



CATE Storage and Backup Engineering
CATE CitiSystems Engineered Systems
Citigroup Architecture and Technology Engineering

ScaleIO R1.32

CSBE-15021-RN

Release Notes

1.0

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1 Version Control

Version	Date	Author	Reviewed	Comments
0.1	22-April-2015	Scott Torgerson, Chris Clayton, Chris Howarth, Eliot Wilson	Ludwig Derodel	Peer
0.5	20-July-2015	Scott Torgerson, Chris Clayton, Chris Howarth, Eliot Wilson	Global Stakeholders	RFT
1.0	24-Aug-2015	Scott Torgerson, Chris Clayton, Chris Howarth, Eliot Wilson	Global Stakeholders	Release to Production

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3 Contact

Please address any comments or questions regarding the information contained in this document via email to the [*CATE Global Engineering Support – ScaleIO](#) distribution list.

4 Latest Versions

It is recommended that the latest version of the document be used from the CSBE website at the following URL:
<http://catecollaboration.citigroup.net/domains/platstor/gdse/products/default.aspx>.
Newer versions may include certification on additional platforms, or comments on issues discovered after deployment.

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7 Introduction

EMC ScaleIO is software that creates a SAN by aggregating servers' local direct-attached storage (DAS) to form globally shared block storage accessible over IP. The lightweight ScaleIO software components are installed on the application hosts and inter-communicate via a standard LAN to handle the application I/O requests sent to ScaleIO block volumes. This decentralized block I/O flow combined with a distributed, sliced volume layout results in parallelism which allows it to scale too many nodes (servers).

A ScaleIO volume is a block device that is exposed to one or more hosts (much like a traditional SAN LUN). ScaleIO breaks each volume into a large number of 1MB data chunks which are spread across the servers and disks within the ScaleIO cluster. Each volume also has a corresponding mirror on different nodes and servers in the cluster. This layout goes a long way in eliminating hot spots across the cluster and allows for the scaling of the overall I/O performance of the system through the addition of nodes and or disks. Furthermore, this layout enables a single application that is accessing a single volume to use the full IOPs of all the cluster's disks (much like XIV storage arrays).

Traditional storage systems typically combine system software with commodity hardware (which is comparable to application server hardware) to provide enterprise-grade resilience. ScaleIO provides similar enterprise-grade resilience by running the storage software directly on application servers. Designed for fault tolerance and high availability, ScaleIO handles all types of failures including failures of media, connectivity, nodes, software interruptions, and more.

The ScaleIO software features distributed auto-healing processes that can overcome media and node failures without requiring administrator involvement. Dynamic and elastic, ScaleIO enables administrators to add or remove nodes and capacity on the fly. The software immediately responds to changes by rebalancing the storage distribution to achieve a layout that optimally suits the new configuration. All performance and redistributions on ScaleIO can be monitored and observed on the ScaleIO dashboard which is a simple Java applet.

8 Applicable Environments

This new 1.32 version of ScaleIO is certified for DEV and UAT workloads on Tornado++ hardware environments. POC (Proof Of Concept) or Pilot environments not running on Tornado++ hardware will only be supported working in conjunction with CATE. Any POC/Pilot environments implementers should first contact CATE at [*CATE GLOBAL Engineering Support – ScaleIO](#) prior to starting the installation of the environment.

9 Component Certification Matrix

9.1 Certified Component and Functionality Matrix

Component Matrix	
ScaleIO ¹	1.32.402
ScaleIO Dashboard	1.32.402
REST Gateway	1.32.402
ScaleIO GUI/Dashboard Supported platforms ²	Laptops VDI
MDM	RHEL 6.X (SOE Build)
Tie-Breaker	RHEL 6.X (SOE Build)
SDS	RHEL 6.X (SOE Build)
SDC Supported O.S. versions ³	RHEL 6.X (SOE Build) Windows 2012 (SOE Build) Windows 2012 R2 (SOE Build) ESXi 5.5 SP1 (SOE Build)

Before installation or configuration of any ScaleIO Cluster it should be validated by the implementer that all component versions are listed in the above certified matrix. Any software versions not listed in the above matrix will not be supported, with the exception of R1.31 SDCs which are compatible with a ScaleIO R1.32 cluster.

Complete best practices, installation, and configuration instructions and details for all of the components listed in the above table can be found in the [EMC ScaleIO R1.32.402 Solutions Guide](#).

