



Dell PowerEdge R720xd 12,000 Mailbox Resiliency Microsoft Exchange 2013 Storage Solution

Tested with ESRP – Storage Version 4.0
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1 Overview

This document provides information about Dell's storage solution for Microsoft® Exchange Server, based on the *Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program v4.0*. For any questions or comments regarding the contents of this document, see [Additional Information](#).

The ESRP – Storage program was developed by Microsoft Corporation to provide a common storage testing framework that enables vendors to provide information on their storage solutions for Microsoft Exchange Server software. For more details on the Microsoft ESRP – Storage program, see <http://technet.microsoft.com/en-us/exchange/ff182054.aspx>

1.1 Disclaimer

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The information in this document represents the current view of Dell on the issues discussed as of the date of publication. Due to changing market conditions, it should not be interpreted to be a commitment on the part of Dell and cannot guarantee the accuracy of any information presented after the date of publication.

2 Features

This technical paper describes a tested and validated resilient storage solution for a 12,000 mailbox Exchange 2013 site with Data Availability Group (DAG). A DAG is a high availability mechanism in Microsoft Exchange 2013.

This mailbox resiliency model supports multiple copies (up to 16) of Exchange database in a DAG. A DAG can span sites, providing site resiliency. There is only one active copy of a given Exchange 2013 database at any given time. Secondary copies including the copies located at remote sites, are periodically synched with the primary copy. Mail clients access the primary (active) copy; and database changes to the primary copy are copied to the secondary (passive) copies in the form of transaction logs. The copied log records are applied to the secondary copy to keep the secondary database copies consistent with the primary copy. All hosts within a DAG are configured to be identical in terms of storage resources for Exchange 2013 databases and logs. The primary and secondary copies do not share any storage resources and reside on their own dedicated storage resources, as discussed later.

The solution presented here is a Mailbox Resiliency solution with a single DAG and three copies of each data base spanning two sites: Local and Remote. The local site has two database copies--active and passive--while the remote site has a passive copy of the database. The tested environment simulates up to 12,000 users with 5 Gigabyte (GB) Mailbox size and 150 messages a day or 0.121 IOPS per user, including the 20% headroom.

In this solution, Dell™ PowerEdge™ R720xd attached to a PowerVault™ MD1200 with 12, 3.5-inch drives is configured for the Mailbox Server Role. Each Dell PowerEdge R720xd and its attached storage hosts one active copy of an Exchange 2013 database and transaction logs and one passive copy of the peer node's active databases at the local site. Secondary passive copies of databases for the local site are hosted at the remote site. Dell PowerEdge R720xd provides SAS-based internal storage with RAID. The following are major features of the server or storage system:

- Capable of hosting up to 12, 3.5-inch Large Form Factor(LFF) SAS/Nearline SAS/SATA drives of up to 4 TB¹, plus two additional 2.5-inch disk drives in the back of the system (The 3.5-inch LFF configuration of the PowerEdge R720xd is used as part of this solution.)
- Or up to 26, 2.5-inch Small Form Factor(SFF) SAS/Nearline SAS/SATA drives of up to 1.2 TB¹ capacity(including the two 2.5-inch back-accessible disk drives)
- Host-based RAID options with Dell PowerEdge RAID Controller H710P Mini for internal drives
- Host-based RAID options with Dell PowerEdge RAID Controller H810 for external drives

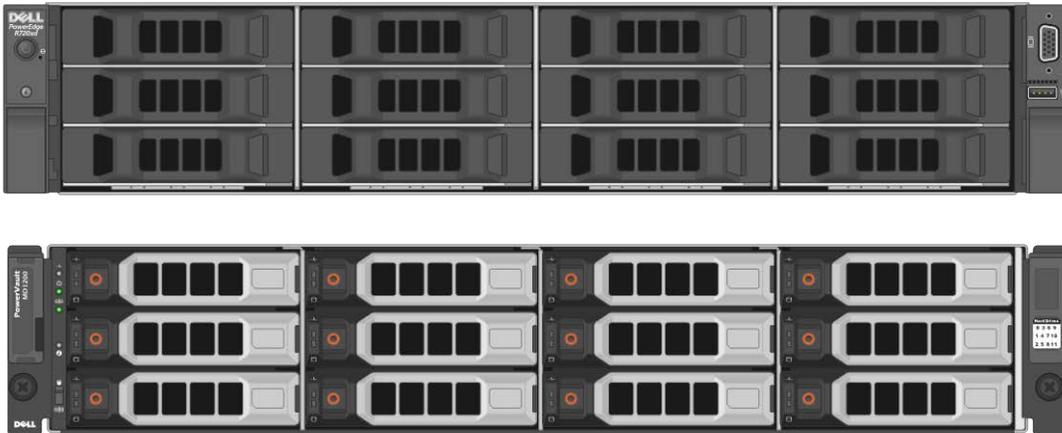
The PowerVault MD1200 is used here as an expansion for the Dell PowerEdge R720xd with the PERC H810 HostRAID adapter with 3.5-inch SAS HDDs.

¹ This information is accurate to the date of writing

3 Solution Components

The Dell PowerEdge R720xd server and Dell PowerVault MD1200 combination is the building block for this solution. The presented solution is for up to 12,000 mailboxes of size 5 GB each. The following sub-sections describe the hardware components that are part of this Exchange solution.

Figure 1 Dell PowerEdge R720xd 3.5-inch Server(top) Plus PowerVault MD1200 (bottom) building block



3.1 Dell PowerEdge R720xd Features

Dell PowerEdge R720xd is a 2-socket CPU, 2U, multi-purpose server, offering an excellent balance of an ultra-dense internal storage, redundancy and value in a compact form factor. It is a great hardware building block for any mid-size or large business that requires scalability in both memory density and storage capacity. It delivers enormous storage capacity and IOPS performance in a dense 2U form-factor, enabling larger and more efficient databases and mail servers. The internal RAID controller enable a range of RAID levels for improved storage reliability while the optional CacheCade™ feature caches most frequently accessed data, boosting database performance. The following are major features of the server or storage system:

- Intel® Xeon® processor E5-2600 and E5-2600 v2 product family
- Dual processor sockets
- Up to 768GB of Memory with 24 DIMMs
- Up to 48TB Maximum Raw Internal Storage
- Choice of chassis configuration with 12 (3.5-inch LFF disk drives) or 24 (2.5-inch SFF disk drives) front loading drive bays plus two 2.5-inch SFF back-accessible drives
- Integrated RAID support via PERC H310, PERC H710, PERC H710P & External JBOD RAID support via PERC H810
- Six PCIe 3.0 expansion slots
- Choice of NIC technologies

- Dell OpenManage™ Essentials and Dell Management Console, Dell OpenManage Power Center & Dell OpenManage Connections.

The PowerEdge R720xd chassis configured with the 3.5-inch large form factor drives is used as part of this solution. For more information, see [Dell PowerEdge R720xd Server product page](#).

3.2 Dell PowerVault MD1200 Features

The PowerVault MD1200 offers seamless expansion for Dell PowerEdge servers with the PERC H810 HostRAID adapter and provides expansion storage for Dell Compellent, EqualLogic and PowerVault array series. It gives customers the versatility to expand storage as their business grows. It can easily expand your server capacity with twelve 2.5-inch or 3.5-inch SAS HDDs and SAS SSDs in a 2U array and expands up to 8 arrays behind a single PERC H810 Host-RAID adapter. Table 1 lists the features of the Dell PowerVault MD1200.

Table 1 Dell PowerVault MD1200 Features

| Feature | Specification |
|--|---|
| Drives | Up to twelve (12) hot-pluggable SAS Hard Disk Drives (HDDs) at 7.2K, 10K, and 15K rpm and SAS Solid State Drives (SSDs). Mix and match 3.5-inch HDDs and 2.5-inch HDDs (2.5-inch requires 3.5-inch carriers) within enclosure. |
| Drive Performance and Capacities | 3.5-inch HDDs available in 7.2K rpm (4TB/3TB/2TB/1TB/500GB) SAS; 15K rpm (600GB/300GB) SAS SSD HDDs available in 400GB & 200GB |
| Maximum Capacity (per enclosure) | Up to 48TB using twelve (12) 4TB 7.2K rpm HDDs (6Gb/s SAS) |
| Expansion Capabilities | PERC H810 Host-RAID adapter enables expansion to 8 enclosures (4 enclosures per port) |
| Host Connectivity Unified Mode | Unified mode (single path) for daisy chaining of up to 8 enclosures per PERC H810 (4 enclosures per port, single path) Unified mode (recommended redundant path) for daisy chaining up to 4 enclosures per PERC H810 (4 enclosures connected to both ports through redundant path cabling) |
| Host Connectivity Split-Mode/Dual-Host Access | Split mode with dual Enclosure Management Modules (EEM) providing direct connectivity to drives 0 through 5 and a separate connectivity to drives 6 through 11 |

| | |
|--|---|
| Enclosure Management Modules and RAID levels | |
| Enclosure Management Modules (EMM) | 2 EMM provide redundant enclosure management capability; hot-swappable |
| RAID Levels | PERC H810 supports RAID levels 0, 1, 5, 6, 10, 50, and 60 |
| Back-Panel Connectors (per EMM) | |
| Host Connectivity | 1 SAS (SFF 8088) IN connector for connection to the host |
| Expansion Connectivity | 1 SAS (SFF 8088) OUT connector for expansion to an additional enclosure |
| Service Management | 1 6-pin UART mini-DIN connector (for factory use only) |

3.3 Dell PowerEdge RAID Controller (PERC) H710P Mini and H810

The Dell PowerEdge RAID Controller (PERC) H710P Mini and PERC H810 are used in the PowerEdge R720xd server hosting the Exchange server. The PERC H710P Mini and PERC H810 are the latest host-based RAID Controller cards from the PERC Series 8 Family. Dell PERC cards are built on the LSISA2208 dual-core PowerPC RAID-on-Chip (ROC), offer unmatched I/O performance for database, applications and streaming digital media environments.

Table 2 lists the technical specification of the PERC H710P Mini and PERC H810. For more information, see [Dell PowerEdge RAID Controller product page](#).

Table 2 Dell PowerEdge RAID Controller H710P Mini and PERC H810 Technical Specifications

| Feature | Specification |
|--------------------|---|
| Solution | Eight-port internal SATA+SAS solution supporting up to 32 hard disk drives (HDDs) and solid-state drives (SSDs) |
| Physical dimension | 167.6mm (6.6in) x 64.4mm (2.5-inch) (MD2 low profile) |
| Connectors | Two internal mini-SAS SFF8088 |

| | |
|---------------------------|--|
| Device support | Up to 32 (SAS, SATA) |
| Host bus type | 8-lane, PCI Express 2.0 compliant |
| Data transfer rate | Up to 6 Gb/s per port |
| SAS controller | LSISAS2208 dual-core PowerPC ROC |
| Cache size | 1 GB |
| RAID management | Dell OpenManage Storage Services & Additional management through UEFI (HII) & CEM |
| Optional SSD optimization | CacheCade software: provides boost in READs from SSD cache Dell FastPath software: delivers high IOPs performance on SSD arrays |

For more information about recommended hardware specifications, see [Section 4.4](#).

4 Solution Description

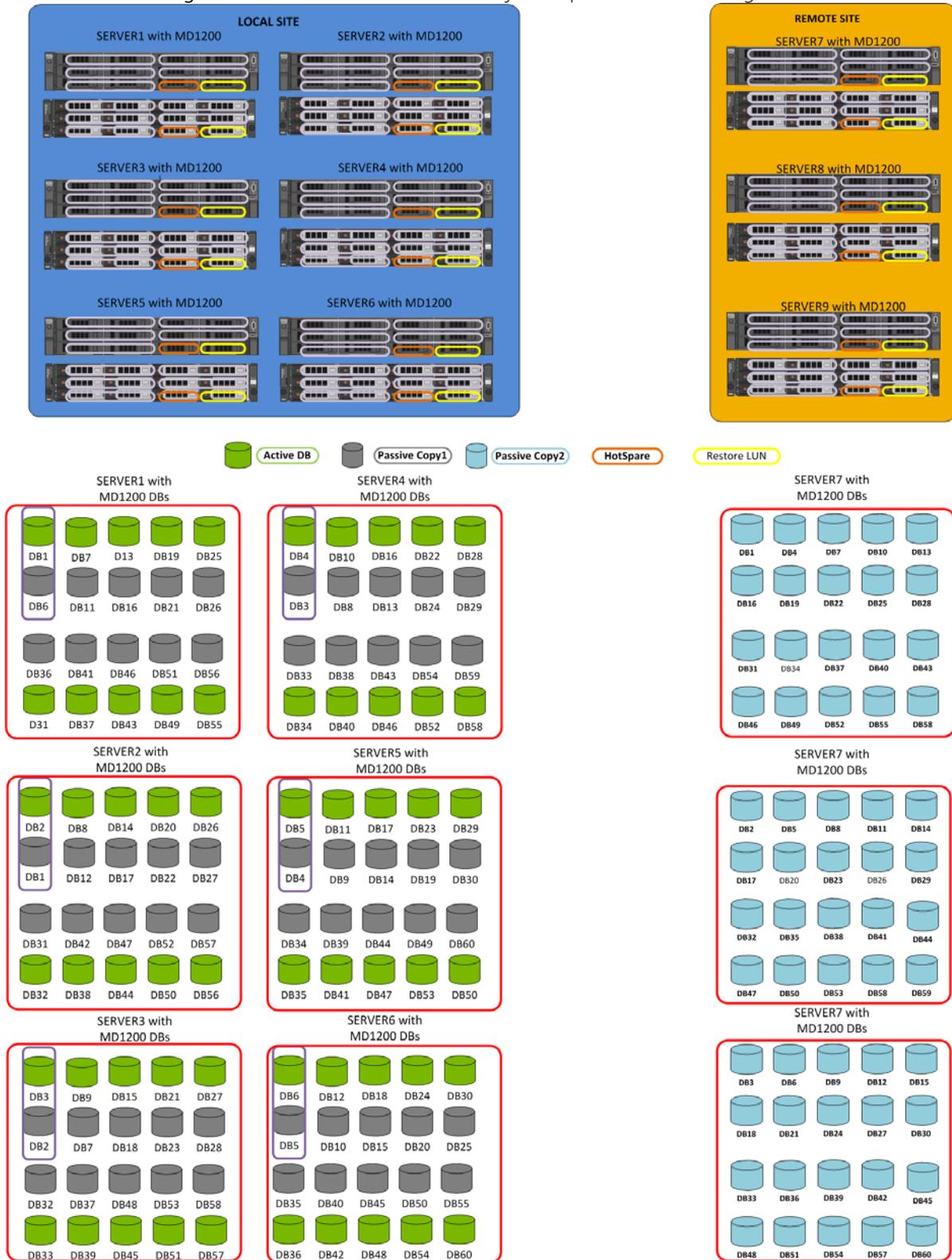
In this solution, Dell PowerEdge R720xd with 3.5-inch LFF drives, along with PowerVault MD1200, also with 3.5-inch LFF drives, are used for the Mailbox Server Role. PowerEdge R720xd provides SAS-based Internal Storage with RAID. The add-on PCIe PERC H810 RAID controller provides access to external storage in PowerVault MD1200. The presented solution utilizes all of the 12 3.5-inch LFF 7.2KRPM NL-SAS disks in the Dell PowerEdge R720xd, along with the 12 3.5-inch LFF 7.2KRPM NL-SAS disks in the attached PowerVault MD1200 with the back-accessible 2.5-inch disk drives on the R720xd. The disk drives are configured in the following layout.

- Two back-accessible disk drives (in RAID 1 container) for the operating system plus application files and Exchange Transport database
- Ten disk drives (in five RAID 1 containers) for Exchange database and its transaction logs
- Ten disk drives (in five RAID 1 containers) in attached PowerVault MD1200 for Exchange database and its transaction logs
- Two disk drive marked for Restore LUN
- Two disk drive configured as a Global Hot-spare

The presented solution has a 3-copy DAG Layout with Exchange Servers distributed among two sites: Local and Remote. Each server node has 10 –RAID 1 LUNs hosting one active and one passive database per LUN. Each of these databases hosts 200 users with a 5 GB mailbox each. Thus a single server can accommodate 2,000 users during normal operating conditions. Six such servers plus storage building blocks are placed in the local site, providing Exchange Mailbox Services for 12,000 users. The remote site, which holds one passive copy, has three such servers, plus storage building blocks. The tested mailbox user profile here was 150 messages a day or 0.121 transactions per user, which included a 20% IO overhead.

Figure 2 represents the distribution of database copies across the DAG members. A 3-copy DAG site resiliency solution with Exchange Servers hosted at both local and remote site is shown in the figure. The local site has two database copies of each of the databases, with one active and the other passive. The remote site holds one passive copy of each of the databases. If a server fails in the local site, the databases are activated on the surviving hosts to provide mailbox service continuity. If the site fails, the databases are activated in the remote site, thus providing Exchange Server service.

Figure 2 Database Availability Group architectural diagram



4.1 Failure and Recovery Scenarios

There are a total of six servers on the local site and three servers on the remote site. A single server failure on the local site activates the passive copies of the impacted databases local to the site because there are two copies at the local site, thus ensuring that the users impacted stay local. If there is a complete site failure, then the remote passive copies get activated and the users connect to their databases on the remote site. The condition considered and simulated here is a worst-case failure scenario wherein local site is completely unavailable and all the databases are activated on the remote site. Thus, each of the hosts is designed such that any three servers and the attached PowerVault MD1200 are capable of supporting the entire load. Each server is capable of handling the load for 4,000 users. Therefore, with three servers, all the 12,000 users can be served without compromising the performance.

Figure 3 represents the scenario where the local site is completely unavailable. In this case, the databases are activated on the remote site. These hosts are designed such that each host is capable of handling 4,000 users in the worst-case scenario. Thus, a total of 12,000 users could be handled by three servers located in the remote site.

Figure 3 With all servers unavailable at the Local Site

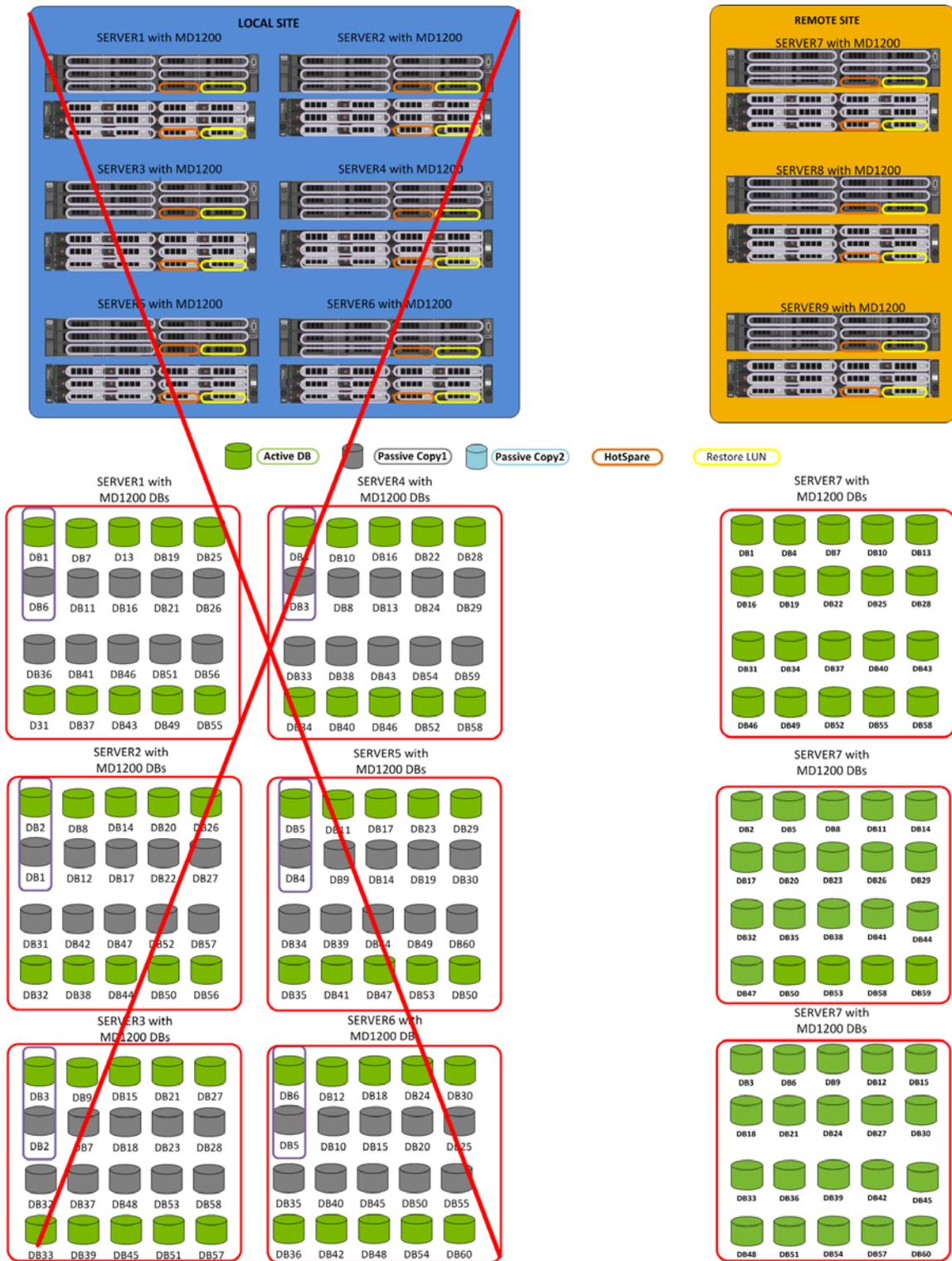


Table 3 represents the database distribution across servers. The [Microsoft Exchange 2013 Server Role Requirements Calculator](#) can be used to derive the database distribution, including the active and passive copies across servers located both in local and remote sites. The database distribution follows a particular pattern to ensure that if a server fails, the passive copies are activated on the remaining host such that, the load on each of the host machines is evenly distributed.

