FUJITSU PRIMERGY SX350 S8 Storage system

Executive summary

After performing all tests, the FUJITSU PRIMERGY SX350 S8 has been officially certified according to the Open-E Hardware Certification Program Guide 2.1.

During the tests, it was found that the system is functional and efficient. With the Open-E DSS V7 operating system installed, the FUJITSU PRIMERGY SX350 S8 is stable and performs well.

In general, the system can be used for many different applications, but the following are recommended:

- ✓ **iSCSI storage**

  The following features make FUJITSU PRIMERGY SX350 S8 good iSCSI storage:

  - **Various hardware RAID levels and enterprise class disks for high performance and data safety.**
  - **Two 1GbE and two 10GbE interfaces for fast MPIO connection and flexible network topology.**
  - **Redundant power supply for system reliability.**

- ✓ **NAS filer**

  The following features make FUJITSU PRIMERGY SX350 S8 a good NAS filer solution:

  - **Ten high class SAS hard drives provide a lot of space for user files and ensure good random access speed.**
  - **Hardware RAID5 and RAID6 for fault tolerance and the efficient use of available disk space.**
  - **Two 10GbE and two 1GbE interfaces for independent connection to different networks or link aggregation for improved throughput.**

- ✓ **Storage for CCTV**

  For this application the following can be used:

  - **Ten high capacity SAS drives with hardware RAID provide lots of redundant storage for CCTV records.**
  - **Multiple network interfaces for flexible and fast network connections.**

Certification notes

For link aggregation, it is recommended to use balance-alb or 802.3ad bonding modes. Tests were performed on four iSCSI targets simultaneously.

FUJITSU PRIMERGY SX350 S8 hardware components 4
FUJITSU PRIMERGY SX350 S8 photos 5
Auxiliary systems hardware components 6
Administration functionality 7
Network functionality 8
Network test topology 8
802.3ad bonding mode test 9
Balance-alb bonding mode test 11
Balance-rr bonding mode test 13
Single NIC performance test 15
RAID functionality 17
RAID test topology 17
Hardware RAID0 test 18
Hardware RAID5 test 19
Hardware RAID6 test 20
Hardware RAID10 test 21
Hardware RAID50 test 22
Hardware RAID60 test 23
NAS functionality 24
NAS test topology 24
SMB test 25
iSCSI functionality 26
iSCSI Initiator test topology 26
iSCSI Target test topology 26
iSCSI Initiator test 27
iSCSI Target test 28

FUJITSU PRIMERGY SX350 S8 hardware components

Technical specifications about the certified system are listed below:

Model	FUJITSU PRIMERGY SX350 S8
Operating system	Open-E DSS V7 build 18016
Enclosure/chassis	PRIMERGY SX350 S8
CPU	Intel® Xeon® Processor E5-2630 v2 2.60GHz
Motherboard	FUJITSU D2949-B1
Memory	2x 8GB Hynix HMT41GR7AFR4A DDR3 ECC REG
Network	Intel® Ethernet Controller I350-AM2
Network	FUJITSU PRIMERGY 10Gb Network Controller (D2755)
HW RAID	FUJITSU RAID Controller SAS 6Gbit/s 1GB (D3116C)
Hard disk drives	2x 300GB Seagate Savio® ST300MM0006
Hard disk drives	8x 600GB Seagate Savio® ST600MM0006