¹ All servers that makeup the ScaleIO cluster (MDM, SDS, REST Gateway) will only be certified on Linux SOE built servers.

² For this release of ScaleIO the GUI/Dashboard will now be approved for Laptops and VDI and be ordered in CMP. The GUI/Dashboard will not longer be packaged in TPM.

³ Currently there is no ScaleIO support for Solaris and AIX.

9.1 Major Enhancements for this Release

The major changes and enhancements to be added by this version of the EMC ScaleIO project are as follows:

- R1.32-402.1
- Rolling Upgrades
- Password obfuscation in various configuration files
- Background device scanning
- Various bug fixes
- Tornado++ Hardware Environments testing

10 Known Issues

During the certification testing of the EMC ScaleIO project, the following issues were found and recorded. An ongoing list of all Bugs and Requests for Enhancements for EMC ScaleIO are being tracked and recorded in [JIRA](#) tracking system.

10.1 Thin Provisioning on Physical Servers

Impact – High

Affects – Any cluster that has thinly provisioned LUNs when a pool fills up.

Description

When LUNs are thinly provisioned they do as expected during normal use in that free storage is only taken from the pool when the thinly provisioned LUN uses space. However, when the pools that contain thin LUNs were tested against the pool reaching the hard limit, there were unexpected results. When the pool should have filled and locked the thin LUNs as read-only, the pool started using protected space in the pool to fulfill the actual LUN write request. Since a higher priority was given to the thin LUN, it was able to finish the write using protected space making the cluster show as unprotected.

Workaround

There is no current workaround for this issue. As a result, CATE will not certify thin provisioned LUNs for physical servers in this initial release of ScaleIO.

Further Information

This issue was reported to EMC and they were able to duplicate the issue. EMC has stated that this issue is partly resolved in the 1.32 with a full fix in 2.0. CATE will re-evaluate and test this issue in that release and attempt to certify this functionality for that release.

10.2 EMC SRM

Impact – Medium

Affects – Performance and capacity reporting of ScaleIO with SRM

Description

Performance and capacity reports required in SRM for ScaleIO management are either not available or where available, some are inaccurate.

Workaround

Use SIO Dashboard to get pool level metrics for capacity planning purposes.

Further Information

EMC are planning to meet Citi's reporting requirement over the next few releases of SRM focusing on:

1. Fixing any algorithm issues in existing reports that Citi detects.
2. Reporting on data already in SRM database for which there were no reports
3. Pulling additional data (e.g. volume performance metrics) into SRM database and reporting on that
4. Adding new performance metrics (e.g. client level metrics) into the SIO REST API to allow them to be consumed by SRM

10.3 No chargeback-related data in SRM

Impact – Medium

Affects – Chargeback

Description

No volume or client-related data in SRM that can be used for chargeback.

Workaround

Chargeback for virtual environments will need to be undertaken using VMware tools (as today). No chargeback is possible for physical hosts.

Further Information

Volume related data will start to appear in SRM from 3.6.3 onwards.

10.4 Data Mobility

Impact – Medium

Affects – Movement of data between pools (tiers) or protection domains.

Description

It is not possible to move data at the ScaleIO level between pools (tiers) or protection domains.

Workaround

All data migration between pools or protection domains will need to be undertaken using VMware tools (e.g. storage VMotion).

Further Information

The functionality is on EMC's roadmap for post R2.0.

10.5 Maintenance mode

Impact – Medium

Affects – Removal of SDS nodes for maintenance tasks

Description

Need to ability to migrate data from an SDS prior to shut down without completely removing SDS from cluster

Workaround

For short outages (reboots) CATE is recommending not removing the SDS but instead using a hardened DRL to ensure the data is degraded for the minimum period possible.

Further Information

Native maintenance mode is coming in ScaleIO R2.0.

10.6 Silent data corruption

Impact – Medium

Affects – Data integrity

Description

ScaleIO is unable to detect and correct copies of data that have suffered from silent data corruption.

Workaround

None for R1.311.

Further Information

R1.32 will introduce the ability to detect (but not correct) data corruption. Correction will not come until post-2.0 and certain server hardware enhancements are available.

10.7 Recovery from MDM loss

Impact – Medium

Affects – Cluster availability

Description

Cluster only has a maximum of 2 MDMs. There is exposure if one is down.