Table 3 Database/Transaction Log Layout across servers in DAG

| Database Name | Active Server | LOCAL SITE | | | | | | REMOTE SITE | | |
|---------------|---------------|------------|---------|---------|---------|---------|---------|-------------|---------|---------|
| | | Server1 | Server2 | Server3 | Server4 | Server5 | Server6 | Server7 | Server8 | Server9 |
| DB1 | Server1 | 1 | 2 | | | | | 3 | | |
| DB2 | Server2 | | 1 | 2 | | | | | 3 | |
| DB3 | Server3 | | | 1 | 2 | | | | | 3 |
| DB4 | Server4 | | | | 1 | 2 | | 3 | | |
| DB5 | Server5 | | | | | 1 | 2 | | 3 | |
| DB6 | Server6 | 2 | | | | | 1 | | | 3 |
| DB7 | Server1 | 1 | | 2 | | | | 3 | | |
| DB8 | Server2 | | 1 | 2 | | | | | 3 | |
| DB9 | Server3 | | | 1 | 2 | | | | | 3 |
| DB10 | Server4 | | | | 1 | 2 | | 3 | | |
| DB11 | Server5 | 2 | | | | 1 | | | 3 | |
| DB12 | Server6 | | 2 | | | | 1 | | | 3 |
| DB13 | Server1 | 1 | | | 2 | | | 3 | | |
| DB14 | Server2 | | 1 | | | 2 | | | 3 | |
| DB15 | Server3 | | | 1 | | | 2 | | | 3 |
| DB16 | Server4 | 2 | | | 1 | | | 3 | | |
| DB17 | Server5 | | 2 | | | 1 | | | 3 | |
| DB18 | Server6 | | | 2 | | | 1 | | | 3 |
| DB19 | Server1 | 1 | | | | 2 | | 3 | | |
| DB20 | Server2 | | 1 | | | | 2 | | 3 | |
| DB21 | Server3 | 2 | | 1 | | | | | | 3 |
| DB22 | Server4 | | 2 | | 1 | | | 3 | | |
| DB23 | Server5 | | | 2 | | 1 | | | 3 | |
| DB24 | Server6 | | | | 2 | | 1 | | | 3 |
| DB25 | Server1 | 1 | | | | | 2 | 3 | | |
| DB26 | Server2 | 2 | 1 | | | | | | 3 | |
| DB27 | Server3 | | 2 | 1 | | | | | | 3 |
| DB28 | Server4 | | | 2 | 1 | | | 3 | | |
| DB29 | Server5 | | | | 2 | 1 | | | 3 | |
| DB30 | Server6 | | | | | 2 | 1 | | | 3 |
| DB31 | Server1 | 1 | 2 | | | | | 3 | | |
| DB32 | Server2 | | 1 | 2 | | | | | 3 | |
| DB33 | Server3 | | | 1 | 2 | | | | | 3 |
| DB34 | Server4 | | | | 1 | 2 | | 3 | | |
| DB35 | Server5 | | | | | 1 | 2 | | 3 | |
| DB36 | Server6 | 2 | | | | | 1 | | | 3 |
| DB37 | Server1 | 1 | | 2 | | | | 3 | | |
| DB38 | Server2 | | 1 | | 2 | | | | 3 | |
| DB39 | Server3 | | | 1 | | 2 | | | | 3 |
| DB40 | Server4 | | | | 1 | | 2 | 3 | | |
| DB41 | Server5 | 2 | | | | 1 | | | 3 | |
| DB42 | Server6 | | 2 | | | | 1 | | | 3 |
| DB43 | Server1 | 1 | | | 2 | | | 3 | | |
| DB44 | Server2 | | 1 | | | 2 | | | 3 | |
| DB45 | Server3 | | | 1 | | | 2 | | | 3 |
| DB46 | Server4 | 2 | | | 1 | | | 3 | | |
| DB47 | Server5 | | 2 | | | 1 | | | 3 | |
| DB48 | Server6 | | | 2 | | | 1 | | | 3 |
| DB49 | Server1 | 1 | | | | 2 | | 3 | | |
| DB50 | Server2 | | 1 | | | | 2 | | 3 | |
| DB51 | Server3 | 2 | | 1 | | | | | 3 | |
| DB52 | Server4 | | 2 | | 1 | | | 3 | | |
| DB53 | Server5 | | | 2 | | 1 | | | 3 | |
| DB54 | Server6 | | | | 2 | | 1 | | | 3 |
| DB55 | Server1 | 1 | | | | | 2 | 3 | | |
| DB56 | Server2 | 2 | 1 | | | | | | 3 | |
| DB57 | Server3 | | 2 | 1 | | | | | | 3 |
| DB58 | Server4 | | | 2 | 1 | | | 3 | | |
| DB59 | Server5 | | | | 2 | 1 | | | 3 | |
| DB60 | Server6 | | | | | 2 | 1 | | | 3 |



4.2 Storage Sizing

Storage sizing typically involves the type of RAID, type of disk drives and the number of disk drives, both from a Capacity and IOPS perspective. Selecting the right storage is crucial to achieve the balance between cost and performance. Jetstress tools provide a way of capturing the storage subsystem IOPS. Storage design also depends on the actual size of the mailbox on the disk drive, content indexing space and Log space required. You can use Dell Open Manage Server Administrator (OMSA) software for managing the Storage.

[Microsoft Exchange 2013 Server Role Requirements Calculator](#) can be used to derive the required IOPS for a particular user profile. Figure 4 shows the Mailbox Calculator output for 12,000 users with 150 messages per day profile. The recommended IOPS per server is 482. This will be the target IOPs that will be verified and tested as part of ESRP Jetstress verification. For more information, see [Section 5](#).

Figure 4 Recommended IOPS from the Microsoft Exchange 2013 Server Role Requirements Calculator

| Host IO and Throughput Requirements | / Database | / Server | / DAG | / Environment |
|---|------------|----------|----------|---------------|
| Total Database Required IOPS | 24 | 482 | 4342 | 4342 |
| Total Log Required IOPS | 5 | 102 | 920 | 920 |
| Database Read I/O Percentage | 60% | -- | -- | -- |
| Background Database Maintenance Throughput Requirements | 1.0 MB/s | 20 MB/s | 180 MB/s | 180 MB/s |

4.3 Recommended Hardware Configuration

Based on the solution requirements as described in the earlier sections, table 4 provides more information about the server and storage configuration. Additionally, the firmware and driver versions are also provided for the tested solution.

Table 4 Exchange Server Configuration (Dell PowerEdge R720xd server)

| Microsoft Exchange Server System | Dell PowerEdge R720xd Server with 3.5-inch HDD Chassis |
|----------------------------------|---|
| CPU | 2 x 2.8GHz Intel Intel® Xeon® processor E5-2680 v2 with 10 cores |
| Memory | Up to 128 GB DDR3 for local site servers; Up to 160 GB DDR3 for remote site servers; |
| NIC | Broadcom NetXtreme II |
| RAID Controller | Dell PowerEdge RAID Controller H710P Mini Firmware version: 21.2.0-0007 Driver version 6.600.2.08 |

| | |
|----------------|--|
| Internal Disks | 2 x 1.2 TB SAS 2.5-inch 10K RPM disk drives (Operating System and Application) |
|----------------|--|

Table 5 Storage Subsystem configuration (Dell PowerEdge R720xd server storage)

| Storage System | Dell PowerEdge R720xd Internal 3.5-inch drives |
|-----------------|---|
| Disks | 12 x 4 TB 7.2K RPM NL-SAS 3.5-inch disk: <ul style="list-style-type: none"> • 10 x 4 TB 7.2K RPM NL-SAS 3.5-inch drive in 5 x RAID 1 (for DB and Log) • 1 x 4 TB 7.2K RPM NL-SAS 3.5-inch drive (for Restore LUN) • 1 x 4 TB 7.2K RPM NL-SAS 3.5-inch drive (for Global Hot-spare) |
| RAID Controller | Dell PowerEdge RAID Controller H710P Mini (Firmware version: 21.2.0.007) |

Table 6 Storage Subsystem configuration(Dell PowerVault MD1200 storage)

| Storage System | Dell PowerVault MD1200 3.5-inch drives |
|-----------------|---|
| Disks | 12 x 4 TB 7.2K RPM NL-SAS 3.5-inch disk: <ul style="list-style-type: none"> • 10 x 4 TB 7.2K RPM NL-SAS 3.5-inch drive in 5 x RAID 1 (for DB and Log) • 1 x 4 TB 7.2K RPM NL-SAS 3.5-inch drive (for Restore LUN) • 1 x 4 TB 7.2K RPM NL-SAS 3.5-inch drive (for Global Hot-spare) |
| RAID Controller | Dell PowerEdge RAID Controller H810(Firmware version: 21.2.0.007) |

5 Targeted Customer Profile

This solution is intended for mid-size to large organizations hosting up to 12,000 Exchange 2013 mailboxes. The configuration used for testing was as follows:

- Number of mailboxes: 12,000
- Number of Sites: 2 (Local & Remote)
- Number of Servers in Each Site: 6 in Local and 3 in Remote
- User IO profile: 150 messages sent and received or 0.121 I/O Operations per second per mailbox (This includes 20% IO headroom factor)
- 5 GB Mailbox quota per mailbox
- 24x7 Background Database Maintenance enabled
- Data Availability Group (DAG) for Mailbox Resiliency (3 copies simulated--1 Active, 2 Passive)

5.1 Tested User Profile

The tested user profile was 0.121 IOPS per user with a 5 GB mailbox size. This IO profile for Exchange 2013 represents about 150 messages (sent/received) per mailbox per day and accounts for an additional 20% IO overhead. Sometimes additional applications, such as certain mobile messaging applications, can raise the IOPS profile of a user as high as three or four times that of normal.

5.2 Tested Deployment

The tested deployment simulated a failure scenario where up to 6 members of the local site are completely unavailable and the passive copies on the surviving DAG members at the remote site are activated to provide mailbox service continuity. Therefore the IOPs simulated mimicked that of 4,000 active mailboxes on the same Exchange 2013 Server. The target IOPs for the given profile was 482. The average achieved IOPs were 890—which were much higher than the target—and maintained read and write latencies well within the recommended thresholds. The following tables summarizes the testing environment.

Table 7 Simulated Exchange Configuration

| Feature | Specification |
|---|------------------------------------|
| Number of Exchange mailboxes simulated | 12,000 (at 5 GB mailbox size each) |
| Number of Database Availability Groups (DAGs) | 1 |
| Number of Sites | 2 (Local and Remote) |

| Feature | Specification |
|--|--|
| Number of servers/DAG | 9 (6Local and 3 Remote) (3 Tested) |
| Number of active mailboxes/server | 2,000 (during normal operations) & 4,000 (during site failure) |
| Number of databases/server | 20 (10 active, 10 passive) |
| Number of copies/database | 3 (2 in Local and 1 in remote site) |
| Number of mailboxes/database | 200 |
| Simulated profile: IOPS/mailbox | 0.121 (150 messages/day) This includes 20% IO overhead factor |
| Database/Log LUN size | 3725GB |
| Number of LUNs per server | 10 |
| Number of DBs per LUN | 2 (one active, one passive) |
| Background database maintenance (BDM) | Tested with BDM enabled |
| Total database size for performance testing | 986GB per DB 57.8 TB total |
| % storage capacity used by Exchange database | 57.8 TB / 109.2 TB 52.9% |

Table 8 Storage and Server Hardware

| Feature | Specification |
|--|---|
| Storage Connectivity (Fiber Channel, SAS, SATA, iSCSI) | SAS |
| Storage model and OS/firmware revision | PowerEdge R720xd with PERC H710P Mini Firmware 21.2.0-0007 attached to internal drives PERC H810 Firmware 21.2.0-0007 PowerVault MD1200 attached to PERC H810 |
| Storage cache | 1 GB- PERC H710P 1 GB- PERC H810 |
| Number of storage controllers | 1 attached to internal drives 1 attached to external drives in PowerVault MD1200 |
| Number of storage ports | 2 (Two internal mini-SAS SFF8088) |
| Maximum bandwidth of storage connectivity to host | 6 Gb/s per port |
| Switch type/model/firmware revision | NA |
| HBA model and firmware | H710P Mini Firmware 21.2.0.007 H810 Firmware 21.2.0.007 |
| Number of HBA's/host | 2 |
| Host server type | PowerEdge R720xd 2 CPU 10-core Intel® Xeon® processor E5-2660 v2 128 GB RAM |
| Total number of disks tested in solution | Internal to R720xd:30 (10 per server) External connecting to MD 1200: 30 (10 per server) Total: 60 (20 per server) |

| Feature | Specification |
|---|--|
| Maximum number of spindles can be hosted in the storage | 12 x 3.5-inch and 2 x 2.5-inch per Dell PowerEdge R720xd server 12 x 3.5-inch and 2 x 2.5-inch per Dell PowerVault MD1200 |

Table 9 Storage and Server Software (internal storage)

| Feature | Specification |
|-----------------------------------|---|
| HBA driver | PERC H710P SAS-RAID 6.600.2.8 |
| HBA QueueTarget Setting | N/A |
| HBA QueueDepth Setting | N/A |
| Multi-Pathing | N/A |
| Host OS | Windows Server [®] 2012 datacenter X64 Edition |
| ESE.dll file version | 15.00.0847.030 |
| Replication solution name/version | N/A |

Table 10 Storage and software (external storage)

| Feature | Specification |
|-----------------------------------|---|
| HBA driver | PERC H810P SAS-RAID 6.600.2.8 attached to PowerVault MD1200 |
| HBA QueueTarget Setting | N/A |
| HBA QueueDepth Setting | N/A |
| Multi-Pathing | N/A |
| Host OS | Windows Server 2012 datacenter X64 Edition |
| ESE.dll file version | 15.00.0847.030 |
| Replication solution name/version | N/A |
| HBA driver | PERC H810 SAS-RAID 6.600.2.8 |

| Feature | Specification |
|-------------------------|---------------|
| HBA QueueTarget Setting | N/A |

Table 11 Storage Disk Configuration (Mailbox Store Disks)

| Feature | Specification |
|--|---|
| Disk type, speed and firmware revision | DELL 7.2K 3.5-inch RPM 4 TB NL-SAS Model – ST4000NM0063 |
| Raw capacity per disk (TB) | 4 TB |
| Number of physical disks in test | 30 (10 per Server) |
| Total raw storage capacity (TB) | 120 TB(40 TB per Server) |
| Raid level | RAID 1 pairs |
| Number of disks per LUN | 2 |
| Total formatted capacity | 3725 GB per LUN 54.6 TB total |
| Storage capacity utilization | 54.6/120=45.5% Formatted capacity/Total raw capacity |
| Database capacity utilization | 28.9 TB / 54.6 TB=52.9% Database size / Total formatted capacity |

5.3 Best Practices

Exchange Server 2007, 2010 and 2013 overcome the memory limitations of previous Exchange versions by providing support as a 64-bit application capable of running on supported x64 platforms. On Windows Server 2012 x64 Edition, about 4TB of addressable memory is available for the kernel mode and the user mode applications. Both the application and kernel have sufficient memory for operations, allowing the Extensible Storage Engine (ESE) in Exchange Server 2013 to utilize more memory to buffer data pages. The result is a reduction in the number of I/O, specifically the read operations, required to the disk sub-system. The total number of database disk I/O operations for a given user load depends on the available system memory. For a given load, the total database disk I/O operations required per second (IOPS) decreases over a period with increase in system memory. This decrease in database IOPS is primarily caused by a decrease in database reads.

Even with the decrease in database IOPS using larger server memory, it is essential to size the Exchange Storage subsystem accurately to ensure that there are no I/O bottlenecks, both from an IOPs and disk latency perspective. The disk subsystem should be capable of supporting both the capacity and I/O throughput demands of the application. Based on testing using the ESRP framework, we recommend the following best practices to help improve the I/O subsystem performance:

- Sharing Exchange 2013 storage resources with other applications may negatively impact the performance of Exchange 2013 deployment and, therefore, we don't recommend sharing the spindles hosting the Exchange Database and log with any other application or operating system.
- During testing, the database and log folders shared the same physical disk. Other testing indicated that separating the database folders from log folders onto a different set of disks does not provide a noticeable performance advantage. In an Exchange Server 2013 resiliency solution, separating the database and log folders is no longer a required best practice. For standalone Exchange 2013 solutions that do not deploy a DAG, it is a best practice to separate the database and log onto separate physical disks.
- For Exchange 2013 database, it is recommended that the size of elements within a RAID stripe be set to 512K for best performance.
- Windows NTFS allocation unit size for Exchange 2013 database partitions should be set to 64K for best performance. For log partitions, if separated from the database, the default allocation unit size should be used. When formatting the windows partitions, GUID partition table (GPT) should be used.
- Exchange Server 2013 storage latencies are most often related to the number of disks available for a given a workload. Windows Performance Monitor may be used to monitor Exchange Server 2013 database counters. Average database read latencies (Avg. Disk sec/Read) should not exceed 20ms.

For Exchange 2013 best practices on storage design, please see the following:

[http://technet.microsoft.com/en-us/library/ee832792\(v=exchg.150\).aspx](http://technet.microsoft.com/en-us/library/ee832792(v=exchg.150).aspx)

5.4 Backup Strategy

To protect e-mail data from potential disasters, having a well designed and implemented backup solution is critical. Depending on environment requirements, different backup strategies may be implemented, such as backup to tape or LAN/SAN-based backup. In this solution, DAG is used to maintain a passive database copy on a separate storage system.

The test performed for backup was log replay. The log replay test was used to measure the maximum rate at which the log files can be played against the databases. This is used to determine the restore times and also database write throughput that can be achieved during a log recovery.

6 Test Result Summary

This section provides a high-level summary of the test data from Microsoft Exchange Jetstress—as part of the ESRP requirements—and the link to the detailed html reports which are generated by the ESRP testing framework. Click on the underlined headings below to view the html report for each test.

6.1 Reliability

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

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

- Any errors reported in the saved event log file? No
- Any errors reported in during the database and log checksum process? No

6.2 [Storage Performance Test Result Report](#)

The Storage performance test is designed to exercise the storage with maximum sustainable Exchange IO for 2 hours. The test shows how long it takes for the storage to respond to an IO under load. The data below is the sum of all of the logical disk I/O's and average of all the logical disks I/O latency in the 2-hour test. The achieved IOPS were around 880.