TABLE 1: Hardware components list of Certified System with Open-E DSS V7

FUJITSU PRIMERGY SX350 S8 photos

FIGURE 1: Front photo

FIGURE 2: Rear photo

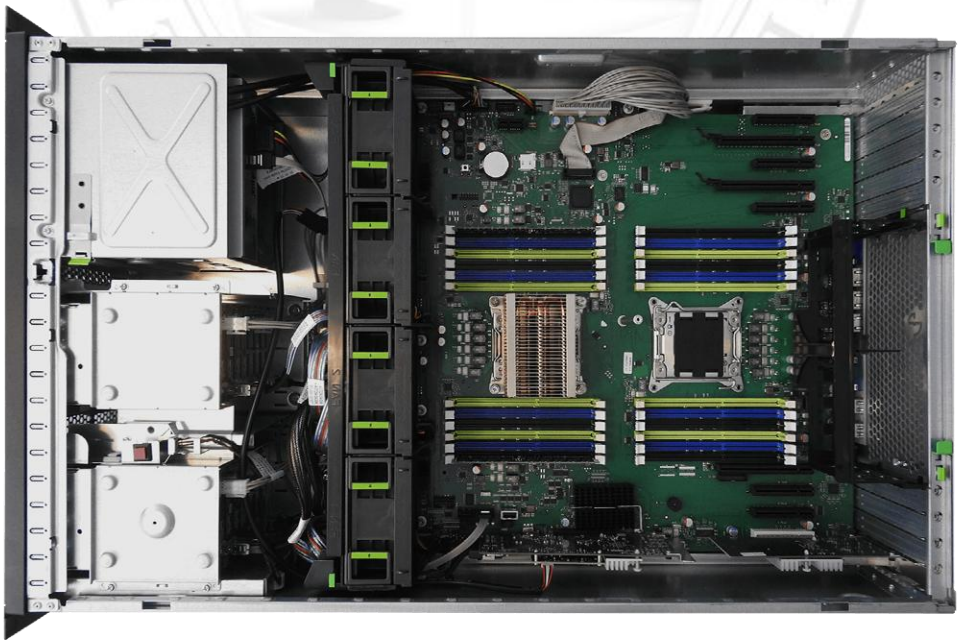

FIGURE 3: Top photo

Auxiliary systems hardware components

Auxiliary systems with MS Windows or Open-E DSS V7 installed, used in Open-E Hardware Certification Process.

Model	Custom
Operating system	MS Windows Server 2012 R2
Enclosure/chassis	Intel® R2224GZ4GC4 2U Chassis
Motherboard	Intel® Server Board S2600GZ4
CPU	Intel® Xeon® Processor E5-2643 3.30GHz
Memory	8x 16GB Kingston 9965516-421.A00LF DDR3 ECC REG
Network	Intel® Ethernet Controller I350-AM4
Network	Dual Port Intel® 82599EB 10GbE I/O Module AXX10GBNIAIOM
Hard disk controller	Intel® Integrated RAID Module RMS25PB080
Hard disk drives	900GB Western Digital XE WD9001BKHG

TABLE 2: Hardware components of first Workstation with MS Windows

Model	Custom
Operating system	MS Windows Server 2012 R2
Enclosure/chassis	Intel® R2224GZ4GC4 2U Chassis
Motherboard	Intel® Server Board S2600GZ4
CPU	Intel® Xeon® Processor E5-2643 3.30GHz
Memory	8x 16GB Kingston 9965516-421.A00LF DDR3 ECC REG
Network	Intel® Ethernet Controller I350-AM4
Network	Dual Port Intel® 82599EB 10GbE I/O Module AXX10GBNIAIOM
Hard disk controller	Intel® Integrated RAID Module RMS25PB080
Hard disk drives	900GB Western Digital XE WD9001BKHG

TABLE 3: Hardware components of second Workstation with MS Windows

Model	FUJITSU PRIMERGY SX350 S8
Operating system	Open-E DSS V7 build 18016
Enclosure/chassis	PRIMERGY SX350 S8
CPU	Intel® Xeon® Processor E5-2630 v2 2.60GHz
Motherboard	FUJITSU D2949-B1
Memory	2x 8GB Hynix HMT41GR7AFR4A DDR3 ECC REG
Network	Intel® Ethernet Controller I350-AM2
Network	FUJITSU PRIMERGY 10Gb Network Controller (D2755)
HW RAID	FUJITSU RAID Controller SAS 6Gbit/s 1GB (D3116C)
Hard disk drives	2x 300GB Seagate Savio® ST300MM0006
Hard disk drives	8x 600GB Seagate Savio® ST600MM0006

TABLE 4: Hardware components of Workstation with Open-E DSS V7

Model	Supermicro SSE-X3348TR
Description	24-port 10GbE switch

TABLE 5: Network switch details for connection with 10GbE

Administration functionality

The following functionality has been tested.

Drive identifier	N/A
Power button	OK
Front and rear LEDs	OK

TABLE 6: Administration functionality test results

Network functionality

Tests performed in this section check the functionality, performance and stability of the network solutions available in the Open-E DSS V7 product on the certified system.

The tests rely on configuring the iSCSI targets and copying the data from many *Workstations with MS Windows* through various network connections with big block size using appropriate testing tools.

Network test topology

Network topology for Network testing is shown below.