Workaround

Use the `mdm_failover` script provided by ScaleIO.

Further Information

R2.0 will have 3 MDMs minimum.

10.8 No VASA support

Impact – Medium

Affects – VMware operations

Description

VMware cannot query the ScaleIO storage to determine its capabilities.

Workaround

Use a sensible pool naming convention to identify pool capabilities.

Further Information

Stretch goal for EMC for R2.0

10.9 Rebuilds do not complete

Impact – High

Affects – Data availability

Description

Rebuilds do not complete even though there is still spare capacity available. This is believed (at the time of writing) to be due to the use of fault sets.

Workaround

Leave additional unused capacity to allow rebuild to complete. Values to be determined by trial and error (already done and documented for T++ pools).

Further Information

EMC indicate that this will be fixed in a future patched version of R1.32 (post R1.32-402.1).

10.10 SDC balancing algorithms

Impact – Low

Affects – Optimal use of resources

Description

SDC & SDS traffic is not always evenly balanced across all paths

Workaround

None.

Further Information

EMC will analyze ScaleIO interface balancing algorithms to determine if changes are needed to improve performance and utilization of multiple connections to storage. EMC has confirmed this is a bug and plans a fix in v2.0.

11 References

Document	Location
CATE Scale-out commodity block storage position paper	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/Eval/Scale_Out_Block_storage_position_paper_V1.0.pdf
ScaleIO Product Page	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/techstdshmpgs/emcscaleIO.aspx
ScaleIO Standard Build Page	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/platforms/EMC%20ScaleIO/ScaleIO_csb.aspx
ScaleIO v1.32 Solutions Guide.	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/platforms/EMC%20ScaleIO/CSBE-15021-1.32-SG.pdf
ScaleIO on Tornado++ Hardware Environments Best Practices	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/platforms/EMC%20ScaleIO/CSBE-15004-BP.pdf
EMC ScaleIO v1.32 Users Guide	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/platforms/EMC%20ScaleIO/ScaleIO-User-Guide-1.32.pdf
EMC ScaleIO v1.32 Installation Guide	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/platforms/EMC%20ScaleIO/ScaleIO-Installation-Guide-1.32.pdf
ScaleIO Security Model	http://ewiki.nam.nsroot.net/w/images/f/f6/ScaleIO_Security_Model_071014.pdf
VMWare VSI Storage	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/Designs/CSBE-11079-DD.pdf

12 Appendices

12.1 Appendix A: Pertinent Packages for this Release

For Phase 1 certification, the following packages have been uploaded to test/UAT locations for RFT. All repository and TPM locations are defined in the [ScaleIO R1.32 Solutions Guide](#).

- Windows ScaleIO Packages

SDC – CITI_WIN_EMCScaleIOSDC_132402_00 (TPM)

GUI – CITI_WIN_EMCScaleIOGUI_132402_00 (Laptop, VDI)

- Linux Repository Containing the following packages

MDM – EMC-ScaleIO-mdm.x86_64

SDS – EMC-ScaleIO-sds.x86_64

Tie-Breaker – EMC-ScaleIO-tb.x86_64

REST Gateway – EMC-ScaleIO-gateway.noarch

SDC – EMC-ScaleIO-sds.x86_64

carrier-mon_1.0 – Citi package to setup ScaleIO network interfaces

sds_routes_1.0 – Citi package to configure routing tables T++ nodes.

- Vmware Repository Containing the following packages

SDC vib – sdc-1.32.343.1-esx5.zip

12.2 Appendix B: Test Environments

Multiple test environments were used when testing ScaleIO performance and functionality. This was in part due to the lack of a large scale test environment when most functional tests were completed. As the certification progressed more realistic test environments became available and tests were performed again where needed. At the very end of this initial certification, the MWDC Tornado++ environment was made available so that CATE can test on it for approximately one week.

The following sections will show the test environments used for testing ScaleIO as part of this certification.

12.2.1 Warren LAB Cluster

The Warren LAB cluster is a small (4) node cluster running on HP DL360-G7 servers. Each of the SDS nodes only contains (3) SAS drives that are in the cluster. This environment was used for most of the security testing that was completed. This was the Cluster used for all CIVA testing.