As part of the ESRP framework, the Stress Test was also performed. The duration of the test was for 24 hours, with a target IOPS of 0.121, or 482 IOPs per server. The achieved IOPs were around 890 IOPs per server, well above the target IOPs per server. The [Stress Test Result](#) Report is provided for reference.

6.2.1 Individual Server Metrics

The sum of I/Os across Storage Groups and the average latency across all Storage Groups on a per server basis is shown below.

Table 12 Individual Server Metrics

Server 1: Host-1

| | |
|---|------|
| Database I/O | |
| Target Disk Transfers/sec | 484 |
| Achieved Database Disks Transfers/sec | 863 |
| Database Disks Reads/sec | 586 |
| Database Disks Writes/sec | 277 |
| Average Database Disk Read Latency (ms) | 13.8 |

| | |
|--|------|
| Database I/O | |
| Average Database Disk Write Latency (ms) | 1.92 |
| Transaction Log I/O | |
| Log Disks Writes/sec | 64. |
| Average Log Disk Write Latency (ms) | 0.56 |

Server 2: Host-2

| | |
|--|------|
| Database I/O | |
| Target Database Disks Transfers/sec | 484 |
| Achieved Database Disks Transfers/sec | 866 |
| Database Disks Reads/sec | 589 |
| Database Disks Writes/sec | 277 |
| Average Database Disk Read Latency (ms) | 13.7 |
| Average Database Disk Write Latency (ms) | 1.9 |
| Transaction Log I/O | |
| Log Disks Writes/sec | 64.5 |
| Average Log Disk Write Latency (ms) | 0.54 |

Server 3: Host-3

| | |
|--|------|
| Database I/O | |
| Target Database Disks Transfers/sec | 484 |
| Achieved Database Disks Transfers/sec | 940 |
| Database Disks Reads/sec | 638 |
| Database Disks Writes/sec | 302 |
| Average Database Disk Read Latency (ms) | 13.0 |
| Average Database Disk Write Latency (ms) | 2.1 |
| Transaction Log I/O | |
| Log Disks Writes/sec | 69.8 |

| Database I/O | |
|-------------------------------------|------|
| Average Log Disk Write Latency (ms) | 0.59 |

6.2.1 Aggregate Performance across all servers/DAGs Metrics

The sum of I/Os across servers in solution and the average latency across all servers in solution is shown below.

Table 13 Aggregated Performance Metrics across all servers

| Database I/O | |
|--|-------|
| Database Disks Transfers/sec | 2669 |
| Database Disks Reads/sec | 1813 |
| Database Disks Writes/sec | 856 |
| Average Database Disk Read Latency (ms) | 13.5 |
| Average Database Disk Write Latency (ms) | 1.7 |
| Transaction Log I/O | |
| Log Disks Writes/sec | 198.3 |
| Average Log Disk Write Latency (ms) | 0.57 |

6.3 Database Backup/Recovery Performance

There are two tests reports in this section. The first one is to measure the sequential read rate of the database files, and the second is to measure the recovery/replay performance (playing transaction logs in to the database).

6.3.1 Database Backup Test Result Report

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

Table 14 Database Backup Test Metrics

| | |
|------------------------------|-------|
| MB read/sec per database | 140.8 |
| MB read/sec total per server | 2752 |

6.3.2 Soft Recovery test Result Report

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 503 log files played in a single storage group. Each log file is 1 MB in size.

Table 15 SoftRecovery Test Metrics

| | |
|---|------|
| Average number of log files played | 507 |
| Average time to play one Log file (sec) | 4.74 |

7 Conclusion

This ESRP document presents a tested and validated Exchange solution for 12,000 mailbox with 5GB mailbox size supporting up to 150 messages/day in a 3 copy DAG. The solution uses the Dell PowerEdge R720xd attached to PowerVault MD1200 as the building block for the Exchange mailbox servers and storage for Exchange mailbox databases and transactional logs.

Testing was carried out as part of the ESRP test framework using Microsoft Exchange Server 2013 Jetstress. The testing results show that the proposed solution is more than capable of delivering the IOPs and meeting the capacity requirements to support 12,000 mailboxes with the set mailbox profile.

This document is developed by storage solution providers, and reviewed by the Microsoft Exchange Product team. The test results/data presented in this document are based on the tests introduced in the ESRP test framework. Customers 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.

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

8 Additional Information

1. [Support.dell.com](http://support.dell.com) is focused on meeting customer requirements with proven services.
2. DellTechCenter.com is an IT Community where you can connect with Dell Customers and Dell employees for the purpose of sharing knowledge, best practices and information about Dell products and installations.
3. Referenced or recommended Dell publications:
 - a. [Dell Unified Communication and Collaboration website](#)
 - b. [Dell PowerEdge R720xd](#)
 - c. [Dell PowerEdge RAID Controller \(PERC\) H710P Spec Sheet](#)
 - d. [Dell PowerVault MD1200](#)
 - e. [Dell PowerEdge RAID controller \(PERC\) H810 Spec Sheet](#)

A Performance Test Result Report

A.1 Server1

Microsoft Exchange Jetstress 2013

Performance Test Result Report

Test Summary

| | |
|------------------------------|---|
| Overall Test Result | Pass |
| Machine Name | HOST-1 |
| Test Description | 5GB Mailboxes Up to 4000 Mailboxes 150 Messages per user perday |
| Test Start Time | 3/13/2014 12:26:12 PM |
| Test End Time | 3/13/2014 4:28:48 PM |
| Collection Start Time | 3/13/2014 12:35:04 PM |
| Collection End Time | 3/13/2014 2:34:52 PM |
| Jetstress Version | 15.00.0775.000 |
| ESE Version | 15.00.0847.030 |
| Operating System | Windows Server 2012 R2 Datacenter (6.2.9200.0) |
| Performance Log | C:\Program Files\Exchange Jetstress\ESRP\Performance_2014_3_13_12_26_53.blg |

Database Sizing and Throughput

| | |
|--|----------------|
| Achieved Transactional I/O per Second | 863.162 |
| Target Transactional I/O per Second | 484 |
| Initial Database Size (bytes) | 21079498162176 |
| Final Database Size (bytes) | 21083734409216 |
| Database Files (Count) | 20 |

Jetstress System Parameters

| | |
|--|-----------|
| Thread Count | 20 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |
| Run Background Database Maintenance | True |
| Number of Copies per Database | 3 |

Database Configuration

Instance2904.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance2904.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance2904.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance2904.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance2904.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance2904.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance2904.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance2904.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance2904.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance2904.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance2904.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance2904.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance2904.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance2904.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance2904.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance2904.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance2904.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance2904.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance2904.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance2904.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb

| Transactional I/O Performance | | | | | | | | | | | | |
|---------------------------------|---|---|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| MSExchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Reads Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
| Instance2904.1 | 19.423 | 1.048 | 29.501 | 13.987 | 33248.998 | 34576.533 | 0.000 | 0.848 | 0.000 | 3.243 | 0.000 | 26433.703 |
| Instance2904.2 | 16.643 | 1.089 | 29.184 | 13.720 | 33238.136 | 34592.342 | 0.000 | 0.870 | 0.000 | 3.196 | 0.000 | 26498.024 |
| Instance2904.3 | 13.419 | 1.163 | 29.155 | 13.842 | 33326.482 | 34638.071 | 0.000 | 0.648 | 0.000 | 3.229 | 0.000 | 21092.466 |
| Instance2904.4 | 13.237 | 1.150 | 29.250 | 13.654 | 33300.152 | 34610.323 | 0.000 | 0.647 | 0.000 | 3.158 | 0.000 | 26665.250 |
| Instance2904.5 | 12.941 | 1.202 | 29.422 | 13.755 | 33293.977 | 34588.017 | 0.000 | 0.582 | 0.000 | 3.182 | 0.000 | 26398.631 |
| Instance2904.6 | 12.944 | 1.408 | 29.281 | 13.789 | 33278.878 | 34589.960 | 0.000 | 0.388 | 0.000 | 3.181 | 0.000 | 26398.844 |
| Instance2904.7 | 13.480 | 1.929 | 29.251 | 13.681 | 33355.213 | 34591.313 | 0.000 | 0.425 | 0.000 | 3.198 | 0.000 | 26474.133 |
| Instance2904.8 | 13.392 | 1.471 | 29.193 | 13.801 | 33277.906 | 34613.358 | 0.000 | 0.308 | 0.000 | 3.197 | 0.000 | 26814.789 |
| Instance2904.9 | 13.453 | 1.770 | 29.408 | 13.889 | 33301.893 | 34587.791 | 0.000 | 0.532 | 0.000 | 3.173 | 0.000 | 26972.500 |
| Instance2904.10 | 13.443 | 1.679 | 29.323 | 13.779 | 33229.026 | 34562.570 | 0.000 | 0.446 | 0.000 | 3.173 | 0.000 | 26722.958 |
| Instance2904.11 | 13.705 | 2.123 | 29.478 | 14.178 | 33274.315 | 34573.365 | 0.000 | 0.582 | 0.000 | 3.263 | 0.000 | 26639.881 |
| Instance2904.12 | 13.678 | 2.021 | 29.206 | 13.625 | 33271.073 | 34617.429 | 0.000 | 0.493 | 0.000 | 3.191 | 0.000 | 26483.207 |
| Instance2904.13 | 13.335 | 2.261 | 29.291 | 13.671 | 33317.392 | 34661.372 | 0.000 | 0.617 | 0.000 | 3.183 | 0.000 | 26485.674 |
| Instance2904.14 | 13.441 | 2.322 | 29.064 | 13.772 | 33307.457 | 34666.335 | 0.000 | 0.612 | 0.000 | 3.249 | 0.000 | 26775.060 |
| Instance2904.15 | 13.276 | 2.516 | 29.559 | 14.004 | 33291.454 | 34593.338 | 0.000 | 0.513 | 0.000 | 3.242 | 0.000 | 26287.767 |
| Instance2904.16 | 13.205 | 2.514 | 29.286 | 13.773 | 33306.521 | 34626.335 | 0.000 | 0.422 | 0.000 | 3.208 | 0.000 | 26762.454 |
| Instance2904.17 | 13.205 | 2.661 | 29.535 | 14.133 | 33318.514 | 34573.015 | 0.000 | 0.365 | 0.000 | 3.193 | 0.000 | 26965.306 |
| Instance2904.18 | 13.199 | 2.685 | 29.318 | 13.698 | 33289.307 | 34581.005 | 0.000 | 0.322 | 0.000 | 3.180 | 0.000 | 26749.612 |
| Instance2904.19 | 13.432 | 2.898 | 29.332 | 13.940 | 33277.432 | 34881.104 | 0.000 | 0.418 | 0.000 | 3.261 | 0.000 | 26049.619 |
| Instance2904.20 | 13.300 | 2.935 | 29.262 | 13.879 | 33305.527 | 34625.719 | 0.000 | 0.501 | 0.000 | 3.198 | 0.000 | 21026.672 |

| Background Database Maintenance I/O Performance | | |
|---|-----------------------------------|---|
| MSExchange Database => Instance | Database Maintenance IO Reads/sec | Database Maintenance IO Reads Average Bytes |
| Instance2904.1 | 8.582 | 261717.685 |
| Instance2904.2 | 8.827 | 261797.820 |
| Instance2904.3 | 8.707 | 261736.460 |
| Instance2904.4 | 8.924 | 261689.612 |
| Instance2904.5 | 8.929 | 261684.318 |
| Instance2904.6 | 8.920 | 261728.277 |
| Instance2904.7 | 8.918 | 261733.388 |
| Instance2904.8 | 8.919 | 261801.979 |
| Instance2904.9 | 8.912 | 261730.863 |
| Instance2904.10 | 8.937 | 261660.242 |
| Instance2904.11 | 8.896 | 261720.721 |
| Instance2904.12 | 8.903 | 261813.974 |
| Instance2904.13 | 8.917 | 261794.102 |
| Instance2904.14 | 8.923 | 261790.632 |
| Instance2904.15 | 8.915 | 261658.791 |
| Instance2904.16 | 8.932 | 261743.229 |
| Instance2904.17 | 8.922 | 261717.439 |
| Instance2904.18 | 8.932 | 261697.110 |
| Instance2904.19 | 8.908 | 261697.306 |
| Instance2904.20 | 8.928 | 261838.698 |

| Log Replication I/O Performance | | |
|---------------------------------|-------------------|-----------------------------|
| MSExchange Database => Instance | I/O Log Reads/sec | I/O Log Reads Average Bytes |
| Instance2904.1 | 0.562 | 109977.660 |
| Instance2904.2 | 0.562 | 109967.238 |
| Instance2904.3 | 0.577 | 113746.917 |
| Instance2904.4 | 0.554 | 108202.427 |
| Instance2904.5 | 0.554 | 108202.427 |
| Instance2904.6 | 0.557 | 108990.402 |
| Instance2904.7 | 0.562 | 109700.154 |
| Instance2904.8 | 0.564 | 110160.842 |
| Instance2904.9 | 0.559 | 109610.712 |
| Instance2904.10 | 0.557 | 109550.154 |
| Instance2904.11 | 0.569 | 111752.093 |
| Instance2904.12 | 0.554 | 108202.427 |
| Instance2904.13 | 0.552 | 107712.823 |
| Instance2904.14 | 0.572 | 112273.8413 |
| Instance2904.15 | 0.559 | 109488.056 |
| Instance2904.16 | 0.564 | 110160.842 |
| Instance2904.17 | 0.562 | 109671.238 |
| Instance2904.18 | 0.556 | 108202.427 |
| Instance2904.19 | 0.554 | 108639.505 |
| Instance2904.20 | 0.567 | 110650.446 |

| Total I/O Performance | | | | | | | | | | | | |
|---------------------------------|---|---|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| MSExchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Reads Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
| Instance2904.1 | 19.423 | 1.048 | 36.083 | 13.987 | 64750.224 | 34576.533 | 2.142 | 0.848 | 0.562 | 3.243 | 109977.660 | 26433.703 |
| Instance2904.2 | 16.643 | 1.089 | 36.023 | 13.720 | 64690.214 | 34592.342 | 2.207 | 0.870 | 0.562 | 3.196 | 109671.238 | 26498.024 |
| Instance2904.3 | 13.419 | 1.163 | 36.066 | 13.842 | 64773.861 | 34638.071 | 2.182 | 0.648 | 0.577 | 3.229 | 113746.917 | 21092.466 |
| Instance2904.4 | 13.237 | 1.150 | 36.182 | 13.654 | 64680.826 | 34610.323 | 2.047 | 0.647 | 0.554 | 3.158 | 108202.427 | 26665.250 |
| Instance2904.5 | 12.941 | 1.202 | 36.351 | 13.755 | 64667.664 | 34588.017 | 2.092 | 0.582 | 0.554 | 3.182 | 108202.427 | 26398.631 |
| Instance2904.6 | 12.944 | 1.408 | 36.166 | 13.789 | 64759.459 | 34589.960 | 1.800 | 0.388 | 0.557 | 3.181 | 108990.402 | 26398.844 |
| Instance2904.7 | 13.480 | 1.929 | 36.189 | 13.881 | 64711.214 | 34591.313 | 1.791 | 0.425 | 0.562 | 3.195 | 109700.154 | 26474.133 |
| Instance2904.8 | 13.392 | 1.471 | 36.112 | 13.801 | 64737.605 | 34613.358 | 1.904 | 0.308 | 0.564 | 3.197 | 110160.842 | 26814.789 |
| Instance2904.9 | 13.453 | 1.770 | 36.320 | 13.889 | 64626.243 | 34587.791 | 1.758 | 0.532 | 0.539 | 3.173 | 109610.712 | 26972.500 |
| Instance2904.10 | 13.443 | 1.679 | 36.240 | 13.779 | 64699.783 | 34588.017 | 1.746 | 0.446 | 0.537 | 3.173 | 109889.114 | 26722.958 |
| Instance2904.11 | 13.705 | 2.123 | 36.374 | 14.178 | 64642.501 | 34573.365 | 1.992 | 0.582 | 0.569 | 3.263 | 111752.093 | 26639.881 |
| Instance2904.12 | 13.678 | 2.021 | 36.109 | 13.625 | 64664.626 | 34617.429 | 1.982 | 0.493 | 0.554 | 3.191 | 108202.427 | 26483.207 |
| Instance2904.13 | 13.335 | 2.261 | 36.209 | 13.671 | 64635.332 | 34661.372 | 1.819 | 0.617 | 0.552 | 3.183 | 107712.823 | 26485.674 |
| Instance2904.14 | 13.441 | 2.322 | 36.187 | 13.772 | 64678.868 | 34666.335 | 2.003 | 0.612 | 0.572 | 3.249 | 110278.613 | 26775.060 |
| Instance2904.15 | 13.276 | 2.516 | 36.474 | 14.084 | 64620.932 | 34593.338 | 1.875 | 0.515 | 0.559 | 3.242 | 110488.056 | 26287.767 |
| Instance2904.16 | 13.205 | 2.514 | 36.219 | 13.773 | 64626.335 | 34626.335 | 2.096 | 0.422 | 0.564 | 3.208 | 110160.842 | 26762.454 |
| Instance2904.17 | 13.205 | 2.661 | 36.437 | 14.133 | 64605.673 | 34593.015 | 1.741 | 0.365 | 0.562 | 3.193 | 109671.238 | 26965.306 |
| Instance2904.18 | 13.199 | 2.685 | 36.250 | 13.698 | 64607.448 | 34581.005 | 1.701 | 0.322 | 0.554 | 3.180 | 108202.427 | 26749.612 |
| Instance2904.19 | 13.432 | 2.899 | 36.440 | 13.960 | 64620.965 | 34591.104 | 1.928 | 0.418 | 0.554 | 3.261 | 108639.505 | 26049.619 |
| Instance2904.20 | 13.300 | 2.935 | 36.187 | 13.879 | 64719.262 | 34625.719 | 1.864 | 0.501 | 0.567 | 3.198 | 110650.446 | 21026.672 |

| Host System Performance | | | |
|--------------------------------|---------------|---------------|---------------|
| Counter | Average | Minimum | Maximum |
| % Processor Time | 0.449 | 0.230 | 0.921 |
| Available Mbytes | 193916.603 | 193823.000 | 193944.000 |
| Free System Page Table Entries | 16330482.408 | 16329901.000 | 16330764.000 |
| Transition Pages Re/Purposed/s | 0.000 | 0.000 | 0.000 |
| Pool Managed Bytes | 11932699.543 | 11930094.000 | 11934004.000 |
| Pool Paged Bytes | 112337842.333 | 112316416.000 | 112394240.000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

```

Test Log
3/13/2014 12:26:12 PM -- Preparing for testing --
3/13/2014 12:26:32 PM -- Attaching databases --
3/13/2014 12:26:32 PM -- Preparations for testing are complete.
3/13/2014 12:26:32 PM -- Starting transaction dispatch --
3/13/2014 12:26:32 PM -- Database cache settings (minimum: 640.0 MB, maximum: 3.0 GB)
3/13/2014 12:26:32 PM -- Database flush thresholds (target: 51.2 MB, step: 102.4 MB)
3/13/2014 12:26:33 PM -- Database read latency thresholds (average: 20 msec/read, maximum: 100 msec/read)
3/13/2014 12:26:33 PM -- Database write latency thresholds (average: 10 msec/write, maximum: 100 msec/write)
3/13/2014 12:26:36 PM -- Operation mix: Sessions 20, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%
3/13/2014 12:26:36 PM -- Performance logging started (interval: 15000 ms)
3/13/2014 12:26:36 PM -- Performance logging has ended.
3/13/2014 4:28:20 PM -- WaitForChangeDatabase($serverWin)/Database Cache Size: Last: 4850754000.0 (lower bound: 4831630000.0, upper bound: none)
3/13/2014 4:28:20 PM -- Dispatching transactions end.
3/13/2014 4:28:21 PM -- Shutting down databases --
3/13/2014 4:28:48 PM -- Instance2904.1 (complete), Instance2904.2 (complete), Instance2904.3 (complete), Instance2904.4 (complete), Instance2904.5 (complete), Instance2904.6 (complete), Instance2904.7 (complete), Instance2904.8 (complete), Instance2904.9 (complete), Instance2904.10 (complete), Instance2904.11 (complete), Instance2904.12 (complete), Instance2904.13 (complete), Instance2904.14 (complete), Instance2904.15 (complete), Instance2904.16 (complete), Instance2904.17 (complete), Instance2904.18 (complete), Instance2904.19 (complete) and Instance2904.20 (complete)
3/13/2014 4:28:48 PM -- C:\Program Files\Microsoft SQL Server\90\Performance\2014_3_13_12_26_33.txt has 508 samples.
3/13/2014 4:28:48 PM -- Creating test report.
3/13/2014 4:28:50 PM -- Instance2904.1 has 19.4 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.1 has 0.8 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.1 has 0.8 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.2 has 16.6 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.2 has 0.9 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.2 has 0.9 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.3 has 13.4 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.3 has 0.6 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.3 has 0.6 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.4 has 13.3 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.4 has 0.6 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.4 has 0.6 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.5 has 12.9 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.5 has 0.6 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.5 has 0.6 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.6 has 13.4 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.6 has 0.6 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.6 has 0.6 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.7 has 0.4 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.7 has 0.4 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.8 has 13.4 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.8 has 0.5 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.8 has 0.5 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.9 has 13.5 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.9 has 0.5 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.9 has 0.5 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.10 has 0.4 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.10 has 0.4 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.11 has 13.7 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.11 has 0.6 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.11 has 0.6 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.12 has 13.7 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.12 has 0.5 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.12 has 0.5 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.13 has 13.4 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.13 has 0.5 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.13 has 0.5 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.14 has 0.6 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.14 has 0.6 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.15 has 13.3 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.15 has 0.5 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.15 has 0.5 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.16 has 13.2 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.16 has 0.4 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.16 has 0.4 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.17 has 13.2 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.17 has 0.6 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.17 has 0.6 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.18 has 12.2 for I/O Database Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.18 has 0.3 for I/O Log Writes Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.18 has 0.3 for I/O Log Reads Average Latency.
3/13/2014 4:28:50 PM -- Instance2904.19 has 13.5 for I/O Database Reads Average Latency.

