -- Loading performance counters...

12/4/2006 3:45:49 PM -- Instance4240.1: IO parameters are thread (9), insert (17), replace (70), delete (5), and lazy commit (90)

12/4/2006 3:45:49 PM -- Start Jetstress test...

12/4/2006 3:45:50 PM -- Starting Performance test run...

12/4/2006 3:45:51 PM -- Performance logging started.

12/4/2006 3:45:51 PM -- Performance data will be saved to C:\Documents and Settings\Administrator.EXCHANGE\Desktop\j2k3\lsgby24r10\new memory 9 thread\perf\Performance_2006_12_4_15-45-49.blg.

12/4/2006 5:45:36 PM -- Adding new data to the performance log file...

12/4/2006 5:45:51 PM -- Performance logging stopped.

12/4/2006 5:45:51 PM -- Stopping Jetstress...

12/4/2006 5:46:00 PM -- Creating test report ...

12/4/2006 5:46:02 PM -- Volume C:\Exchange\SG2\db has 0.0179 for Avg. Disk sec/Read.

12/4/2006 5:46:02 PM -- Volume C:\Exchange\SG2\lg has 0.0009 for Avg. Disk sec/Write.

12/4/2006 5:46:02 PM -- Volume C:\Exchange\SG2\lg has 0.0000 for Avg. Disk sec/Read.

12/4/2006 5:46:02 PM -- Test has 0 Max Database Page Fault Stalls/sec.

12/4/2006 5:46:02 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.