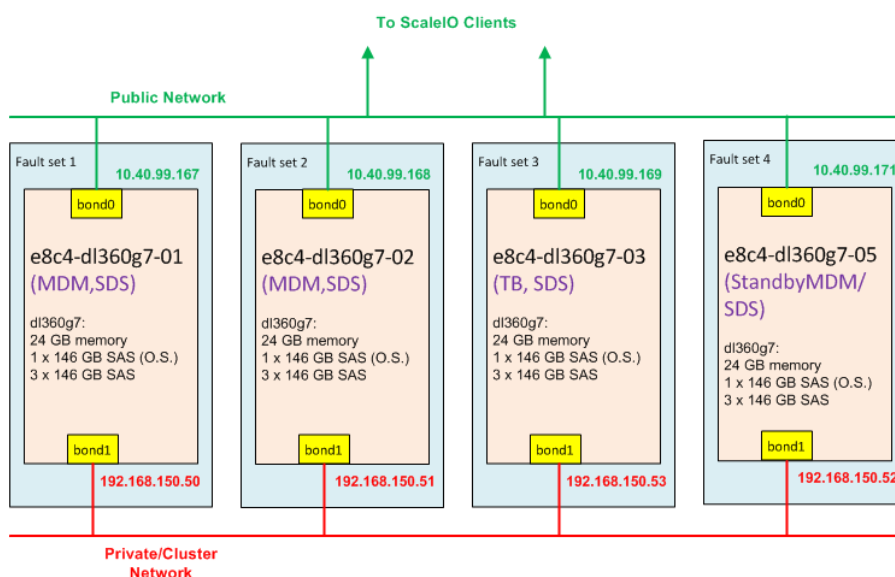


Figure 1 - Warren LAB Cluster Test Environment

12.2.2 Grid LAB Cluster

The Grid LAB cluster is a small (5) node cluster running on IBM HS23 blade servers. Each of the SDS nodes only contains (1) SAS drive that are in the cluster. This test cluster also did not have a second NIC for creating a private network for the ScaleIO cluster traffic. As a result, this environment was only used for functional testing.

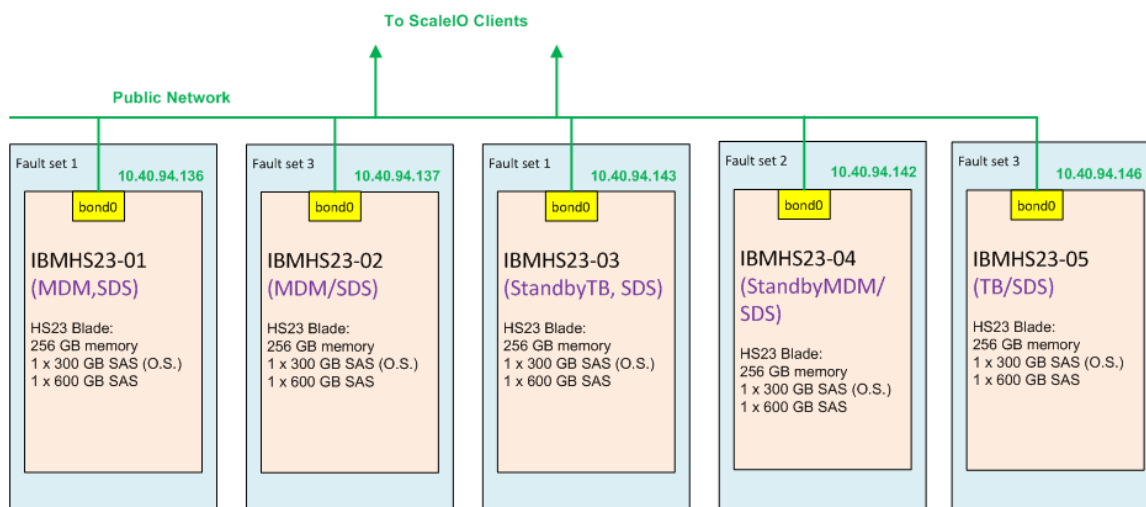


Figure 2 - Grid LAB Cluster Test Environment

12.2.3 Maas (Mongo as a Service) POC Environment

The Maas Cluster was a POC/Pilot environment that contained (4) nodes in the cluster. However, the nodes in the cluster much closer resembled production nodes in a Tornado++ hardware environment. Each of the nodes in the cluster had (20) SAS drives and (2) SSD drives. Although the nodes in this cluster resembled production nodes, the network did not match a production configuration. As a result, many of the tests in this environment revolved around the functionality of multiple Tiers and SSD pools etc.