```

A.2 Server 2

Microsoft Exchange Jetstress 2013

Performance Test Result Report

Test Summary

| | |
|------------------------------|---|
| Overall Test Result | Pass |
| Machine Name | HOST-2 |
| Test Description | 5GB Mailboxes Up to 4000 Mailboxes 150 Messages per user per day |
| Test Start Time | 3/13/2014 12:26:20 PM |
| Test End Time | 3/13/2014 4:30:48 PM |
| Collection Start Time | 3/13/2014 12:34:59 PM |
| Collection End Time | 3/13/2014 2:34:45 PM |
| Jetstress Version | 15.00.0775.000 |
| ESE Version | 15.00.0847.030 |
| Operating System | Windows Server 2012 R2 Datacenter (6.2.9200.0) |
| Performance Log | C:\Program Files\Exchange Jetstress\ESRP\Performance_2014_3_13_12_27_2.blg |

Database Sizing and Throughput

| | |
|--|----------------|
| Achieved Transactional I/O per Second | 866.773 |
| Target Transactional I/O per Second | 484 |
| Initial Database Size (bytes) | 21070404911104 |
| Final Database Size (bytes) | 21074716655616 |
| Database Files (Count) | 20 |

Jetstress System Parameters

| | |
|--|-----------|
| Thread Count | 20 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |
| Run Background Database Maintenance | True |
| Number of Copies per Database | 3 |

Database Configuration

Instance5068.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance5068.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance5068.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance5068.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance5068.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance5068.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance5068.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance5068.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance5068.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance5068.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance5068.11 Log path: K:\LOG1
Database: K:\DB1\Jetstress011001.edb

Instance5068.12 Log path: K:\LOG2
Database: K:\DB2\Jetstress012001.edb

Instance5068.13 Log path: L:\LOG1
Database: L:\DB1\Jetstress013001.edb

Instance5068.14 Log path: L:\LOG2
Database: L:\DB2\Jetstress014001.edb

Instance5068.15 Log path: M:\LOG1
Database: M:\DB1\Jetstress015001.edb

Instance5068.16 Log path: M:\LOG2
Database: M:\DB2\Jetstress016001.edb

Instance5068.17 Log path: N:\LOG1
Database: N:\DB1\Jetstress017001.edb

Instance5068.18 Log path: N:\LOG2
Database: N:\DB2\Jetstress018001.edb

Instance5068.19 Log path: O:\LOG1
Database: O:\DB1\Jetstress019001.edb

Instance5068.20 Log path: O:\LOG2
Database: O:\DB2\Jetstress020001.edb

Transactional I/O Performance

| MSEchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
|--------------------------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| Instance0068.1 | 13.961 | 0.960 | 29.392 | 13.811 | 32248.544 | 34662.260 | 0.000 | 0.861 | 0.000 | 3.207 | 0.000 | 20946.320 |
| Instance0068.2 | 14.325 | 0.964 | 29.309 | 13.676 | 33282.174 | 34685.482 | 0.000 | 0.835 | 0.000 | 3.202 | 0.000 | 20770.574 |
| Instance0068.3 | 13.909 | 1.128 | 29.822 | 14.045 | 33300.627 | 34639.243 | 0.000 | 0.519 | 0.000 | 3.219 | 0.000 | 20914.063 |
| Instance0068.4 | 13.826 | 1.112 | 29.863 | 14.218 | 33338.342 | 34632.780 | 0.000 | 0.566 | 0.000 | 3.228 | 0.000 | 20936.382 |
| Instance0068.5 | 14.370 | 1.280 | 29.370 | 13.989 | 33290.070 | 34634.362 | 0.000 | 0.849 | 0.000 | 3.232 | 0.000 | 20808.246 |
| Instance0068.6 | 14.344 | 1.290 | 29.228 | 13.611 | 33292.008 | 34679.077 | 0.000 | 0.854 | 0.000 | 3.181 | 0.000 | 20947.957 |
| Instance0068.7 | 13.029 | 1.453 | 29.361 | 13.818 | 33271.639 | 34700.336 | 0.000 | 0.412 | 0.000 | 3.236 | 0.000 | 21100.967 |
| Instance0068.8 | 13.023 | 1.446 | 29.470 | 13.880 | 33285.167 | 34667.802 | 0.000 | 0.404 | 0.000 | 3.210 | 0.000 | 21092.963 |
| Instance0068.9 | 14.045 | 1.492 | 29.529 | 14.004 | 33291.457 | 34687.805 | 0.000 | 0.443 | 0.000 | 3.229 | 0.000 | 20838.334 |
| Instance0068.10 | 14.025 | 1.484 | 29.411 | 13.944 | 33286.423 | 34693.043 | 0.000 | 0.390 | 0.000 | 3.283 | 0.000 | 20826.449 |
| Instance0068.11 | 13.470 | 2.073 | 29.449 | 13.991 | 33227.172 | 34654.732 | 0.000 | 0.445 | 0.000 | 3.251 | 0.000 | 20959.201 |
| Instance0068.12 | 13.450 | 2.072 | 29.321 | 13.855 | 33272.443 | 34679.549 | 0.000 | 0.411 | 0.000 | 3.224 | 0.000 | 21239.146 |
| Instance0068.13 | 13.414 | 2.367 | 29.495 | 13.758 | 33323.991 | 34696.908 | 0.000 | 0.517 | 0.000 | 3.194 | 0.000 | 20842.999 |
| Instance0068.14 | 13.413 | 2.341 | 29.532 | 13.972 | 33299.139 | 34707.284 | 0.000 | 0.433 | 0.000 | 3.233 | 0.000 | 20882.746 |
| Instance0068.15 | 14.306 | 2.473 | 29.569 | 13.932 | 33345.364 | 34577.306 | 0.000 | 0.474 | 0.000 | 3.226 | 0.000 | 20911.874 |
| Instance0068.16 | 14.076 | 2.567 | 29.398 | 13.848 | 33278.483 | 34677.721 | 0.000 | 0.446 | 0.000 | 3.249 | 0.000 | 20865.466 |
| Instance0068.17 | 13.366 | 2.704 | 29.383 | 13.764 | 33317.716 | 34674.842 | 0.000 | 0.563 | 0.000 | 3.186 | 0.000 | 21008.033 |
| Instance0068.18 | 13.266 | 2.745 | 29.462 | 13.821 | 33275.226 | 34675.899 | 0.000 | 0.498 | 0.000 | 3.214 | 0.000 | 20776.686 |
| Instance0068.19 | 13.423 | 2.975 | 29.500 | 13.998 | 33312.612 | 34662.750 | 0.000 | 0.481 | 0.000 | 3.243 | 0.000 | 20764.294 |
| Instance0068.20 | 13.477 | 2.923 | 29.251 | 13.733 | 33240.322 | 34728.383 | 0.000 | 0.441 | 0.000 | 3.242 | 0.000 | 21051.774 |

Background Database Maintenance I/O Performance

| MSEchange Database => Instance | Database Maintenance IO Reads/sec | Database Maintenance IO Reads Average Bytes |
|--------------------------------|-----------------------------------|---|
| Instance0068.1 | 8.881 | 261699.422 |
| Instance0068.2 | 8.898 | 2618305.848 |
| Instance0068.3 | 8.902 | 261784.568 |
| Instance0068.4 | 8.906 | 261828.417 |
| Instance0068.5 | 8.898 | 261774.639 |
| Instance0068.6 | 8.890 | 261921.038 |
| Instance0068.7 | 8.919 | 261723.476 |
| Instance0068.8 | 8.938 | 261786.373 |
| Instance0068.9 | 8.915 | 2617061.199 |
| Instance0068.10 | 8.917 | 261750.242 |
| Instance0068.11 | 8.907 | 261689.690 |
| Instance0068.12 | 8.932 | 261667.641 |
| Instance0068.13 | 8.923 | 261689.874 |
| Instance0068.14 | 8.920 | 261661.641 |
| Instance0068.15 | 8.873 | 261827.094 |
| Instance0068.16 | 8.904 | 261727.303 |
| Instance0068.17 | 8.913 | 261681.165 |
| Instance0068.18 | 8.927 | 261731.786 |
| Instance0068.19 | 8.917 | 261794.223 |
| Instance0068.20 | 8.928 | 261685.061 |

Log Replication I/O Performance

| MSEchange Database => Instance | I/O Log Reads/sec | I/O Log Reads Average Bytes |
|--------------------------------|-------------------|-----------------------------|
| Instance0068.1 | 0.564 | 110467.264 |
| Instance0068.2 | 0.562 | 109671.238 |
| Instance0068.3 | 0.567 | 111524.601 |
| Instance0068.4 | 0.564 | 110397.758 |
| Instance0068.5 | 0.564 | 110597.920 |
| Instance0068.6 | 0.564 | 110160.842 |
| Instance0068.7 | 0.572 | 112638.240 |
| Instance0068.8 | 0.567 | 110820.466 |
| Instance0068.9 | 0.569 | 111883.549 |
| Instance0068.10 | 0.574 | 112638.563 |
| Instance0068.11 | 0.572 | 112166.780 |
| Instance0068.12 | 0.578 | 113404.886 |
| Instance0068.13 | 0.562 | 109671.238 |
| Instance0068.14 | 0.572 | 111829.653 |
| Instance0068.15 | 0.559 | 109181.633 |
| Instance0068.16 | 0.572 | 111629.653 |
| Instance0068.17 | 0.567 | 111045.003 |
| Instance0068.18 | 0.569 | 111140.050 |
| Instance0068.19 | 0.572 | 112066.731 |
| Instance0068.20 | 0.577 | 112608.861 |

Total I/O Performance

| MSEchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
|--------------------------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| Instance0068.1 | 13.961 | 0.960 | 38.273 | 13.811 | 66272.335 | 34662.260 | 1.775 | 0.861 | 0.364 | 3.207 | 110467.264 | 20946.320 |
| Instance0068.2 | 14.325 | 0.964 | 38.204 | 13.676 | 66495.964 | 34685.482 | 1.713 | 0.835 | 0.562 | 3.202 | 109671.238 | 20770.574 |
| Instance0068.3 | 13.909 | 1.128 | 38.524 | 14.045 | 66095.390 | 34639.243 | 2.020 | 0.519 | 0.587 | 3.219 | 111524.601 | 20914.063 |
| Instance0068.4 | 13.826 | 1.112 | 38.771 | 14.218 | 66710.812 | 34632.798 | 2.043 | 0.566 | 0.288 | 3.228 | 110397.758 | 20936.382 |
| Instance0068.5 | 14.370 | 1.280 | 38.468 | 13.989 | 66138.235 | 34634.362 | 2.130 | 0.849 | 0.584 | 3.232 | 110597.920 | 20808.246 |
| Instance0068.6 | 14.344 | 1.290 | 38.149 | 13.611 | 66825.819 | 34679.077 | 2.151 | 0.854 | 0.684 | 3.181 | 110160.842 | 20947.957 |
| Instance0068.7 | 13.029 | 1.453 | 38.280 | 13.818 | 66497.665 | 34700.336 | 1.942 | 0.412 | 0.372 | 3.236 | 112638.240 | 21100.967 |
| Instance0068.8 | 13.023 | 1.446 | 38.407 | 13.880 | 66488.767 | 34667.802 | 1.873 | 0.404 | 0.387 | 3.210 | 110820.466 | 21092.963 |
| Instance0068.9 | 14.045 | 1.492 | 38.444 | 14.004 | 66242.615 | 34687.805 | 1.846 | 0.443 | 0.569 | 3.229 | 111883.549 | 20838.334 |
| Instance0068.10 | 14.025 | 1.484 | 38.328 | 13.944 | 66440.373 | 34693.043 | 1.792 | 0.390 | 0.374 | 3.283 | 112638.563 | 20826.449 |
| Instance0068.11 | 13.470 | 2.073 | 38.396 | 13.961 | 66287.060 | 34644.732 | 1.985 | 0.445 | 0.372 | 3.251 | 112166.780 | 20940.201 |
| Instance0068.12 | 13.450 | 2.072 | 38.283 | 13.855 | 66264.109 | 34679.549 | 1.899 | 0.411 | 0.378 | 3.224 | 113404.886 | 21239.146 |
| Instance0068.13 | 13.414 | 2.367 | 38.418 | 13.758 | 66361.954 | 34696.908 | 1.748 | 0.517 | 0.362 | 3.194 | 109671.238 | 20842.999 |
| Instance0068.14 | 13.413 | 2.341 | 38.451 | 13.972 | 66272.174 | 34707.284 | 1.831 | 0.433 | 0.372 | 3.233 | 111829.653 | 20882.746 |
| Instance0068.15 | 14.306 | 2.473 | 38.442 | 13.932 | 66078.885 | 34577.306 | 2.115 | 0.474 | 0.359 | 3.226 | 109181.633 | 20911.874 |
| Instance0068.16 | 14.076 | 2.567 | 38.302 | 13.848 | 66386.208 | 34677.721 | 1.947 | 0.446 | 0.372 | 3.249 | 111629.653 | 20865.466 |
| Instance0068.17 | 13.366 | 2.704 | 38.296 | 13.764 | 66449.856 | 34674.842 | 1.945 | 0.563 | 0.567 | 3.186 | 111045.003 | 21008.033 |
| Instance0068.18 | 13.266 | 2.745 | 38.389 | 13.821 | 66400.971 | 34675.899 | 1.835 | 0.498 | 0.569 | 3.214 | 111140.050 | 20776.686 |
| Instance0068.19 | 13.423 | 2.975 | 38.417 | 13.998 | 66246.923 | 34662.750 | 2.179 | 0.481 | 0.372 | 3.243 | 112066.731 | 20764.294 |
| Instance0068.20 | 13.477 | 2.923 | 38.179 | 13.733 | 66276.433 | 34728.383 | 2.065 | 0.441 | 0.377 | 3.242 | 112608.861 | 21051.774 |

Host System Performance

| Counter | Average | Minimum | Maximum |
|---------------------------------|---------------|---------------|---------------|
| % Processor Time | 0.404 | 0.241 | 0.904 |
| Available MBytes | 102130.309 | 102102.000 | 102490.000 |
| Free System Page Table Entries | 16531169.374 | 16520741.000 | 16531567.000 |
| Transition Pages RePurposed/sec | 0.000 | 0.000 | 0.000 |
| Pool Nonpaged Bytes | 121802717.560 | 121716736.000 | 122060000.000 |
| Pool Paged Bytes | 112664636.220 | 112603136.000 | 112910936.000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

A.3 Server 3

Microsoft Exchange Jetstress 2013

Performance Test Result Report

Test Summary

| | |
|------------------------------|---|
| Overall Test Result | Pass |
| Machine Name | HOST-3 |
| Test Description | 5GB Mailboxes Up to 4000 Mailboxes 150 Messages per user per day |
| Test Start Time | 3/13/2014 12:26:05 PM |
| Test End Time | 3/13/2014 4:31:39 PM |
| Collection Start Time | 3/13/2014 12:34:02 PM |
| Collection End Time | 3/13/2014 2:34:00 PM |
| Jetstress Version | 15.00.0775.000 |
| ESE Version | 15.00.0847.030 |
| Operating System | Windows Server 2012 R2 Datacenter (6.2.9200.0) |
| Performance Log | C:\Program Files\Exchange Jetstress\ESRP\Performance_2014_3_13_12_26_47.blg |

Database Sizing and Throughput

| | |
|--|----------------|
| Achieved Transactional I/O per Second | 940.013 |
| Target Transactional I/O per Second | 484 |
| Initial Database Size (bytes) | 21065967337472 |
| Final Database Size (bytes) | 21070639792128 |
| Database Files (Count) | 20 |

Jetstress System Parameters

| | |
|--|-----------|
| Thread Count | 20 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |
| Run Background Database Maintenance | True |
| Number of Copies per Database | 3 |