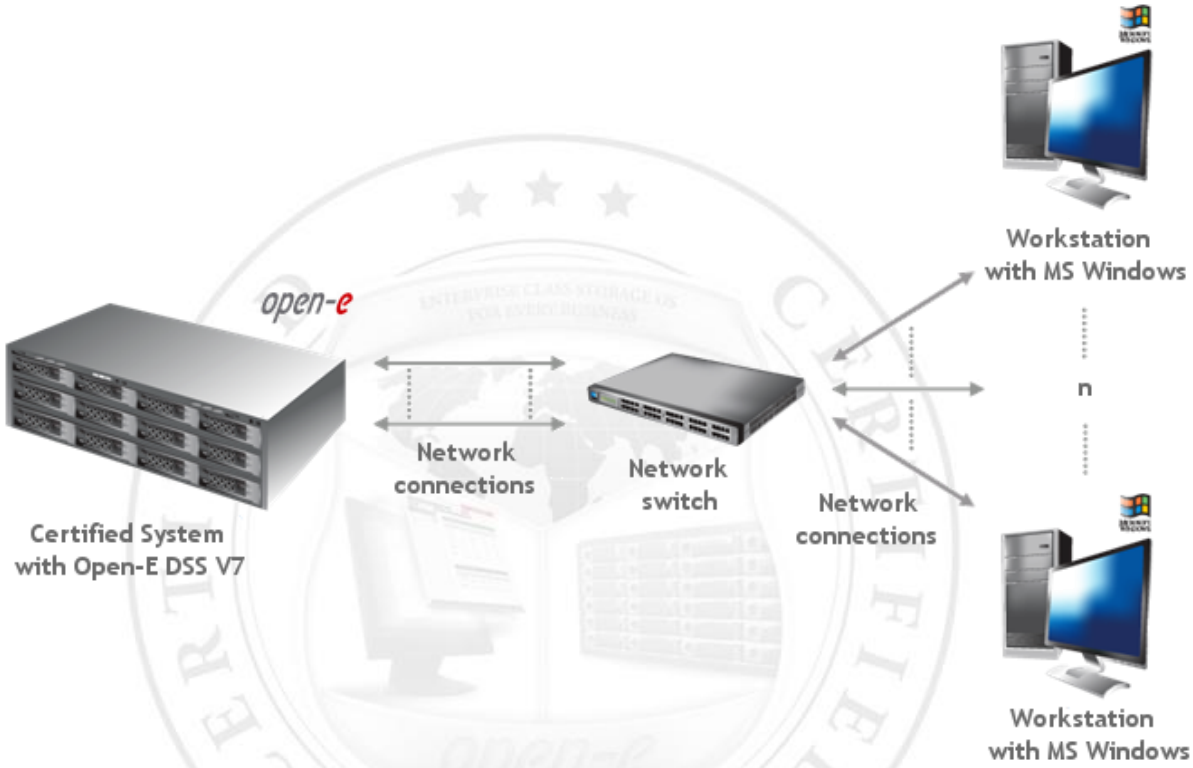

FIGURE 4: Network topology for Network testing

802.3ad bonding mode test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from many Workstations with MS Windows through an 802.3ad bonding mode network connection with a 4MB block size using the Iometer testing tool.

2. Test results for 802.3ad bonding mode test performed on Intel® Ethernet Controller I350-AM2

802.3ad bonding mode performance test results			
NIC model	Intel® Ethernet Controller I350-AM2		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	113.02	57.33	passed
2nd Workstation	112.89	57.25	passed

TABLE 7: 802.3ad bonding mode performance test results table for Intel® Ethernet Controller I350-AM2

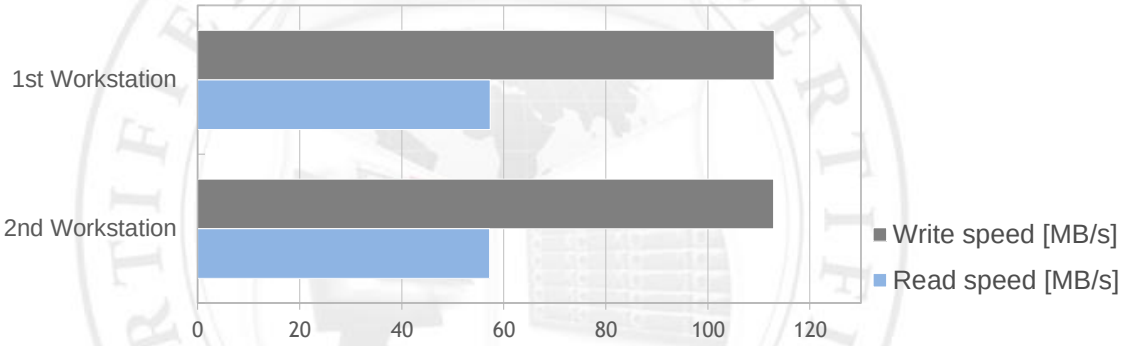

FIGURE 5: 802.3ad bonding mode performance test results chart for Intel® Ethernet Controller I350-AM2

3. Test results for 802.3ad bonding mode test performed on FUJITSU PRIMERGY 10Gb Network Controller (D2755)

802.3ad bonding mode performance test results			
NIC model	FUJITSU PRIMERGY 10Gb Network Controller		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	479.58	445.24	passed
2nd Workstation	1128.8	606.09	passed

TABLE 8: 802.3ad bonding mode performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