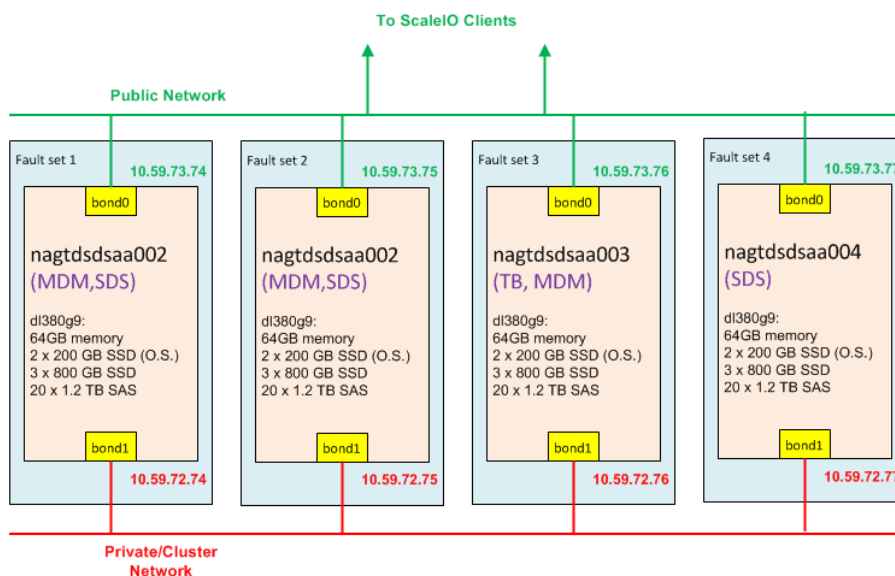


Figure 3 - Maas Cluster Test Environment

12.2.4 Raas (Oracle RAC as a Service) POC Environment

The Raas Cluster was a POC/Pilot environment that contained (4) nodes in the cluster. Like the Maas cluster, these nodes also resembled a Tornado++ production node. Each of the nodes in the cluster had (20) SAS drives and (3) SSD drives. This test cluster also had the added benefit of having a planned production type network configuration also. Most every kind of test that could be run on this cluster was run as time permitted since it closely resembled production.

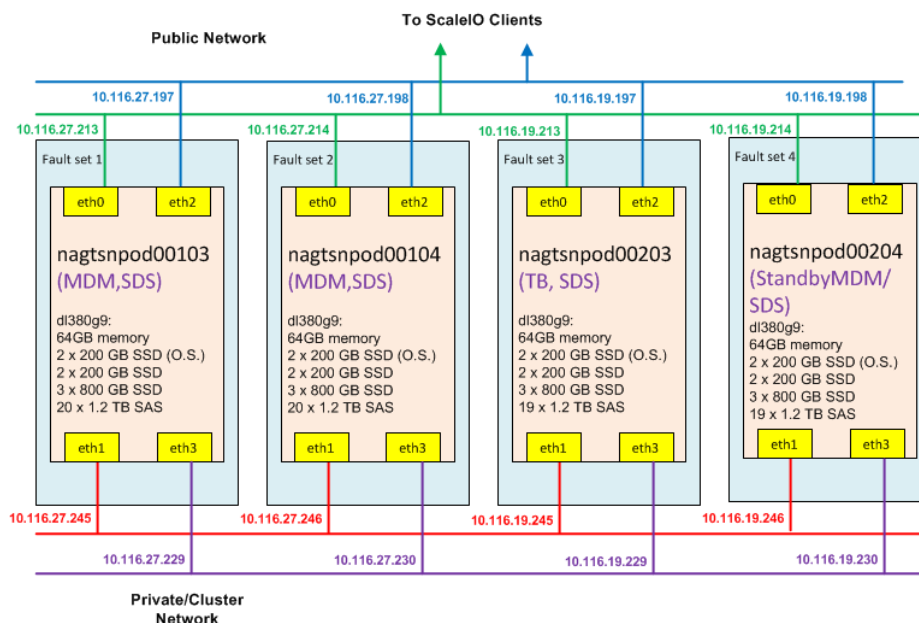


Figure 4 - Raas Cluster Test Environment

12.2.5 MWDC Tornado++ Cluster

The Tornado++ cluster was a real production configuration as described in the [Tornado++ Best Practices document](#). CATE was given this environment for two weeks to test on prior to it being turned over to the Operations team. This environment was used to do any performance and network testing that could be completed. Many functional tests were also completed on this environment by setting up the environment by using the CATE Solutions Guides for ScaleIO.