Database Configuration

Instance952.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance952.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance952.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance952.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance952.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance952.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance952.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance952.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance952.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance952.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance952.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance952.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance952.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance952.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance952.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance952.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance952.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance952.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance952.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance952.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb

| Transactional I/O Performance | | | | | | | | | | | | | |
|---------------------------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|--|
| MSExchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes | |
| Instance052.1 | 15.291 | 0.978 | 31.773 | 15.002 | 3322.371 | 34694.956 | 0.000 | 0.871 | 0.000 | 3.482 | 0.000 | 20964.786 | |
| Instance052.2 | 15.226 | 0.956 | 31.778 | 14.828 | 33242.972 | 34633.350 | 0.000 | 0.856 | 0.000 | 3.438 | 0.000 | 20648.903 | |
| Instance052.3 | 16.401 | 1.197 | 31.915 | 15.082 | 33224.303 | 34672.829 | 0.000 | 0.889 | 0.000 | 3.513 | 0.000 | 20419.293 | |
| Instance052.4 | 16.400 | 1.193 | 31.717 | 15.200 | 33241.499 | 34684.240 | 0.000 | 0.894 | 0.000 | 3.521 | 0.000 | 21076.510 | |
| Instance052.5 | 16.113 | 1.476 | 32.133 | 15.256 | 33239.891 | 34637.414 | 0.000 | 0.374 | 0.000 | 3.501 | 0.000 | 20547.209 | |
| Instance052.6 | 16.141 | 1.461 | 32.194 | 15.404 | 33192.830 | 34646.538 | 0.000 | 0.397 | 0.000 | 3.551 | 0.000 | 20482.482 | |
| Instance052.7 | 14.347 | 1.625 | 32.032 | 15.172 | 33223.913 | 34631.990 | 0.000 | 0.331 | 0.000 | 3.497 | 0.000 | 20479.499 | |
| Instance052.8 | 14.410 | 1.675 | 32.015 | 15.136 | 33282.471 | 34668.141 | 0.000 | 0.399 | 0.000 | 3.543 | 0.000 | 20573.935 | |
| Instance052.9 | 14.315 | 1.922 | 31.699 | 14.910 | 33281.369 | 34690.859 | 0.000 | 0.492 | 0.000 | 3.437 | 0.000 | 21039.962 | |
| Instance052.10 | 14.354 | 1.932 | 32.127 | 15.068 | 33265.104 | 34623.846 | 0.000 | 0.392 | 0.000 | 3.440 | 0.000 | 20754.574 | |
| Instance052.11 | 9.816 | 2.328 | 31.847 | 15.079 | 33271.170 | 34622.324 | 0.000 | 0.537 | 0.000 | 3.461 | 0.000 | 20778.826 | |
| Instance052.12 | 10.125 | 2.314 | 31.826 | 14.933 | 33248.282 | 34668.362 | 0.000 | 0.506 | 0.000 | 3.469 | 0.000 | 20891.338 | |
| Instance052.13 | 13.352 | 2.590 | 31.994 | 15.140 | 33242.194 | 34643.723 | 0.000 | 0.471 | 0.000 | 3.557 | 0.000 | 20382.077 | |
| Instance052.14 | 13.107 | 2.559 | 31.970 | 15.139 | 33219.892 | 34645.780 | 0.000 | 0.713 | 0.000 | 3.507 | 0.000 | 20674.961 | |
| Instance052.15 | 9.835 | 2.716 | 31.871 | 15.059 | 33290.928 | 34663.210 | 0.000 | 0.526 | 0.000 | 3.495 | 0.000 | 20959.338 | |
| Instance052.16 | 10.167 | 2.782 | 31.883 | 15.007 | 33249.727 | 34639.218 | 0.000 | 0.518 | 0.000 | 3.457 | 0.000 | 20897.491 | |
| Instance052.17 | 10.029 | 3.008 | 31.796 | 14.983 | 33240.691 | 34674.699 | 0.000 | 0.401 | 0.000 | 3.509 | 0.000 | 20758.448 | |
| Instance052.18 | 10.148 | 3.002 | 31.985 | 15.106 | 33264.381 | 34641.809 | 0.000 | 0.420 | 0.000 | 3.481 | 0.000 | 20923.464 | |
| Instance052.19 | 9.501 | 3.333 | 31.745 | 14.876 | 33250.520 | 34679.301 | 0.000 | 0.435 | 0.000 | 3.456 | 0.000 | 20966.329 | |
| Instance052.20 | 10.112 | 3.239 | 32.035 | 15.217 | 33312.363 | 34650.978 | 0.000 | 0.522 | 0.000 | 3.505 | 0.000 | 20737.582 | |

| Background Database Maintenance I/O Performance | | |
|---|-----------------------------------|---|
| MSExchange Database => Instance | Database Maintenance IO Reads/sec | Database Maintenance IO Reads Average Bytes |
| Instance052.1 | 8.021 | 261750.076 |
| Instance052.2 | 8.031 | 261750.297 |
| Instance052.3 | 8.001 | 261661.544 |
| Instance052.4 | 8.795 | 261662.677 |
| Instance052.5 | 9.796 | 261715.946 |
| Instance052.6 | 8.808 | 261699.829 |
| Instance052.7 | 8.049 | 261957.002 |
| Instance052.8 | 8.048 | 261937.781 |
| Instance052.9 | 8.851 | 261803.903 |
| Instance052.10 | 8.859 | 261837.683 |
| Instance052.11 | 9.011 | 261878.812 |
| Instance052.12 | 8.931 | 261876.272 |
| Instance052.13 | 8.756 | 261741.047 |
| Instance052.14 | 8.812 | 261761.063 |
| Instance052.15 | 9.012 | 261857.113 |
| Instance052.16 | 8.936 | 261723.882 |
| Instance052.17 | 9.003 | 261799.080 |
| Instance052.18 | 8.930 | 261765.172 |
| Instance052.19 | 9.214 | 261756.727 |
| Instance052.20 | 8.937 | 261784.720 |

| Log Replication I/O Performance | | |
|---------------------------------|-------------------|-----------------------------|
| MSExchange Database => Instance | I/O Log Reads/sec | I/O Log Reads Average Bytes |
| Instance052.1 | 0.618 | 120993.843 |
| Instance052.2 | 0.601 | 117256.029 |
| Instance052.3 | 0.608 | 118740.603 |
| Instance052.4 | 0.628 | 123243.922 |
| Instance052.5 | 0.608 | 118723.743 |
| Instance052.6 | 0.616 | 120189.490 |
| Instance052.7 | 0.608 | 119027.542 |
| Instance052.8 | 0.618 | 121134.225 |
| Instance052.9 | 0.611 | 119212.340 |
| Instance052.10 | 0.603 | 117746.614 |
| Instance052.11 | 0.611 | 120826.596 |
| Instance052.12 | 0.613 | 120006.693 |
| Instance052.13 | 0.613 | 119700.915 |
| Instance052.14 | 0.616 | 120189.490 |
| Instance052.15 | 0.621 | 121166.641 |
| Instance052.16 | 0.608 | 118723.765 |
| Instance052.17 | 0.616 | 120189.490 |
| Instance052.18 | 0.613 | 119700.915 |
| Instance052.19 | 0.611 | 119212.340 |
| Instance052.20 | 0.616 | 120189.490 |

| Total I/O Performance | | | | | | | | | | | | | |
|---------------------------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|--|
| MSExchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes | |
| Instance052.1 | 15.291 | 0.978 | 40.594 | 15.002 | 82892.554 | 24694.956 | 2.120 | 0.871 | 0.618 | 3.482 | 120993.843 | 20964.786 | |
| Instance052.2 | 15.226 | 0.956 | 40.609 | 14.828 | 82925.119 | 24633.350 | 1.896 | 0.856 | 0.601 | 3.438 | 117256.029 | 20648.903 | |
| Instance052.3 | 16.401 | 1.197 | 40.716 | 15.082 | 82825.792 | 24672.829 | 2.306 | 0.889 | 0.608 | 3.513 | 118740.603 | 20419.293 | |
| Instance052.4 | 16.400 | 1.193 | 40.512 | 15.200 | 82834.117 | 24684.240 | 2.466 | 0.894 | 0.628 | 3.521 | 123243.922 | 21076.510 | |
| Instance052.5 | 16.113 | 1.476 | 40.928 | 15.256 | 82329.220 | 24637.414 | 2.089 | 0.374 | 0.608 | 3.501 | 118723.765 | 20547.209 | |
| Instance052.6 | 16.141 | 1.461 | 40.962 | 15.404 | 82330.824 | 24646.538 | 2.393 | 0.397 | 0.616 | 3.551 | 120189.490 | 20482.482 | |
| Instance052.7 | 14.347 | 1.625 | 40.881 | 15.172 | 82712.462 | 24631.990 | 2.056 | 0.331 | 0.608 | 3.497 | 119027.542 | 20479.499 | |
| Instance052.8 | 14.410 | 1.675 | 40.882 | 15.136 | 82762.309 | 24668.141 | 2.275 | 0.399 | 0.618 | 3.543 | 121134.225 | 20573.935 | |
| Instance052.9 | 14.315 | 1.922 | 40.550 | 14.910 | 83159.339 | 24690.859 | 2.174 | 0.492 | 0.611 | 3.437 | 119212.340 | 21039.962 | |
| Instance052.10 | 14.354 | 1.932 | 40.986 | 15.068 | 83027.276 | 24623.846 | 2.037 | 0.392 | 0.602 | 3.440 | 117746.614 | 20754.574 | |
| Instance052.11 | 9.816 | 2.328 | 40.958 | 15.079 | 83028.157 | 24622.324 | 1.591 | 0.537 | 0.611 | 3.461 | 120826.596 | 20778.826 | |
| Instance052.12 | 10.125 | 2.314 | 40.797 | 14.933 | 83311.407 | 24668.362 | 1.690 | 0.506 | 0.613 | 3.469 | 120006.693 | 20891.338 | |
| Instance052.13 | 13.352 | 2.590 | 40.750 | 15.140 | 82340.370 | 24643.723 | 2.127 | 0.471 | 0.613 | 3.557 | 119700.915 | 20382.077 | |
| Instance052.14 | 13.107 | 2.559 | 40.782 | 15.139 | 82999.867 | 24645.780 | 2.313 | 0.713 | 0.616 | 3.507 | 120189.490 | 20674.961 | |
| Instance052.15 | 9.835 | 2.716 | 40.883 | 15.059 | 83429.713 | 24663.210 | 1.561 | 0.526 | 0.621 | 3.495 | 121166.641 | 20959.338 | |
| Instance052.16 | 10.167 | 2.782 | 40.818 | 15.007 | 83265.164 | 24639.218 | 1.693 | 0.518 | 0.608 | 3.457 | 118723.765 | 20897.491 | |
| Instance052.17 | 10.029 | 3.008 | 40.799 | 14.983 | 83078.179 | 24674.699 | 1.611 | 0.401 | 0.616 | 3.509 | 120189.490 | 20758.448 | |
| Instance052.18 | 10.148 | 3.002 | 40.921 | 15.106 | 83159.266 | 24641.809 | 1.453 | 0.420 | 0.613 | 3.481 | 119700.915 | 20923.464 | |
| Instance052.19 | 9.501 | 3.333 | 40.798 | 14.876 | 83784.300 | 24679.301 | 1.658 | 0.435 | 0.611 | 3.456 | 119212.340 | 20966.329 | |
| Instance052.20 | 10.112 | 3.239 | 40.932 | 15.217 | 83147.720 | 24650.978 | 1.351 | 0.522 | 0.616 | 3.505 | 120189.490 | 20737.582 | |

| Host System Performance | | | |
|---------------------------------|---------------|---------------|---------------|
| Counter | Average | Minimum | Maximum |
| % Processor Time | 4.4928 | 0.359 | 1.249 |
| Available MBytes | 122976.394 | 122947.000 | 123389.000 |
| Free System Page Table Entries | 16376524.597 | 16376056.000 | 16376026.000 |
| Transition Pages Reassigned/sec | 0.000 | 0.000 | 0.000 |
| Pool Nonpaged Bytes | 108293706.043 | 108289128.000 | 108466176.000 |
| Pool Paged Bytes | 133002087.044 | 132788312.000 | 133133056.000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

B Stress Test Result Report

B.1 Server 1

Microsoft Exchange Jetstress 2013

Stress Test Result Report

Test Summary

| | |
|------------------------------|---|
| Overall Test Result | Pass |
| Machine Name | HOST-1 |
| Test Description | 5GB Mailboxes Up to 4000 Mailboxes 150 Messages per user perday |
| Test Start Time | 3/13/2014 4:35:08 PM |
| Test End Time | 3/17/2014 8:54:35 AM |
| Collection Start Time | 3/13/2014 4:43:58 PM |
| Collection End Time | 3/14/2014 4:43:58 PM |
| Jetstress Version | 15.00.0775.000 |
| ESE Version | 15.00.0847.030 |
| Operating System | Windows Server 2012 R2 Datacenter (6.2.9200.0) |
| Performance Log | C:\Program Files\Exchange Jetstress\ESRP\Stress_2014_3_13_16_35_49.blg |

Database Sizing and Throughput

| | |
|--|----------------|
| Achieved Transactional I/O per Second | 863.918 |
| Target Transactional I/O per Second | 484 |
| Initial Database Size (bytes) | 21083734409216 |
| Final Database Size (bytes) | 21176252366848 |
| Database Files (Count) | 20 |

Jetstress System Parameters

| | |
|--|-----------|
| Thread Count | 20 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |
| Run Background Database Maintenance | True |
| Number of Copies per Database | 3 |

Database Configuration

Instance2904.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance2904.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance2904.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance2904.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance2904.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance2904.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance2904.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance2904.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance2904.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance2904.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance2904.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance2904.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance2904.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance2904.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance2904.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance2904.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance2904.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance2904.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance2904.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance2904.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb

| Transactional I/O Performance | | | | | | | | | | | | | |
|----------------------------------|---|---|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|--------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|--|
| MSExchange Database => Instances | | | | | | | | | | | | | |
| Instance | I/O Database Reads Average Latency (msec) | I/O Database Reads Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Reads Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes | |
| Instance2904.1 | 19.271 | 1.029 | 29.295 | 13.864 | 33278.304 | 34514.926 | 0.000 | 0.861 | 0.000 | 3.168 | 0.000 | 20719.241 | |
| Instance2904.2 | 16.487 | 1.016 | 29.207 | 13.875 | 33298.730 | 34546.540 | 0.000 | 0.918 | 0.000 | 3.193 | 0.000 | 20810.431 | |
| Instance2904.3 | 13.420 | 1.152 | 29.263 | 13.857 | 33299.123 | 34548.364 | 0.000 | 0.620 | 0.000 | 3.182 | 0.000 | 20811.487 | |
| Instance2904.4 | 13.359 | 1.160 | 29.323 | 13.956 | 33299.948 | 34532.208 | 0.000 | 0.645 | 0.000 | 3.198 | 0.000 | 20740.418 | |
| Instance2904.5 | 12.964 | 1.207 | 29.310 | 13.872 | 33228.179 | 34529.637 | 0.000 | 0.575 | 0.000 | 3.192 | 0.000 | 20760.448 | |
| Instance2904.6 | 12.917 | 1.303 | 29.323 | 13.900 | 33218.466 | 34535.243 | 0.000 | 0.577 | 0.000 | 3.202 | 0.000 | 20710.154 | |
| Instance2904.7 | 13.556 | 1.498 | 29.295 | 13.926 | 33216.151 | 34539.520 | 0.000 | 0.409 | 0.000 | 3.211 | 0.000 | 20714.208 | |
| Instance2904.8 | 13.460 | 1.487 | 29.330 | 13.999 | 33294.038 | 34529.924 | 0.000 | 0.287 | 0.000 | 3.205 | 0.000 | 20750.487 | |
| Instance2904.9 | 13.550 | 1.725 | 29.317 | 13.904 | 33301.021 | 34523.333 | 0.000 | 0.474 | 0.000 | 3.189 | 0.000 | 20817.617 | |
| Instance2904.10 | 13.582 | 1.712 | 29.337 | 13.909 | 33301.555 | 34520.782 | 0.000 | 0.474 | 0.000 | 3.201 | 0.000 | 20703.113 | |
| Instance2904.11 | 13.631 | 2.054 | 29.320 | 13.904 | 33293.152 | 34531.015 | 0.000 | 0.479 | 0.000 | 3.184 | 0.000 | 20714.874 | |
| Instance2904.12 | 13.617 | 2.088 | 29.284 | 13.916 | 33294.188 | 34530.990 | 0.000 | 0.497 | 0.000 | 3.202 | 0.000 | 20889.299 | |
| Instance2904.13 | 13.434 | 2.267 | 29.237 | 13.866 | 33318.794 | 34542.634 | 0.000 | 0.530 | 0.000 | 3.185 | 0.000 | 20845.369 | |
| Instance2904.14 | 13.362 | 2.278 | 29.299 | 13.937 | 33315.982 | 34539.560 | 0.000 | 0.501 | 0.000 | 3.205 | 0.000 | 20748.250 | |
| Instance2904.15 | 13.372 | 2.485 | 29.262 | 13.870 | 33320.133 | 34541.595 | 0.000 | 0.497 | 0.000 | 3.187 | 0.000 | 20886.299 | |
| Instance2904.16 | 13.296 | 2.480 | 29.281 | 13.909 | 33303.239 | 34543.042 | 0.000 | 0.527 | 0.000 | 3.194 | 0.000 | 20845.369 | |
| Instance2904.17 | 13.228 | 2.689 | 29.305 | 13.906 | 33313.101 | 34543.742 | 0.000 | 0.540 | 0.000 | 3.192 | 0.000 | 20732.102 | |
| Instance2904.18 | 13.154 | 2.706 | 29.289 | 13.885 | 33313.541 | 34538.378 | 0.000 | 0.534 | 0.000 | 3.182 | 0.000 | 20863.957 | |
| Instance2904.19 | 13.334 | 2.898 | 29.268 | 13.891 | 33303.778 | 34544.239 | 0.000 | 0.504 | 0.000 | 3.187 | 0.000 | 20846.510 | |
| Instance2904.20 | 13.268 | 2.895 | 29.215 | 13.896 | 33309.698 | 34551.849 | 0.000 | 0.524 | 0.000 | 3.185 | 0.000 | 20927.388 | |

| Background Database Maintenance I/O Performance | | | | | | | | | | | | | |
|--|--------------|------------------------|--|--|--|--|--|--|--|--|--|--|--|
| MSExchange Database => Instances Database Maintenance IO Reads/sec Database Maintenance IO Reads Average Bytes | | | | | | | | | | | | | |
| Instance | IO Reads/sec | IO Reads Average Bytes | | | | | | | | | | | |
| Instance2904.1 | 8.602 | 261602.701 | | | | | | | | | | | |
| Instance2904.2 | 8.855 | 261767.147 | | | | | | | | | | | |
| Instance2904.3 | 8.923 | 261737.221 | | | | | | | | | | | |
| Instance2904.4 | 8.917 | 261720.296 | | | | | | | | | | | |
| Instance2904.5 | 8.935 | 261744.228 | | | | | | | | | | | |
| Instance2904.6 | 8.933 | 261740.034 | | | | | | | | | | | |
| Instance2904.7 | 8.921 | 261720.374 | | | | | | | | | | | |
| Instance2904.8 | 8.920 | 261720.708 | | | | | | | | | | | |
| Instance2904.9 | 8.923 | 261724.917 | | | | | | | | | | | |
| Instance2904.10 | 8.916 | 261721.127 | | | | | | | | | | | |
| Instance2904.11 | 8.920 | 261718.712 | | | | | | | | | | | |
| Instance2904.12 | 8.917 | 261734.762 | | | | | | | | | | | |
| Instance2904.13 | 8.929 | 261736.782 | | | | | | | | | | | |
| Instance2904.14 | 8.924 | 261730.927 | | | | | | | | | | | |
| Instance2904.15 | 8.920 | 261718.461 | | | | | | | | | | | |
| Instance2904.16 | 8.923 | 261744.197 | | | | | | | | | | | |
| Instance2904.17 | 8.933 | 261713.703 | | | | | | | | | | | |
| Instance2904.18 | 8.930 | 261707.154 | | | | | | | | | | | |
| Instance2904.19 | 8.930 | 261721.056 | | | | | | | | | | | |
| Instance2904.20 | 8.930 | 261724.440 | | | | | | | | | | | |

| Log Replication I/O Performance | | | | | | | | | | | | | |
|----------------------------------|-------------------|-----------------------------|--|--|--|--|--|--|--|--|--|--|--|
| MSExchange Database => Instances | | | | | | | | | | | | | |
| Instance | I/O Log Reads/sec | I/O Log Reads Average Bytes | | | | | | | | | | | |
| Instance2904.1 | 0.554 | 10841.169 | | | | | | | | | | | |
| Instance2904.2 | 0.542 | 10899.028 | | | | | | | | | | | |
| Instance2904.3 | 0.559 | 109404.269 | | | | | | | | | | | |
| Instance2904.4 | 0.561 | 109819.928 | | | | | | | | | | | |
| Instance2904.5 | 0.558 | 109013.343 | | | | | | | | | | | |
| Instance2904.6 | 0.561 | 109910.530 | | | | | | | | | | | |
| Instance2904.7 | 0.563 | 109992.891 | | | | | | | | | | | |
| Instance2904.8 | 0.562 | 109886.021 | | | | | | | | | | | |
| Instance2904.9 | 0.560 | 109591.614 | | | | | | | | | | | |
| Instance2904.10 | 0.560 | 109381.428 | | | | | | | | | | | |
| Instance2904.11 | 0.557 | 109103.605 | | | | | | | | | | | |
| Instance2904.12 | 0.564 | 109289.808 | | | | | | | | | | | |
| Instance2904.13 | 0.562 | 109898.517 | | | | | | | | | | | |
| Instance2904.14 | 0.562 | 109961.346 | | | | | | | | | | | |
| Instance2904.15 | 0.562 | 110050.517 | | | | | | | | | | | |
| Instance2904.16 | 0.562 | 109877.595 | | | | | | | | | | | |
| Instance2904.17 | 0.560 | 109423.269 | | | | | | | | | | | |
| Instance2904.18 | 0.561 | 109848.087 | | | | | | | | | | | |
| Instance2904.19 | 0.562 | 109661.468 | | | | | | | | | | | |
| Instance2904.20 | 0.563 | 110018.208 | | | | | | | | | | | |