See [Tornado++ Best Practices document](#) for a hardware diagram of a Tornado++ cluster.

12.3 Appendix C: Test Plans

Test	Test Environments Used	Test
<u>1</u>	Tornado++, Warren LAB, Grid LAB	ScaleIO Cluster components Installation (MDM, SDS, Tie-Breaker, REST Gateway)
<u>2</u>	Maas, Raas, Warren LAB, Grid LAB	Non-disruptive upgrades from 1.31 to 1.32
<u>3</u>	Tornado++, Maas, Raas, Warren LAB, Grid LAB	ScaleIO Cluster Configuration
<u>4</u>	Warren LAB VMWare 5.5 Cluster pointing at Tornado++, Warren LAB, and Grid LAB clusters	SDC Installation/Configuration (VMWare)
<u>5</u>	Windows and Linux servers in Warren Lab pointing at Warren LAB, and Grid LAB clusters	SDC Installation/Configuration (physical)
<u>6</u>	Tornado++, Maas, Raas, Warren LAB	RAM Read Cache Settings
<u>7</u>	Tornado++, Warren LAB, Grid LAB	Pool/Disk type Throttling
<u>8</u>	Tornado++, Warren LAB, Grid LAB	Thick Provisioning (virtual and physical environments)
<u>9</u>	Warren LAB, Grid LAB	Thin Provisioning (physical servers only)
<u>10</u>	Warren LAB, Grid LAB	Log Reconciliation (SEMs/ArcSight)
<u>11</u>	Warren LAB, Grid LAB	Automated SBCC (HPNA)
<u>12</u>	Warren LAB, Grid LAB	EMC SRM Performance Reporting
<u>13</u>	Warren LAB, Grid LAB	Background CRC Scrubbing.
<u>14</u>	Warren LAB, Grid LAB	Security Fixes Verification (Password Obfuscation)
<u>15</u>	Tornado++	Testing on MWDC Tornado++ environment.
<u>16</u>	Warren LAB, Tornado++	Rebuild IO priority controls

12.4 Appendix D: Test Steps and Results

The following sections will show the test results of the tests that were run as part of this project certification. It is important to note that some tests that were run using steps in the Solutions Guide will refer to that document for the steps.

12.4.1 Test #1 – ScaleIO Cluster Components Installation

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Install all components of the ScaleIO Cluster (MDM, Tie-Breaker, SDS, REST Gateway)	All ScaleIO components should install without errors	As Expected	Pass ✓	Use documented procedure in ScaleIO Cluster Installation section of the Solutions Guide .

12.4.2 Test #2 – Non-disruptive upgrades

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Upgrade ScaleIO cluster from 1.31 to 1.32	All ScaleIO components should upgrade without errors.	As Expected	Pass ✓	Use documented procedure in Upgrading a ScaleIO Cluster Installation section of the Solutions Guide .

12.4.3 Test #3 – ScaleIO Cluster Configuration

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Configure the ScaleIO Cluster	Cluster should configure without error and be able to return basic commands such as scli -query_cluster_all	As Expected	Pass ✓	Use documented procedure in ScaleIO Cluster Configuration section of the Solutions Guide .

Note: All installation and configuration commands used in Test #1 and #2 were taken from the documented steps in the Solutions Guide. The same commands were used by operational partners to build all POC environments.

12.4.4 Test #4 – SDC Installation/Configuration (VMWare)

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Install and configure a VMWare SDC. This will allow VMWare Clusters to see ScaleIO storage.	At this point a ScaleIO LUN should be able to be provisioned to the VMWare cluster. ScaleIO Cluster should also show the newly added VMWare SDC as Connected in the following command: <code>sccli -query_all_sdc</code>	As Expected	Pass ✓	Use documented procedure in <u>VMWare SDC Installation</u> section of the Solutions Guide .

12.4.5 Test #5 – SDC Installation/Configuration (Physical Servers)

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Install and configure a Windows physical server SDC	At this point a ScaleIO LUN should be able to be provisioned to the Windows server. Cluster should also show the newly added VMWare SDC as Connected in the following command: <code>sccli -query_all_sdc</code>	As Expected	Pass ✓	Use documented procedure in <u>Windows SDC Installation</u> section of the Solutions Guide .
2	Install and configure a Linux physical server SDC	At this point a ScaleIO LUN should be able to be provisioned to the Linux server. Cluster should also show the newly added VMWare SDC as Connected in the following command: <code>sccli -query_all_sdc</code>	As Expected	Pass ✓	Use documented procedure in <u>Linux SDC Installation</u> section of the Solutions Guide .

12.4.6 Test #6 – RAM Read Cache Settings

Item	Test	Expected Results / Explanation	Actual Results	Pass/Fail	Notes
1	Calculate and configure RAM Read Cache on SDS nodes.	The following command will show that all SDS RAM Read cache sizes were able to be set at 65% of the total memory on each SDS: <pre>scli --query_properties --object_type SDS -- properties RMCACHE_SIZE_IN_KB -- all_objects</pre>	As Expected	Pass ✓	Use documented procedure in RAM Read Cache section of the Solutions Guide . <u>This was specifically retested to validate that the EMC misspelled config file entries were no longer needed</u>

12.4.7 Test #7 – Pool/Disk type Throttling

Item	Test	Expected Results / Explanation	Actual Results	Pass/Fail	Notes
1	Volume QoS. Limit the IOPS that a volume can have.	Volume performance will be limited to IOPS throttle set. <pre># scli -- set_sdc_volume_limits --mdm_ip 10.40.99.173 - -volume_name cac01 -- sdc_ip 10.40.99.171 -- limit_iops 100</pre> Reest to unlimited with <pre># scli -- set_sdc_volume_limits --mdm_ip 10.40.99.173 - -volume_name cac01 -- sdc_ip 10.40.99.171 -- limit_bandwidth 0</pre>	As Expected	Pass ✓	SIO Dashboard was to confirm that the throttle was being adhered to.
2	Volume QoS. Limit the bandwidth that a volume can have.	Volume performance will be limited to bandwidth throttle set.	As Expected	Pass ✓	SIO Dashboard was to confirm that the throttle was being adhered to.

Item	Test	Expected Results / Explanation	Actual Results	Pass/Fail	Notes
		<pre># scli -- set_sdc_volume_limits --mdm_ip 10.40.99.173 - -volume_name cac01 -- sdc_ip 10.40.99.171 -- limit_bandwidth 10</pre> Reest to unlimited with <pre># scli -- set_sdc_volume_limits --mdm_ip 10.40.99.173 - -volume_name cac01 -- sdc_ip 10.40.99.171 -- limit_bandwidth 0</pre>			

12.4.8 Test #8 – Thick Provisioning

Item	Test	Expected Results / Explanation	Actual Results	Pass/Fail	Notes
1	Create a Thick volumes and provision it to a test SDC	LUN should show up to SDC and be mountable.	As Expected	Pass ✓	Use documented procedure in <i>Provisioning LUNs for Physical Environments</i> and <i>Provisioning LUNs for Virtual Environments</i> section of the Solutions Guide .
2	Validate that LUN can be used RAW or with filesystem.	LUN should accept I/O in either configuration.	As Expected	Pass ✓	Once raw device showed up to O.S., then created a filesystem on it.
3	Run reads and writes to the LUN	If a copy is used, a file should copy and have same checksum. If a tool was used to generate I/O it should completed without errors.	As Expected	Pass ✓	First ran iorate tool against the raw device. Then used a filesystem and made sure files could be copied to it.

12.4.9 Test #9 – Thin Provisioning (physical servers only)

Note: Further testing for thin provisioning will also be done in phase 2 of this project. In this testing, thin provisioning will be tested without over-commitment.