| Total I/O Performance | | | | | | | | | | | | | |
|----------------------------------|---|---|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|--------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|--|
| MSExchange Database => Instances | | | | | | | | | | | | | |
| Instance | I/O Database Reads Average Latency (msec) | I/O Database Reads Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Reads Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes | |
| Instance2904.1 | 19.271 | 1.029 | 37.897 | 13.864 | 85124.184 | 34514.926 | 2.221 | 0.861 | 0.554 | 3.168 | 10841.169 | 20719.241 | |
| Instance2904.2 | 16.487 | 1.016 | 38.061 | 13.875 | 86498.297 | 34546.540 | 2.204 | 0.918 | 0.562 | 3.193 | 10989.028 | 20810.431 | |
| Instance2904.3 | 13.420 | 1.152 | 38.187 | 13.857 | 86479.679 | 34548.364 | 2.072 | 0.620 | 0.559 | 3.182 | 109404.269 | 20811.487 | |
| Instance2904.4 | 13.359 | 1.160 | 38.240 | 13.906 | 86585.154 | 34532.208 | 2.117 | 0.645 | 0.561 | 3.198 | 109810.938 | 20740.418 | |
| Instance2904.5 | 12.964 | 1.207 | 38.249 | 13.872 | 86599.644 | 34529.637 | 1.882 | 0.575 | 0.558 | 3.182 | 109013.343 | 20760.448 | |
| Instance2904.6 | 12.917 | 1.303 | 38.236 | 13.900 | 86498.189 | 34535.243 | 1.880 | 0.577 | 0.561 | 3.202 | 109910.530 | 20710.154 | |
| Instance2904.7 | 13.556 | 1.498 | 38.216 | 13.936 | 86534.348 | 34539.520 | 1.882 | 0.409 | 0.563 | 3.211 | 109992.891 | 20714.208 | |
| Instance2904.8 | 13.460 | 1.487 | 38.290 | 13.999 | 86567.386 | 34529.924 | 1.970 | 0.287 | 0.562 | 3.205 | 109840.021 | 20750.487 | |
| Instance2904.9 | 13.550 | 1.725 | 38.241 | 13.904 | 86497.588 | 34523.333 | 1.821 | 0.474 | 0.560 | 3.189 | 109699.614 | 20817.617 | |
| Instance2904.10 | 13.582 | 1.712 | 38.232 | 13.939 | 86490.909 | 34520.782 | 1.828 | 0.474 | 0.560 | 3.201 | 109381.428 | 20703.113 | |
| Instance2904.11 | 13.631 | 2.054 | 38.240 | 13.904 | 86582.518 | 34531.015 | 1.987 | 0.479 | 0.557 | 3.184 | 109103.605 | 20714.874 | |
| Instance2904.12 | 13.617 | 2.088 | 38.201 | 13.946 | 86540.053 | 34540.990 | 2.000 | 0.497 | 0.564 | 3.202 | 110045.808 | 20889.299 | |
| Instance2904.13 | 13.434 | 2.267 | 38.166 | 13.866 | 86740.556 | 34542.634 | 1.858 | 0.530 | 0.562 | 3.185 | 110045.808 | 20845.369 | |
| Instance2904.14 | 13.362 | 2.278 | 38.222 | 13.937 | 86547.891 | 34539.560 | 1.899 | 0.501 | 0.562 | 3.205 | 109941.346 | 20748.250 | |
| Instance2904.15 | 13.372 | 2.485 | 38.190 | 13.870 | 86712.464 | 34541.595 | 1.978 | 0.497 | 0.562 | 3.187 | 110052.517 | 20886.299 | |
| Instance2904.16 | 13.296 | 2.480 | 38.204 | 13.909 | 86497.078 | 34543.042 | 1.948 | 0.527 | 0.562 | 3.194 | 109877.595 | 20845.369 | |
| Instance2904.17 | 13.228 | 2.689 | 38.239 | 13.906 | 86673.143 | 34543.742 | 1.793 | 0.540 | 0.562 | 3.192 | 109423.269 | 20732.102 | |
| Instance2904.18 | 13.154 | 2.706 | 38.218 | 13.885 | 86678.520 | 34538.378 | 1.785 | 0.534 | 0.561 | 3.182 | 109848.087 | 20863.957 | |
| Instance2904.19 | 13.334 | 2.898 | 38.198 | 13.891 | 86705.353 | 34544.239 | 1.922 | 0.504 | 0.562 | 3.187 | 109661.468 | 20846.510 | |
| Instance2904.20 | 13.268 | 2.895 | 38.143 | 13.896 | 86711.900 | 34551.849 | 1.960 | 0.524 | 0.563 | 3.185 | 110018.208 | 20927.388 | |

| Host System Performance | | | |
|---------------------------------|---------------|---------------|---------------|
| Counter | Average | Minimum | Maximum |
| % Processor Time | 0.447 | 0.197 | 0.977 |
| Available MBytes | 119178.402 | 119131.000 | 119543.000 |
| Free System Page Table Entries | 16330422.890 | 16329915.000 | 16331093.000 |
| Transaction Pages Retrieved/sec | 0.000 | 0.000 | 0.000 |
| Pool Nonpaged Bytes | 120186162.233 | 119894016.000 | 120504320.000 |
| Pool Paged Bytes | 114082035.554 | 112975872.000 | 119758846.000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

B.2 Server 2

Microsoft Exchange Jetstress 2013

Stress Test Result Report

Test Summary

| | |
|------------------------------|---|
| Overall Test Result | Pass |
| Machine Name | HOST-2 |
| Test Description | 5GB Mailboxes Up to 4000 Mailboxes 150 Messages per user per day |
| Test Start Time | 3/13/2014 4:35:11 PM |
| Test End Time | 3/17/2014 8:54:46 AM |
| Collection Start Time | 3/13/2014 4:43:47 PM |
| Collection End Time | 3/14/2014 4:43:46 PM |
| Jetstress Version | 15.00.0775.000 |
| ESE Version | 15.00.0847.030 |
| Operating System | Windows Server 2012 R2 Datacenter (6.2.9200.0) |
| Performance Log | C:\Program Files\Exchange Jetstress\ESRP\Stress_2014_3_13_16_35_53.blg |

Database Sizing and Throughput

| | |
|--|----------------|
| Achieved Transactional I/O per Second | 869.082 |
| Target Transactional I/O per Second | 484 |
| Initial Database Size (bytes) | 21074716655616 |
| Final Database Size (bytes) | 21167972810752 |
| Database Files (Count) | 20 |

Jetstress System Parameters

| | |
|--|-----------|
| Thread Count | 20 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |
| Run Background Database Maintenance | True |
| Number of Copies per Database | 3 |

Database Configuration

Instance5068.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance5068.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance5068.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance5068.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance5068.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance5068.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance5068.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance5068.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance5068.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance5068.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance5068.11 Log path: K:\LOG1
Database: K:\DB1\Jetstress011001.edb

Instance5068.12 Log path: K:\LOG2
Database: K:\DB2\Jetstress012001.edb

Instance5068.13 Log path: L:\LOG1
Database: L:\DB1\Jetstress013001.edb

Instance5068.14 Log path: L:\LOG2
Database: L:\DB2\Jetstress014001.edb

Instance5068.15 Log path: M:\LOG1
Database: M:\DB1\Jetstress015001.edb

Instance5068.16 Log path: M:\LOG2
Database: M:\DB2\Jetstress016001.edb

Instance5068.17 Log path: N:\LOG1
Database: N:\DB1\Jetstress017001.edb

Instance5068.18 Log path: N:\LOG2
Database: N:\DB2\Jetstress018001.edb

Instance5068.19 Log path: O:\LOG1
Database: O:\DB1\Jetstress019001.edb

Instance5068.20 Log path: O:\LOG2
Database: O:\DB2\Jetstress020001.edb

Transactional I/O Performance

| Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
|----------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| Instance006.1 | 14.241 | 1.017 | 29.397 | 13.941 | 32299.123 | 34582.440 | 0.000 | 0.030 | 0.000 | 3.217 | 0.000 | 20810.060 |
| Instance006.2 | 14.766 | 0.999 | 29.407 | 14.021 | 32299.975 | 34569.850 | 0.000 | 0.779 | 0.000 | 3.223 | 0.000 | 20734.837 |
| Instance006.3 | 13.773 | 1.146 | 29.434 | 13.988 | 32300.229 | 34572.707 | 0.000 | 0.487 | 0.000 | 3.208 | 0.000 | 20832.212 |
| Instance006.4 | 13.770 | 1.144 | 29.488 | 14.030 | 32308.910 | 34561.865 | 0.000 | 0.712 | 0.000 | 3.216 | 0.000 | 20708.848 |
| Instance006.5 | 14.259 | 1.312 | 29.425 | 14.003 | 32317.123 | 34574.147 | 0.000 | 0.692 | 0.000 | 3.218 | 0.000 | 20743.948 |
| Instance006.6 | 14.191 | 1.315 | 29.464 | 14.002 | 32296.073 | 34568.112 | 0.000 | 0.677 | 0.000 | 3.209 | 0.000 | 20691.539 |
| Instance006.7 | 13.075 | 1.490 | 29.428 | 13.973 | 32303.963 | 34571.903 | 0.000 | 0.414 | 0.000 | 3.220 | 0.000 | 20723.476 |
| Instance006.8 | 13.042 | 1.491 | 29.402 | 13.950 | 32305.214 | 34568.209 | 0.000 | 0.430 | 0.000 | 3.209 | 0.000 | 20761.465 |
| Instance006.9 | 13.743 | 1.704 | 29.420 | 14.014 | 32315.660 | 34576.781 | 0.000 | 0.445 | 0.000 | 3.209 | 0.000 | 20821.796 |
| Instance006.10 | 13.892 | 1.696 | 29.429 | 14.024 | 32296.180 | 34569.558 | 0.000 | 0.432 | 0.000 | 3.225 | 0.000 | 20797.570 |
| Instance006.11 | 13.502 | 2.032 | 29.465 | 14.021 | 32305.362 | 34576.988 | 0.000 | 0.471 | 0.000 | 3.221 | 0.000 | 20785.574 |
| Instance006.12 | 13.509 | 2.033 | 29.495 | 14.046 | 32306.327 | 34555.468 | 0.000 | 0.494 | 0.000 | 3.223 | 0.000 | 20726.991 |
| Instance006.13 | 13.430 | 2.276 | 29.402 | 13.979 | 32296.652 | 34574.352 | 0.000 | 0.549 | 0.000 | 3.220 | 0.000 | 20761.215 |
| Instance006.14 | 13.342 | 2.289 | 29.512 | 14.053 | 32305.057 | 34564.328 | 0.000 | 0.622 | 0.000 | 3.217 | 0.000 | 20676.573 |
| Instance006.15 | 14.053 | 2.496 | 29.441 | 14.025 | 32309.301 | 34572.498 | 0.000 | 0.502 | 0.000 | 3.222 | 0.000 | 20762.450 |
| Instance006.16 | 13.801 | 2.479 | 29.445 | 14.023 | 32322.281 | 34579.233 | 0.000 | 0.518 | 0.000 | 3.221 | 0.000 | 20797.993 |
| Instance006.17 | 13.250 | 2.721 | 29.464 | 14.024 | 32287.828 | 34573.225 | 0.000 | 0.527 | 0.000 | 3.227 | 0.000 | 20669.375 |
| Instance006.18 | 13.264 | 2.716 | 29.475 | 14.018 | 32300.274 | 34572.841 | 0.000 | 0.622 | 0.000 | 3.219 | 0.000 | 20766.150 |
| Instance006.19 | 13.477 | 2.951 | 29.491 | 14.048 | 32314.159 | 34593.100 | 0.000 | 0.495 | 0.000 | 3.221 | 0.000 | 20685.274 |
| Instance006.20 | 13.430 | 2.943 | 29.427 | 13.917 | 32324.367 | 34588.496 | 0.000 | 0.519 | 0.000 | 3.204 | 0.000 | 20653.452 |

Background Database Maintenance I/O Performance

| Instance | Database Maintenance IO Reads/sec | Database Maintenance IO Reads Average Bytes |
|----------------|-----------------------------------|---|
| Instance006.1 | 8.889 | 261730.499 |
| Instance006.2 | 8.877 | 261734.325 |
| Instance006.3 | 8.925 | 261687.263 |
| Instance006.4 | 8.906 | 261708.610 |
| Instance006.5 | 8.904 | 261726.975 |
| Instance006.6 | 8.897 | 261739.149 |
| Instance006.7 | 8.927 | 261732.747 |
| Instance006.8 | 8.933 | 261723.278 |
| Instance006.9 | 8.916 | 261748.735 |
| Instance006.10 | 8.907 | 261736.069 |
| Instance006.11 | 8.922 | 261704.328 |
| Instance006.12 | 8.936 | 261737.183 |
| Instance006.13 | 8.924 | 261709.287 |
| Instance006.14 | 8.923 | 261740.545 |
| Instance006.15 | 8.911 | 261742.380 |
| Instance006.16 | 8.907 | 261732.078 |
| Instance006.17 | 8.927 | 261745.878 |
| Instance006.18 | 8.926 | 261717.877 |
| Instance006.19 | 8.923 | 261722.340 |
| Instance006.20 | 8.921 | 261730.897 |

Log Replication I/O Performance

| Instance | I/O Log Reads/sec | I/O Log Reads Average Bytes |
|----------------|-------------------|-----------------------------|
| Instance006.1 | 0.566 | 110554.820 |
| Instance006.2 | 0.565 | 110561.629 |
| Instance006.3 | 0.564 | 110415.834 |
| Instance006.4 | 0.563 | 109998.909 |
| Instance006.5 | 0.564 | 110366.566 |
| Instance006.6 | 0.563 | 109786.431 |
| Instance006.7 | 0.564 | 110374.751 |
| Instance006.8 | 0.563 | 110366.386 |
| Instance006.9 | 0.565 | 110591.662 |
| Instance006.10 | 0.566 | 110694.127 |
| Instance006.11 | 0.563 | 110247.693 |
| Instance006.12 | 0.565 | 110617.610 |
| Instance006.13 | 0.565 | 110604.534 |
| Instance006.14 | 0.562 | 110087.033 |
| Instance006.15 | 0.565 | 110673.459 |
| Instance006.16 | 0.566 | 110887.224 |
| Instance006.17 | 0.564 | 110265.526 |
| Instance006.18 | 0.564 | 110399.486 |
| Instance006.19 | 0.564 | 110202.542 |
| Instance006.20 | 0.560 | 109592.510 |

Total I/O Performance

| Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
|----------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| Instance006.1 | 14.241 | 1.017 | 38.286 | 13.941 | 96340.965 | 34582.440 | 1.750 | 0.030 | 0.566 | 3.217 | 110554.850 | 20810.060 |
| Instance006.2 | 14.766 | 0.999 | 38.284 | 14.021 | 86261.352 | 34569.850 | 1.756 | 0.779 | 0.565 | 3.223 | 110561.629 | 20734.837 |
| Instance006.3 | 13.777 | 1.146 | 38.360 | 13.988 | 86441.777 | 34572.707 | 2.074 | 0.487 | 0.564 | 3.208 | 110415.834 | 20832.212 |
| Instance006.4 | 13.770 | 1.144 | 38.394 | 14.030 | 86288.006 | 34561.865 | 2.063 | 0.712 | 0.563 | 3.216 | 109998.909 | 20708.848 |
| Instance006.5 | 14.259 | 1.312 | 38.329 | 14.003 | 86377.483 | 34574.147 | 2.100 | 0.692 | 0.564 | 3.218 | 110366.566 | 20743.948 |
| Instance006.6 | 14.191 | 1.315 | 38.381 | 14.002 | 86251.548 | 34568.112 | 2.108 | 0.677 | 0.563 | 3.209 | 109786.431 | 20691.539 |
| Instance006.7 | 13.075 | 1.490 | 38.355 | 13.973 | 86472.019 | 34571.903 | 1.908 | 0.414 | 0.564 | 3.220 | 110374.751 | 20723.476 |
| Instance006.8 | 13.042 | 1.491 | 38.333 | 13.950 | 86333.477 | 34568.209 | 1.844 | 0.430 | 0.563 | 3.209 | 110366.386 | 20761.465 |
| Instance006.9 | 13.743 | 1.704 | 38.429 | 14.014 | 86423.269 | 34576.781 | 1.848 | 0.445 | 0.565 | 3.209 | 110591.662 | 20831.796 |
| Instance006.10 | 13.892 | 1.696 | 38.347 | 14.024 | 86396.364 | 34580.558 | 1.830 | 0.432 | 0.566 | 3.225 | 110694.127 | 20797.570 |
| Instance006.11 | 13.502 | 2.032 | 38.457 | 14.021 | 86364.954 | 34576.988 | 1.937 | 0.471 | 0.563 | 3.221 | 110247.693 | 20785.574 |
| Instance006.12 | 13.509 | 2.033 | 38.411 | 14.046 | 86324.164 | 34555.468 | 1.956 | 0.494 | 0.563 | 3.223 | 110517.610 | 20726.991 |
| Instance006.13 | 13.430 | 2.276 | 38.326 | 13.979 | 86483.600 | 34574.352 | 1.864 | 0.549 | 0.563 | 3.220 | 110604.534 | 20761.215 |
| Instance006.14 | 13.342 | 2.289 | 38.436 | 14.053 | 86337.628 | 34564.328 | 1.882 | 0.622 | 0.562 | 3.217 | 110087.033 | 20676.573 |
| Instance006.15 | 14.053 | 2.496 | 38.353 | 14.025 | 86386.332 | 34572.498 | 2.031 | 0.502 | 0.563 | 3.222 | 110673.459 | 20762.450 |
| Instance006.16 | 13.801 | 2.479 | 38.352 | 14.023 | 86375.713 | 34579.233 | 2.064 | 0.518 | 0.566 | 3.221 | 110887.224 | 20797.993 |
| Instance006.17 | 13.250 | 2.721 | 38.391 | 14.024 | 86411.647 | 34573.225 | 1.989 | 0.527 | 0.564 | 3.227 | 110265.526 | 20669.375 |
| Instance006.18 | 13.264 | 2.716 | 38.402 | 14.018 | 86395.132 | 34572.841 | 1.942 | 0.622 | 0.564 | 3.219 | 110399.486 | 20766.150 |
| Instance006.19 | 13.477 | 2.951 | 38.414 | 14.048 | 86367.062 | 34593.100 | 2.027 | 0.495 | 0.564 | 3.221 | 110202.542 | 20685.274 |
| Instance006.20 | 13.430 | 2.943 | 38.348 | 13.917 | 86436.509 | 34568.496 | 2.035 | 0.519 | 0.560 | 3.204 | 109592.510 | 20653.452 |

Host System Performance

| Counter | Average | Minimum | Maximum |
|---------------------------------|---------------|---------------|---------------|
| % Processor Time | 0.405 | 0.219 | 0.947 |
| Available Mbytes | 123109.458 | 122962.000 | 123493.000 |
| Free System Page Table Entries | 16531189.460 | 16520512.000 | 16531703.000 |
| Transition Pages RePurposed/sec | 0.000 | 0.000 | 0.000 |
| Pool Nonpaged Bytes | 121600028.080 | 121203040.000 | 122271088.000 |
| Pool Paged Bytes | 113852209.696 | 114268720.000 | 114054936.000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

B.3 Server 3

Microsoft Exchange Jetstress 2013

Stress Test Result Report

| Test Summary | |
|---------------------------------------|---|
| Overall Test Result | Pass |
| Machine Name | HOST-3 |
| Test Description | 5GB Mailboxes Up to 4000 Mailboxes 150 Messages per user per day |
| Test Start Time | 3/13/2014 4:34:52 PM |
| Test End Time | 3/17/2014 8:54:19 AM |
| Collection Start Time | 3/13/2014 4:42:48 PM |
| Collection End Time | 3/14/2014 4:42:41 PM |
| Jetstress Version | 15.00.0775.000 |
| ESE Version | 15.00.0847.030 |
| Operating System | Windows Server 2012 R2 Datacenter (6.2.9200.0) |
| Performance Log | C:\Program Files\Exchange Jetstress\ESRP\Stress_2014_3_13_16_35_33.blg |
| Database Sizing and Throughput | |
| Achieved Transactional I/O per Second | 938.219 |
| Target Transactional I/O per Second | 484 |
| Initial Database Size (bytes) | 21070639792128 |
| Final Database Size (bytes) | 21171026264064 |
| Database Files (Count) | 20 |
| Jetstress System Parameters | |
| Thread Count | 20 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |
| Run Background Database Maintenance | True |
| Number of Copies per Database | 3 |

Database Configuration

Instance952.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance952.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance952.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance952.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance952.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance952.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance952.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance952.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance952.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance952.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance952.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance952.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance952.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance952.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance952.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance952.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance952.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance952.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance952.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance952.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb

| Transactional I/O Performance | | | | | | | | | | | | |
|---------------------------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| MSExchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
| Instance092.1 | 15.675 | 0.957 | 31.784 | 15.181 | 32227.857 | 24555.212 | 0.000 | 0.054 | 0.000 | 2.478 | 0.000 | 20592.047 |
| Instance092.2 | 15.572 | 0.946 | 31.755 | 15.142 | 32252.266 | 24556.204 | 0.000 | 0.795 | 0.000 | 2.469 | 0.000 | 20678.944 |
| Instance092.3 | 16.498 | 1.203 | 31.710 | 15.116 | 32218.080 | 34572.839 | 0.000 | 0.994 | 0.000 | 2.472 | 0.000 | 20629.552 |
| Instance092.4 | 16.450 | 1.183 | 31.699 | 15.084 | 33226.979 | 34573.039 | 0.000 | 1.003 | 0.000 | 2.467 | 0.000 | 20736.008 |
| Instance092.5 | 16.240 | 1.422 | 31.836 | 15.287 | 33244.773 | 34574.323 | 0.000 | 0.783 | 0.000 | 2.496 | 0.000 | 20337.042 |
| Instance092.6 | 16.205 | 1.440 | 31.792 | 15.164 | 33245.611 | 34566.145 | 0.000 | 0.752 | 0.000 | 2.485 | 0.000 | 20663.161 |
| Instance092.7 | 14.221 | 1.651 | 31.721 | 15.139 | 33230.537 | 34577.997 | 0.000 | 0.403 | 0.000 | 2.481 | 0.000 | 20737.673 |
| Instance092.8 | 14.266 | 1.668 | 31.745 | 15.094 | 33233.604 | 34574.479 | 0.000 | 0.402 | 0.000 | 2.467 | 0.000 | 20705.870 |
| Instance092.9 | 14.229 | 1.933 | 31.769 | 15.120 | 33234.864 | 34578.626 | 0.000 | 0.414 | 0.000 | 2.487 | 0.000 | 20688.922 |
| Instance092.10 | 14.283 | 1.947 | 31.778 | 15.139 | 33231.841 | 34587.372 | 0.000 | 0.407 | 0.000 | 2.482 | 0.000 | 20661.983 |
| Instance092.11 | 9.835 | 0.365 | 31.825 | 15.189 | 33274.859 | 34557.243 | 0.000 | 0.468 | 0.000 | 2.475 | 0.000 | 20723.634 |
| Instance092.12 | 9.984 | 2.343 | 31.795 | 15.135 | 33262.841 | 34564.645 | 0.000 | 0.501 | 0.000 | 2.471 | 0.000 | 20743.196 |
| Instance092.13 | 13.693 | 2.291 | 31.776 | 15.121 | 33245.171 | 34564.398 | 0.000 | 0.890 | 0.000 | 2.470 | 0.000 | 20678.663 |
| Instance092.14 | 13.418 | 2.602 | 31.820 | 15.170 | 33265.274 | 34562.017 | 0.000 | 0.860 | 0.000 | 2.476 | 0.000 | 20633.592 |
| Instance092.15 | 9.833 | 0.823 | 31.736 | 15.095 | 33290.572 | 34574.597 | 0.000 | 0.482 | 0.000 | 2.472 | 0.000 | 20797.819 |
| Instance092.16 | 9.978 | 2.822 | 31.777 | 15.129 | 33282.241 | 34576.019 | 0.000 | 0.533 | 0.000 | 2.478 | 0.000 | 20778.801 |
| Instance092.17 | 9.474 | 3.072 | 31.729 | 15.108 | 33281.309 | 34574.140 | 0.000 | 0.487 | 0.000 | 2.478 | 0.000 | 20831.106 |
| Instance092.18 | 9.983 | 3.064 | 31.763 | 15.084 | 33268.700 | 34581.741 | 0.000 | 0.483 | 0.000 | 2.466 | 0.000 | 20772.128 |
| Instance092.19 | 9.782 | 3.326 | 31.810 | 15.148 | 33268.075 | 34562.290 | 0.000 | 0.499 | 0.000 | 2.489 | 0.000 | 20647.335 |
| Instance092.20 | 9.873 | 3.326 | 31.786 | 15.097 | 33272.374 | 34573.823 | 0.000 | 0.501 | 0.000 | 2.461 | 0.000 | 20861.148 |

| Background Database Maintenance I/O Performance | | |
|---|-----------------------------------|--|
| MSExchange Database => Instance | Database Maintenance IO Reads/sec | Database Maintenance IO Writes Average Bytes |
| Instance092.1 | 8.807 | 26177.479 |
| Instance092.2 | 8.806 | 261728.364 |
| Instance092.3 | 8.788 | 261729.269 |
| Instance092.4 | 8.816 | 261694.260 |
| Instance092.5 | 8.799 | 261724.252 |
| Instance092.6 | 8.867 | 261728.059 |
| Instance092.7 | 8.858 | 261726.032 |
| Instance092.8 | 8.868 | 261751.292 |
| Instance092.9 | 8.837 | 261704.203 |
| Instance092.10 | 9.013 | 261727.451 |
| Instance092.11 | 8.908 | 261724.469 |
| Instance092.12 | 8.769 | 261744.983 |
| Instance092.13 | 8.825 | 261751.094 |
| Instance092.14 | 9.013 | 261712.438 |
| Instance092.15 | 8.935 | 261737.324 |
| Instance092.16 | 9.014 | 261752.611 |
| Instance092.17 | 8.958 | 261730.849 |
| Instance092.18 | 9.017 | 261756.948 |
| Instance092.19 | 8.963 | 261699.633 |

| Log Replication I/O Performance | | |
|---------------------------------|-------------------|-----------------------------|
| MSExchange Database => Instance | I/O Log Reads/sec | I/O Log Reads Average Bytes |
| Instance092.1 | 0.607 | 118742.831 |
| Instance092.2 | 0.607 | 118673.031 |
| Instance092.3 | 0.607 | 118798.295 |
| Instance092.4 | 0.609 | 119087.550 |
| Instance092.5 | 0.609 | 119001.116 |
| Instance092.6 | 0.607 | 118962.735 |
| Instance092.7 | 0.611 | 119504.957 |
| Instance092.8 | 0.607 | 118780.373 |
| Instance092.9 | 0.609 | 119129.269 |
| Instance092.10 | 0.608 | 118826.393 |
| Instance092.11 | 0.609 | 119082.871 |
| Instance092.12 | 0.610 | 118826.391 |
| Instance092.13 | 0.607 | 118668.512 |
| Instance092.14 | 0.607 | 118815.608 |
| Instance092.15 | 0.611 | 119441.047 |
| Instance092.16 | 0.612 | 119624.801 |
| Instance092.17 | 0.613 | 119443.021 |
| Instance092.18 | 0.609 | 119188.488 |
| Instance092.19 | 0.610 | 119373.033 |
| Instance092.20 | 0.610 | 119280.345 |

| Total I/O Performance | | | | | | | | | | | | |
|---------------------------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|
| MSExchange Database => Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
| Instance092.1 | 18.675 | 0.957 | 40.603 | 15.181 | 82868.998 | 34935.212 | 2.072 | 0.854 | 0.607 | 3.478 | 0.000 | 20892.047 |
| Instance092.2 | 18.373 | 0.946 | 40.562 | 15.143 | 82863.336 | 34936.204 | 2.031 | 0.788 | 0.607 | 3.468 | 0.000 | 20878.944 |
| Instance092.3 | 16.498 | 1.203 | 40.516 | 15.116 | 82863.885 | 34572.839 | 2.404 | 0.994 | 0.607 | 3.472 | 0.000 | 20629.553 |
| Instance092.4 | 16.450 | 1.183 | 40.487 | 15.084 | 82826.317 | 34573.039 | 2.445 | 1.003 | 0.609 | 3.467 | 0.000 | 20736.008 |
| Instance092.5 | 16.240 | 1.422 | 40.671 | 15.287 | 82761.718 | 34564.323 | 2.433 | 0.783 | 0.608 | 3.496 | 0.000 | 20337.042 |
| Instance092.6 | 16.205 | 1.440 | 40.591 | 15.164 | 82775.019 | 34566.145 | 2.344 | 0.752 | 0.607 | 3.485 | 0.000 | 20663.161 |
| Instance092.7 | 14.221 | 1.651 | 40.588 | 15.139 | 83148.076 | 34577.997 | 2.244 | 0.405 | 0.611 | 3.481 | 0.000 | 20737.673 |
| Instance092.8 | 14.266 | 1.668 | 40.603 | 15.094 | 83084.065 | 34574.479 | 2.205 | 0.402 | 0.607 | 3.467 | 0.000 | 20705.870 |
| Instance092.9 | 14.229 | 1.933 | 40.627 | 15.150 | 83103.213 | 34578.626 | 2.119 | 0.414 | 0.609 | 3.497 | 0.000 | 20688.922 |
| Instance092.10 | 14.283 | 1.947 | 40.625 | 15.159 | 83028.522 | 34567.372 | 1.996 | 0.407 | 0.608 | 3.490 | 0.000 | 20661.983 |
| Instance092.11 | 9.835 | 0.365 | 40.846 | 15.189 | 83705.902 | 34557.243 | 1.547 | 0.468 | 0.609 | 3.475 | 0.000 | 20723.634 |
| Instance092.12 | 9.984 | 2.343 | 40.793 | 15.135 | 83481.616 | 34564.645 | 1.602 | 0.501 | 0.610 | 3.471 | 0.000 | 20743.196 |
| Instance092.13 | 13.693 | 2.291 | 40.545 | 15.121 | 82963.483 | 34564.398 | 2.224 | 0.890 | 0.607 | 3.470 | 0.000 | 20678.663 |
| Instance092.14 | 13.418 | 2.602 | 40.645 | 15.170 | 82897.075 | 34562.017 | 2.202 | 0.860 | 0.607 | 3.476 | 0.000 | 20633.592 |
| Instance092.15 | 9.833 | 0.823 | 40.750 | 15.095 | 83823.952 | 34574.597 | 1.619 | 0.482 | 0.611 | 3.472 | 0.000 | 20797.819 |
| Instance092.16 | 9.978 | 2.822 | 40.732 | 15.129 | 83509.019 | 34576.019 | 1.663 | 0.533 | 0.612 | 3.475 | 0.000 | 20778.801 |
| Instance092.17 | 9.474 | 3.072 | 40.743 | 15.108 | 83808.556 | 34574.140 | 1.582 | 0.487 | 0.613 | 3.478 | 0.000 | 20831.106 |
| Instance092.18 | 9.983 | 3.064 | 40.718 | 15.084 | 83511.216 | 34581.741 | 1.993 | 0.483 | 0.609 | 3.466 | 0.000 | 20772.128 |
| Instance092.19 | 9.782 | 3.326 | 40.827 | 15.148 | 83731.056 | 34562.290 | 1.959 | 0.499 | 0.610 | 3.489 | 0.000 | 20647.335 |
| Instance092.20 | 9.873 | 3.326 | 40.749 | 15.097 | 83817.424 | 34573.823 | 1.642 | 0.501 | 0.610 | 3.461 | 0.000 | 20861.148 |

| Host System Performance Counts | | | |
|--------------------------------|---------------|---------------|---------------|
| | Average | Minimum | Maximum |
| % Processor Time | 0.608 | 0.315 | 1.334 |
| Available MBytes | 123004.294 | 122970.000 | 123391.000 |
| Free System Page Table Entries | 16376634.178 | 16375879.000 | 16376984.000 |
| Yamouline Flags Helpword/Sec | 0.000 | 0.000 | 0.000 |
| Pool Nonpaged Bytes | 108557306.627 | 108380160.000 | 109457408.000 |
| Pool Paged Bytes | 152764582.506 | 152436736.000 | 153704192.000 |
| Database Page Fault Stalls/Sec | 0.000 | 0.000 | 0.000 |

C Database Backup Test Result Report

C.1 Server 1

Microsoft Exchange Jetstress 2013

Database backup Test Result Report

| Database Backup Statistics - All | | | |
|----------------------------------|------------------------|---------------------|------------------------|
| Database Instance | Database Size (MBytes) | Elapsed Backup Time | MBytes Transferred/sec |
| Instance2904.1 | 1014984.03 | 01:54:51 | 147.28 |
| Instance2904.2 | 1014984.03 | 02:05:08 | 135.17 |
| Instance2904.3 | 1014968.03 | 01:57:59 | 143.36 |
| Instance2904.4 | 1014976.03 | 01:59:22 | 141.71 |
| Instance2904.5 | 1014984.03 | 02:02:50 | 137.71 |
| Instance2904.6 | 1014968.03 | 02:04:50 | 135.50 |
| Instance2904.7 | 1015032.03 | 01:59:56 | 141.04 |
| Instance2904.8 | 1015016.03 | 02:01:42 | 138.99 |
| Instance2904.9 | 1014976.03 | 01:57:36 | 143.84 |
| Instance2904.10 | 1015000.03 | 01:59:22 | 141.72 |
| Instance2904.11 | 1015000.03 | 01:57:46 | 143.64 |
| Instance2904.12 | 1014984.03 | 02:02:20 | 138.28 |
| Instance2904.13 | 1015000.03 | 01:58:39 | 142.56 |
| Instance2904.14 | 1015016.03 | 02:01:19 | 139.44 |
| Instance2904.15 | 1014992.03 | 01:53:57 | 148.44 |
| Instance2904.16 | 1014960.03 | 01:57:59 | 143.36 |
| Instance2904.17 | 1014976.03 | 01:54:53 | 147.24 |
| Instance2904.18 | 1015008.03 | 01:57:02 | 144.54 |
| Instance2904.19 | 1015008.03 | 02:01:03 | 139.74 |
| Instance2904.20 | 1015008.03 | 02:02:56 | 137.61 |
| Avg | | | 141.56 |
| Sum | | | 2831.17 |

| Jetstress System Parameters | |
|-----------------------------|-----------|
| Thread Count | 25 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |

Jetstress System Parameters

| | |
|-------------------------------|-----------|
| Thread Count | 25 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |

Database Configuration

| | |
|------------------------|---|
| Instance2904.1 | Log path: E:\LOG1 Database: E:\DB1\Jetstress001001.edb |
| Instance2904.2 | Log path: E:\LOG2 Database: E:\DB2\Jetstress002001.edb |
| Instance2904.3 | Log path: F:\LOG1 Database: F:\DB1\Jetstress003001.edb |
| Instance2904.4 | Log path: F:\LOG2 Database: F:\DB2\Jetstress004001.edb |
| Instance2904.5 | Log path: G:\LOG1 Database: G:\DB1\Jetstress005001.edb |
| Instance2904.6 | Log path: G:\LOG2 Database: G:\DB2\Jetstress006001.edb |
| Instance2904.7 | Log path: H:\LOG1 Database: H:\DB1\Jetstress007001.edb |
| Instance2904.8 | Log path: H:\LOG2 Database: H:\DB2\Jetstress008001.edb |
| Instance2904.9 | Log path: I:\LOG1 Database: I:\DB1\Jetstress009001.edb |
| Instance2904.10 | Log path: I:\LOG2 Database: I:\DB2\Jetstress010001.edb |
| Instance2904.11 | Log path: J:\LOG1 Database: J:\DB1\Jetstress011001.edb |
| Instance2904.12 | Log path: J:\LOG2 Database: J:\DB2\Jetstress012001.edb |
| Instance2904.13 | Log path: K:\LOG1 Database: K:\DB1\Jetstress013001.edb |
| Instance2904.14 | Log path: K:\LOG2 Database: K:\DB2\Jetstress014001.edb |
| Instance2904.15 | Log path: L:\LOG1 Database: L:\DB1\Jetstress015001.edb |
| Instance2904.16 | Log path: L:\LOG2 Database: L:\DB2\Jetstress016001.edb |
| Instance2904.17 | Log path: M:\LOG1 Database: M:\DB1\Jetstress017001.edb |
| Instance2904.18 | Log path: M:\LOG2 Database: M:\DB2\Jetstress018001.edb |
| Instance2904.19 | Log path: N:\LOG1 Database: N:\DB1\Jetstress019001.edb |

| Transactional I/O Performance | | | | | | | | | | | | | |
|-------------------------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-------------------|--------------------|-----------------------------|------------------------------|--|
| Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads/sec | I/O Log Writes/sec | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes | |
| Instance2904.1 | 2.859 | 0.000 | 288.903 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.2 | 2.862 | 0.000 | 290.313 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.3 | 4.127 | 0.000 | 376.422 | 0.000 | 262144.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.4 | 3.385 | 0.000 | 368.625 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.5 | 4.484 | 0.000 | 332.803 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.6 | 4.164 | 0.000 | 343.930 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.7 | 4.350 | 0.000 | 367.103 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.8 | 3.904 | 0.000 | 356.063 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.9 | 4.119 | 0.000 | 376.335 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.10 | 3.315 | 0.000 | 366.454 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.11 | 4.070 | 0.000 | 376.480 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.12 | 3.620 | 0.000 | 334.680 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.13 | 4.323 | 0.000 | 373.833 | 0.000 | 262143.999 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.14 | 3.600 | 0.000 | 359.525 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.15 | 3.126 | 0.000 | 398.746 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.16 | 3.171 | 0.000 | 373.371 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.17 | 3.914 | 0.000 | 369.133 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.18 | 3.390 | 0.000 | 377.807 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.19 | 4.240 | 0.000 | 361.837 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| Instance2904.20 | 3.714 | 0.000 | 351.974 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |

| Host System Performance | | | |
|----------------------------------|---------------|---------------|---------------|
| Counter | Average | Minimum | Maximum |
| % Processor Time | 2.014 | 0.419 | 2.433 |
| Available MBytes | 126388.337 | 126393.000 | 126379.000 |
| Free System Page Table Entries | 16329923.361 | 16329544.000 | 16330170.000 |
| Transaction Pages Repurposed/sec | 0.000 | 0.000 | 0.000 |
| Pool Repurged Bytes | 145314947.337 | 145318592.000 | 145328224.000 |
| Pool Paged Bytes | 21999926.032 | 213824432.000 | 216203264.000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

Test Log
 4/22/2014 8:39:23 AM -- Preparing for testing ...
 4/22/2014 8:39:44 AM -- Attaching databases ...
 4/22/2014 8:39:44 AM -- Preparing for testing are complete.
 4/22/2014 8:40:06 AM -- Performance logging started (interval 30000 ms).
 4/22/2014 8:40:06 AM -- Raising up databases ...
 4/22/2014 10:48:19 AM -- Performance logging has ended.
 4/22/2014 10:48:15 AM -- Instance2904.1 (100% processed), Instance2904.2 (100% processed), Instance2904.3 (100% processed), Instance2904.4 (100% processed), Instance2904.5 (100% processed), Instance2904.6 (100% processed), Instance2904.7 (100% processed), Instance2904.8 (100% processed), Instance2904.9 (100% processed), Instance2904.10 (100% processed), Instance2904.11 (100% processed), Instance2904.12 (100% processed), Instance2904.13 (100% processed), Instance2904.14 (100% processed), Instance2904.15 (100% processed), Instance2904.16 (100% processed), Instance2904.17 (100% processed), Instance2904.18 (100% processed), Instance2904.19 (100% processed) and Instance2904.20 (100% processed).
 4/22/2014 10:48:15 AM -- C:\Program Files\Microsoft SQL Server\90\Tools\Binn\sqlservr.exe_2014-4-22-8-39-44 has 249 samples.
 4/22/2014 10:48:15 AM -- Creating test report ...