Item	Test	Expected Results / Explanation	Actual Results	Pass/Fail	Notes
1	Create a Thin volumes and provision it to a test SDC		As Expected	Pass ✓	Created thin LUN scott01 as 8GB and mapped to SDC gdsexiv02. Used capacity of the LUN showed as a few KB.
2	Run reads and writes to the LUN	Used space on the LUN should increase	As Expected	Pass ✓	After a few minutes of I/O the actual used space on the LUN was up to 6GB
3	Delete the LUN and fill up all but 1GB of the entire cluster with thick LUNs. Then re-create the thin LUN with a size of 8GB. On the SDC create a filesystem on the LUN. Then start copying a big file (8GB or bigger) to the filesystem.	Cluster should go to 100% and put the SDC thin LUN as read-only. This should happen very quick (minutes only)	Not Expected	Failed ✗	Even though the cluster only had 1GB of free space, it did not mark the filesystem read-only. Instead the cluster allowed the whole file to be copied by using protected space. So although the file copied, the cluster was in an unprotected mode. See Known Issues Section about thin provisioning .

12.4.10 Test #10 – Log Reconciliation (SEMs/ArcSight)

Item	Test	Expected Results / Explanation	Actual Results	Pass/Fail	Notes
1	Configure remote_syslog on ScaleIO cluster	The following command should show that the remote_syslog is pointed to the SEMs/ArcSight servers: <code>scli --query_remote_syslog</code>	As Expected	Pass ✓	Use documented procedure in Log Reconciliation (SEMs/ArcSight) under ScaleIO Cluster Configuration section of the Solutions Guide .
2	Create some change configuration events and non-change	SEMs/ArcSight server should get the events in their syslog	As Expected	Pass ✓	For change configuration events I created and removed a volume. For

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
	configuration events on the ScaleIO Cluster	server			non-change configuration events I did several different types of query commands.
3	Review SEMs reconciliation report	The SEMs/ArcSight report should only contain the change configuration events.	As Expected	Pass ✓	

12.4.11 Test #11 – Automated SBCC (HPNA)

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Configure HPNA on ScaleIO Cluster		As Expected	Pass ✓	Used documented procedure in Automated SBCC (HPNA) under ScaleIO Cluster Configuration section of the Solutions Guide .
2	Create a parameter on the ScaleIO Cluster that goes against the HPNA policies and rules	Cluster should allow these <i>non</i> -best practices settings to be set.	As Expected	Pass ✓	For the EMC ScaleIO – Misc Policy the remote_read-only_limit_stated was disabled. For the EMC ScaleIO – Pools Policy the default storage pool was created.
3	Run the Policy and Rules on the HPNA server and validate that the problems are found.	When the HPNA rules run, it should throw an exception for the two different policies.	As Expected	Pass ✓	

12.4.12 Test #12 – EMC SRM Performance Reporting

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Ensure that SRM data can be set up in a resilient manner	SRM can collect data when MDM fails over or when primary gateway is unavailable.	As Expected for MDM test.	Partial Pass ✓	SRM can now deal with MDM failover. Also SRM permits set up of a second REST gateway to use, but there may be issues with using the token from the

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
					primary with the secondary gateway. Further testing will be undertaken.
2	Ensure ScaleIO data is collected by SRM	Data appears in SRM	As Expected	Pass ✓	
3	Ensure ScaleIO data collected by SRM is valid	Metrics in SRM match metrics in SIO Dashboard	Not Expected	Failed ✗	Outstanding issues logged with EMC via ticket SR #72092654
4	Ensure SRM has all the reports Citi needs	Check reports match requirements doc	Only a subset of required reports are currently available.	Failed ✗	EMC are working to add missing reports in the next few releases of SRM

12.4.13 Test #13 – Background Device Scanner

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Check that background device scanner detects artificially induced corruption.	SNMP trap should be sent, and specific details of comparison error logged.	As Expected	Pass ✓	

12.4.14 Test #14 – Security Fixes Verification

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Validation that the two clear text passwords (snmp and admin) in ScaleIO config files are now obfuscated.	After both upgrade and new installs the clear text passwords in config files should be obfuscated.	As Expected	Pass ✓	

12.4.15 Test #15 – T++ Hardware Environment Testing

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	CATE engineers were given the first Tornado++ environment in MWDC for 12 days. Various tests were run on the only production like test environment CATE was given.	The expected results for these tests varied depending on the test that was being run.	As Expected	Pass ✓	Test document for T++ is at this URL: ScaleIO 1.32.0 MWDC T++ Testing

12.4.16 Test #16 – Rebuild IO priority controls

Item	Test	Expected Results / Explanation	Actual Results	Pass/ Fail	Notes
1	Confirm that the IO priority controls work as expected in R1.32 (broken in R1.31)	Throttles work as documented by EMC.	As Expected	Pass ✓	