C.2 Server 2

Microsoft Exchange Jetstress 2013

Database backup Test Result Report

| Database Backup Statistics - All | | | |
|----------------------------------|------------------------|---------------------|------------------------|
| Database Instance | Database Size (MBytes) | Elapsed Backup Time | MBytes Transferred/sec |
| Instance2904.1 | 1014968.03 | 02:31:12 | 111.87 |
| Instance2904.2 | 1014976.03 | 01:56:15 | 145.51 |
| Instance2904.3 | 1014968.03 | 02:01:21 | 139.38 |
| Instance2904.4 | 1014976.03 | 02:03:48 | 136.64 |
| Instance2904.5 | 1014984.03 | 02:02:57 | 137.58 |
| Instance2904.6 | 1014968.03 | 02:05:10 | 135.14 |
| Instance2904.7 | 1015032.03 | 02:03:42 | 136.74 |
| Instance2904.8 | 1015016.03 | 02:05:59 | 134.27 |
| Instance2904.9 | 1014976.03 | 02:00:02 | 140.91 |
| Instance2904.10 | 1015000.03 | 02:02:39 | 137.91 |
| Instance2904.11 | 1015000.03 | 02:02:23 | 138.23 |
| Instance2904.12 | 1014984.03 | 02:06:11 | 134.06 |
| Instance2904.13 | 1015000.03 | 02:01:17 | 139.47 |
| Instance2904.14 | 1015016.03 | 02:03:58 | 136.45 |
| Instance2904.15 | 1014992.03 | 01:57:49 | 143.58 |
| Instance2904.16 | 1014960.03 | 02:01:58 | 138.69 |
| Instance2904.17 | 1014976.03 | 01:59:34 | 141.47 |
| Instance2904.18 | 1015008.03 | 02:02:36 | 137.98 |
| Instance2904.19 | 1015008.03 | 02:04:23 | 136.00 |
| Instance2904.20 | 1015008.03 | 02:06:37 | 133.61 |
| Avg | | | 136.77 |
| Sum | | | 2735.49 |

Database Configuration

Instance2904.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance2904.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance2904.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance2904.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance2904.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance2904.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance2904.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance2904.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance2904.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance2904.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance2904.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance2904.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance2904.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance2904.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance2904.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance2904.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance2904.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance2904.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance2904.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance2904.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb

Transactional I/O Performance

| Instance | I/O Database Reads Average Latency (msec) | I/O Database Writes Average Latency (msec) | I/O Database Reads/sec | I/O Database Writes/sec | I/O Database Reads Average Bytes | I/O Database Writes Average Bytes | I/O Log Reads Average Latency (msec) | I/O Log Writes Average Latency (msec) | I/O Log Reads Average Bytes | I/O Log Writes Average Bytes |
|-----------------|---|--|------------------------|-------------------------|----------------------------------|-----------------------------------|--------------------------------------|---------------------------------------|-----------------------------|------------------------------|
| Instance2904.1 | 3.404 | 0.000 | 446.825 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.2 | 2.690 | 0.000 | 281.226 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.3 | 4.036 | 0.000 | 359.866 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.4 | 3.704 | 0.000 | 348.166 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.5 | 4.149 | 0.000 | 332.978 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.6 | 3.703 | 0.000 | 342.073 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.7 | 4.399 | 0.000 | 355.678 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.8 | 4.098 | 0.000 | 336.786 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.9 | 4.116 | 0.000 | 354.387 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.10 | 3.466 | 0.000 | 351.177 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.11 | 4.627 | 0.000 | 353.083 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.12 | 3.937 | 0.000 | 327.766 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.13 | 4.508 | 0.000 | 340.182 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.14 | 3.741 | 0.000 | 347.314 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.15 | 3.375 | 0.000 | 376.847 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.16 | 3.289 | 0.000 | 356.828 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.17 | 4.110 | 0.000 | 366.687 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.18 | 3.344 | 0.000 | 331.403 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.19 | 4.318 | 0.000 | 344.297 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance2904.20 | 3.768 | 0.000 | 333.819 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

SQL System Performance

| Counter | Average | Minimum | Maximum |
|--------------------------------|---------------|---------------|---------------|
| % Processor Time | 1.776 | 0.127 | 2.476 |
| Available MBytes | 125543.532 | 125526.000 | 125564.000 |
| Free System Page Table Entries | 16529789.362 | 16529372.000 | 16530018.000 |
| Transaction Pages Refilled/sec | 0.000 | 0.000 | 0.000 |
| Pool Nonpaged Bytes | 145852912.691 | 145825792.000 | 145952716.000 |
| Pool Paged Bytes | 202198182.698 | 202092544.000 | 202448896.000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

Test Log

4/24/2014 9:39:42 AM -- Preparing for testing --
 4/24/2014 9:40:08 AM -- Attaching databases --
 4/24/2014 9:40:08 AM -- Preparations for testing are complete.
 4/24/2014 9:40:28 AM -- Performance logging started (interval: 30000 ms).
 4/24/2014 9:40:30 AM -- Backing up databases --
 4/24/2014 12:11:42 PM -- Performance logging has ended.
 4/24/2014 12:11:42 PM -- Instance2904.1 (100% processed), Instance2904.2 (100% processed), Instance2904.3 (100% processed), Instance2904.4 (100% processed), Instance2904.5 (100% processed), Instance2904.6 (100% processed), Instance2904.7 (100% processed), Instance2904.8 (100% processed), Instance2904.9 (100% processed), Instance2904.10 (100% processed), Instance2904.11 (100% processed), Instance2904.12 (100% processed), Instance2904.13 (100% processed), Instance2904.14 (100% processed), Instance2904.15 (100% processed), Instance2904.16 (100% processed), Instance2904.17 (100% processed), Instance2904.18 (100% processed), Instance2904.19 (100% processed) and Instance2904.20 (100% processed).
 4/24/2014 12:11:42 PM -- [Performance Files](#) \Database Instance\2904\PerformanceBackup_2014_4_24_9_40_816p has 301 samples.
 4/24/2014 12:11:42 PM -- Creating test report --

C.3 Server 3

Microsoft Exchange Jetstress 2013

Database backup Test Result Report

Database Backup Statistics - All

| Database Instance | Database Size (MBytes) | Elapsed Backup Time | MBytes Transferred/sec |
|-------------------|------------------------|---------------------|------------------------|
| Instance952.1 | 1011680.03 | 02:03:18 | 136.74 |
| Instance952.2 | 1011688.03 | 02:07:26 | 132.31 |
| Instance952.3 | 1011680.03 | 02:01:26 | 138.84 |
| Instance952.4 | 1011688.03 | 02:05:26 | 134.42 |
| Instance952.5 | 1011696.03 | 02:04:05 | 135.89 |
| Instance952.6 | 1011640.03 | 02:05:48 | 134.01 |
| Instance952.7 | 1011696.03 | 02:03:16 | 136.78 |
| Instance952.8 | 1011648.03 | 02:07:00 | 132.76 |
| Instance952.9 | 1011616.03 | 02:01:12 | 139.10 |
| Instance952.10 | 1011648.03 | 02:04:51 | 135.04 |
| Instance952.11 | 1011672.03 | 02:07:12 | 132.54 |
| Instance952.12 | 1011672.03 | 02:10:20 | 129.36 |
| Instance952.13 | 1011648.03 | 02:11:00 | 128.70 |
| Instance952.14 | 1011632.03 | 02:33:39 | 109.73 |
| Instance952.15 | 1011680.03 | 02:03:10 | 136.89 |
| Instance952.16 | 1011656.03 | 02:06:13 | 133.57 |
| Instance952.17 | 1011656.03 | 01:57:33 | 143.42 |
| Instance952.18 | 1011616.03 | 02:00:58 | 139.37 |
| Instance952.19 | 1011664.03 | 01:58:16 | 142.55 |
| Instance952.20 | 1011648.03 | 02:01:37 | 138.62 |
| Avg | | | 134.53 |
| Sum | | | 2690.63 |

Jetstress System Parameters

| | |
|------------------------|-----------|
| Thread Count | 20 |
| Minimum Database Cache | 640.0 MB |
| Maximum Database Cache | 5120.0 MB |
| Insert Operations | 40% |
| Delete Operations | 20% |
| Replace Operations | 5% |
| Read Operations | 35% |
| Lazy Commits | 70% |

Database Configuration

Instance952.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance952.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance952.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance952.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance952.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance952.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance952.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance952.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance952.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance952.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance952.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance952.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance952.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance952.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance952.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance952.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance952.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance952.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance952.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance952.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb

| Transactional I/O Performance | | | | | | | | | | | | | | |
|-------------------------------|----------------------------|-----------------------------|------------------------|-------------------------|--------------------|---------------------|----------------------------|-----------------------------|-------------------------------|--------------------------------|-------------------|--------------------|-----------------------|------------------------|
| MSSQL Exchange Database <>> | I/O Database Reads Average | I/O Database Writes Average | I/O Database Reads/Sec | I/O Database Writes/Sec | I/O Database Reads | I/O Database Writes | I/O Database Reads Average | I/O Database Writes Average | I/O Log Reads Average Latency | I/O Log Writes Average Latency | I/O Log Reads/Sec | I/O Log Writes/Sec | I/O Log Reads Average | I/O Log Writes Average |
| Instance | Latency (ms) | Latency (ms) | Bytes | Bytes | Bytes | Bytes | Bytes | Bytes | ms) | ms) | Bytes | Bytes | Bytes | Bytes |
| Instance92.1 | 3.870 | 0.000 | 546.634 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.2 | 3.761 | 0.000 | 528.726 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.3 | 3.746 | 0.000 | 555.623 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.4 | 3.502 | 0.000 | 537.150 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.5 | 4.072 | 0.000 | 546.640 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.6 | 3.602 | 0.000 | 537.592 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.7 | 3.904 | 0.000 | 549.250 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.8 | 3.736 | 0.000 | 532.508 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.9 | 3.919 | 0.000 | 535.756 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.10 | 3.396 | 0.000 | 539.620 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.11 | 4.241 | 0.000 | 531.989 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.12 | 3.745 | 0.000 | 518.763 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.13 | 4.739 | 0.000 | 517.196 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.14 | 4.014 | 0.000 | 440.024 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.15 | 3.771 | 0.000 | 550.914 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.16 | 3.375 | 0.000 | 535.720 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.17 | 3.020 | 0.000 | 574.480 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.18 | 3.073 | 0.000 | 506.958 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.19 | 2.943 | 0.000 | 569.946 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instance92.20 | 2.996 | 0.000 | 554.026 | 0.000 | 262144.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Host System Performance | | | |
|---------------------------------|--------------|--------------|--------------|
| Counter | Average | Minimum | Maximum |
| % Processor Time | 2.580 | 0.126 | 4.842 |
| Available Mbytes | 126784756 | 126739000 | 126809000 |
| Free System Page Table Entries | 16573827233 | 1657343000 | 16576172000 |
| Transition Pages RePurposed/sec | 0.000 | 0.000 | 0.000 |
| Pool Nonpaged Bytes | 100542876327 | 100437120000 | 100719744000 |
| Pool Paged Bytes | 246542819216 | 246448736000 | 246644864000 |
| Database Page Fault Stalls/sec | 0.000 | 0.000 | 0.000 |

Test Log
4/21/2014 3:40:15 PM -- Preparing for testing --
4/21/2014 3:40:20 PM -- Attaching databases --
4/21/2014 3:40:25 PM -- Preparing for testing are complete.
4/21/2014 3:40:27 PM -- Performance logging started (interval: 30000 ms).
4/21/2014 3:40:37 PM -- Backing up databases --
4/21/2014 4:14:37 PM -- Performance logging has ended.
4/21/2014 4:14:37 PM -- Instance92.1 (100% processed), Instance92.2 (100% processed), Instance92.3 (100% processed), Instance92.4 (100% processed), Instance92.5 (100% processed), Instance92.6 (100% processed), Instance92.7 (100% processed), Instance92.8 (100% processed), Instance92.9 (100% processed), Instance92.10 (100% processed), Instance92.11 (100% processed), Instance92.12 (100% processed), Instance92.13 (100% processed), Instance92.14 (100% processed), Instance92.15 (100% processed), Instance92.16 (100% processed), Instance92.17 (100% processed), Instance92.18 (100% processed), Instance92.19 (100% processed) and Instance92.20 (100% processed).
4/21/2014 4:14:37 PM -- [Click here to download Instance92_2014_4_21_14_37_39.dats](#) has 206 samples.
4/21/2014 4:14:37 PM -- Creating test report --

D Soft Recovery test Result Report

D.1 Server 1

Microsoft Exchange Jetstress 2013

SoftRecovery Test Result Report

Soft-Recovery Statistics - All

| Database Instance | Log files replayed | Elapsed seconds |
|-------------------|--------------------|-----------------|
| Instance2904.1 | 501 | 2263.2183717 |
| Instance2904.2 | 504 | 2764.2884777 |
| Instance2904.3 | 501 | 2695.7321887 |
| Instance2904.4 | 511 | 2552.6867585 |
| Instance2904.5 | 502 | 2602.3014296 |
| Instance2904.6 | 505 | 2450.8828724 |
| Instance2904.7 | 504 | 2423.1919031 |
| Instance2904.8 | 507 | 2275.4979305 |
| Instance2904.9 | 506 | 2423.7184168 |
| Instance2904.10 | 509 | 2276.2668236 |
| Instance2904.11 | 505 | 2424.242382 |
| Instance2904.12 | 505 | 2278.8522488 |
| Instance2904.13 | 510 | 2409.8091192 |
| Instance2904.14 | 502 | 2244.4982103 |
| Instance2904.15 | 503 | 2401.3401475 |
| Instance2904.16 | 501 | 2236.2944711 |
| Instance2904.17 | 506 | 2394.4329662 |
| Instance2904.18 | 502 | 2248.5756554 |
| Instance2904.19 | 502 | 2422.677816 |
| Instance2904.20 | 506 | 2282.4344011 |
| Avg | 504 | 2403.547 |
| Sum | 10092 | 48070.9425902 |

Database Configuration

Instance2904.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance2904.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance2904.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance2904.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance2904.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance2904.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance2904.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance2904.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance2904.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance2904.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance2904.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance2904.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance2904.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance2904.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance2904.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance2904.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance2904.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance2904.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance2904.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance2904.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb

D.2 Server 2

Microsoft Exchange Jetstress 2013

SoftRecovery Test Result Report

Soft-Recovery Statistics - All

| Database Instance | Log files replayed | Elapsed seconds |
|-------------------|--------------------|-----------------|
| Instance5068.1 | 505 | 2474.1436129 |
| Instance5068.2 | 506 | 2464.5794531 |
| Instance5068.3 | 506 | 2417.5876144 |
| Instance5068.4 | 511 | 2274.6966375 |
| Instance5068.5 | 501 | 2422.7913626 |
| Instance5068.6 | 502 | 2270.0499792 |
| Instance5068.7 | 505 | 2443.2172479 |
| Instance5068.8 | 502 | 2270.0499792 |
| Instance5068.9 | 502 | 2405.4309604 |
| Instance5068.10 | 504 | 2262.318172 |
| Instance5068.11 | 507 | 2471.0125713 |
| Instance5068.12 | 507 | 2319.6010365 |
| Instance5068.13 | 507 | 2427.6857324 |
| Instance5068.14 | 505 | 2273.4004934 |
| Instance5068.15 | 508 | 2427.4319208 |
| Instance5068.16 | 502 | 2267.4766581 |
| Instance5068.17 | 506 | 2398.6828835 |
| Instance5068.18 | 507 | 2249.916614 |
| Instance5068.19 | 503 | 2410.3552796 |
| Instance5068.20 | 505 | 2258.4401017 |
| Avg | 505 | 2360.443 |
| Sum | 10101 | 47208.8683105 |

Database Configuration

Instance5068.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance5068.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance5068.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance5068.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance5068.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance5068.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance5068.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance5068.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance5068.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance5068.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance5068.11 Log path: K:\LOG1
Database: K:\DB1\Jetstress011001.edb

Instance5068.12 Log path: K:\LOG2
Database: K:\DB2\Jetstress012001.edb

Instance5068.13 Log path: L:\LOG1
Database: L:\DB1\Jetstress013001.edb

Instance5068.14 Log path: L:\LOG2
Database: L:\DB2\Jetstress014001.edb

Instance5068.15 Log path: M:\LOG1
Database: M:\DB1\Jetstress015001.edb

Instance5068.16 Log path: M:\LOG2
Database: M:\DB2\Jetstress016001.edb

Instance5068.17 Log path: N:\LOG1
Database: N:\DB1\Jetstress017001.edb

Instance5068.18 Log path: N:\LOG2
Database: N:\DB2\Jetstress018001.edb

Instance5068.19 Log path: O:\LOG1
Database: O:\DB1\Jetstress019001.edb

Instance5068.20 Log path: O:\LOG2
Database: O:\DB2\Jetstress020001.edb

D.3 Server 3

Microsoft Exchange Jetstress 2013

SoftRecovery Test Result Report

Soft-Recovery Statistics - All

| Database Instance | Log files replayed | Elapsed seconds |
|-------------------|--------------------|-----------------|
| Instance952.1 | 509 | 2435.2642754 |
| Instance952.2 | 502 | 2252.7216558 |
| Instance952.3 | 508 | 2433.9697734 |
| Instance952.4 | 507 | 2284.3801122 |
| Instance952.5 | 501 | 2414.0863614 |
| Instance952.6 | 511 | 2291.0961974 |
| Instance952.7 | 513 | 2610.9415487 |
| Instance952.8 | 501 | 2426.4901791 |
| Instance952.9 | 501 | 2416.6524864 |
| Instance952.10 | 510 | 2282.0556451 |
| Instance952.11 | 510 | 1375.0145185 |
| Instance952.12 | 512 | 1368.7812642 |
| Instance952.13 | 505 | 1482.7629579 |
| Instance952.14 | 502 | 1386.0960861 |
| Instance952.15 | 512 | 1361.253293 |
| Instance952.16 | 510 | 1346.3129331 |
| Instance952.17 | 509 | 1362.0350613 |
| Instance952.18 | 506 | 1349.1351173 |
| Instance952.19 | 502 | 1352.2404478 |
| Instance952.20 | 508 | 1345.0241981 |
| Avg | 506 | 1878.816 |
| Sum | 10139 | 37576.3141122 |

- Database Configuration

Instance952.1 Log path: E:\LOG1
Database: E:\DB1\Jetstress001001.edb

Instance952.2 Log path: E:\LOG2
Database: E:\DB2\Jetstress002001.edb

Instance952.3 Log path: F:\LOG1
Database: F:\DB1\Jetstress003001.edb

Instance952.4 Log path: F:\LOG2
Database: F:\DB2\Jetstress004001.edb

Instance952.5 Log path: G:\LOG1
Database: G:\DB1\Jetstress005001.edb

Instance952.6 Log path: G:\LOG2
Database: G:\DB2\Jetstress006001.edb

Instance952.7 Log path: H:\LOG1
Database: H:\DB1\Jetstress007001.edb

Instance952.8 Log path: H:\LOG2
Database: H:\DB2\Jetstress008001.edb

Instance952.9 Log path: I:\LOG1
Database: I:\DB1\Jetstress009001.edb

Instance952.10 Log path: I:\LOG2
Database: I:\DB2\Jetstress010001.edb

Instance952.11 Log path: J:\LOG1
Database: J:\DB1\Jetstress011001.edb

Instance952.12 Log path: J:\LOG2
Database: J:\DB2\Jetstress012001.edb

Instance952.13 Log path: K:\LOG1
Database: K:\DB1\Jetstress013001.edb

Instance952.14 Log path: K:\LOG2
Database: K:\DB2\Jetstress014001.edb

Instance952.15 Log path: L:\LOG1
Database: L:\DB1\Jetstress015001.edb

Instance952.16 Log path: L:\LOG2
Database: L:\DB2\Jetstress016001.edb

Instance952.17 Log path: M:\LOG1
Database: M:\DB1\Jetstress017001.edb

Instance952.18 Log path: M:\LOG2
Database: M:\DB2\Jetstress018001.edb

Instance952.19 Log path: N:\LOG1
Database: N:\DB1\Jetstress019001.edb

Instance952.20 Log path: N:\LOG2
Database: N:\DB2\Jetstress020001.edb