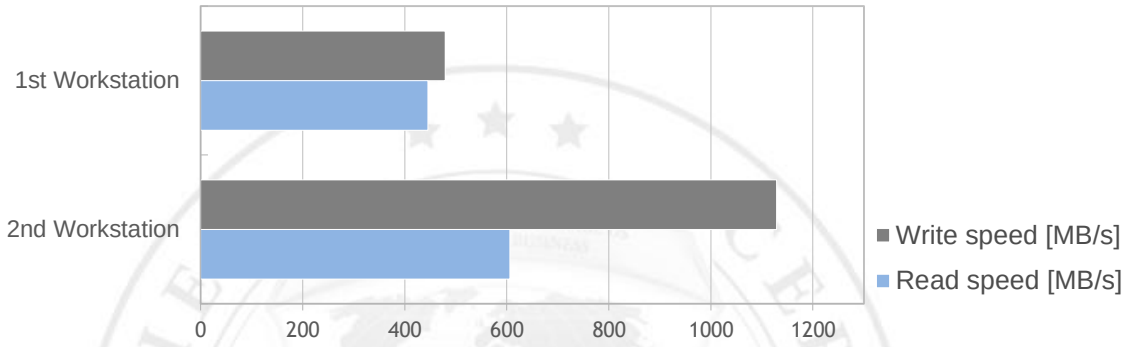

FIGURE 6: 802.3ad bonding mode performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Balance-alb bonding mode test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from many *Workstations with MS Windows* through a Balance-alb bonding mode network connection with a 4MB block size using the Iometer testing tool.

2. Test results for Balance-alb bonding mode test performed on Intel® Ethernet Controller I350-AM2

Balance-alb bonding mode performance test results			
NIC model	Intel® Ethernet Controller I350-AM2		
Workstations with MS Windows	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
1st Workstation	113.02	111.76	passed
2nd Workstation	112.89	111.70	passed

TABLE 9: Balance-alb bonding mode performance test results table for Intel® Ethernet Controller I350-AM2

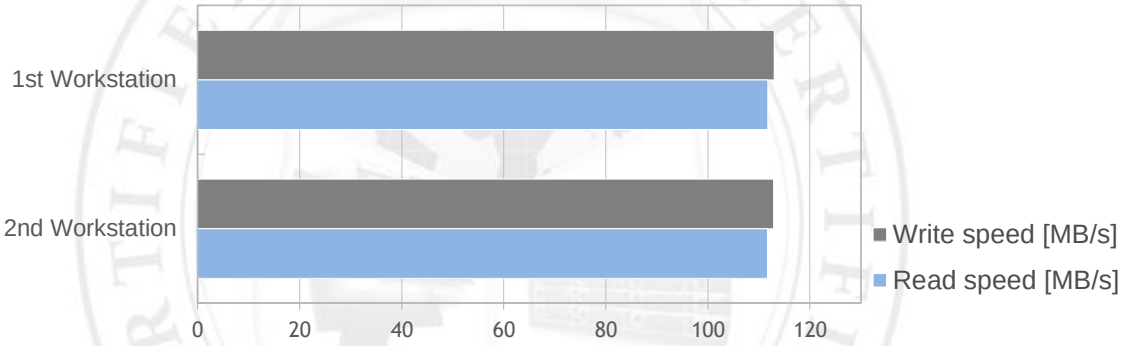

FIGURE 7: Balance-alb bonding mode performance test results chart for Intel® Ethernet Controller I350-AM2

3. Test results for Balance-alb bonding mode test performed on FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Balance-alb bonding mode performance test results			
NIC model	FUJITSU PRIMERGY 10Gb Network Controller		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	921.24	526.37	passed
2nd Workstation	1030.70	507.04	passed

TABLE 10: Balance-alb bonding mode performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

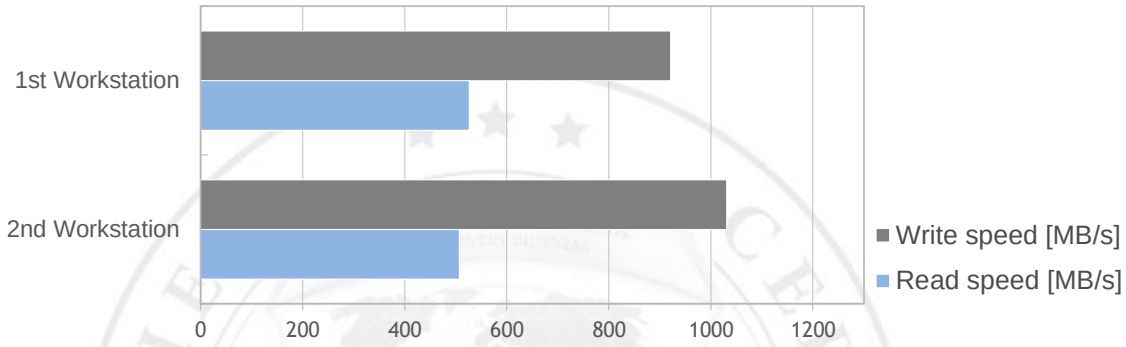

FIGURE 8: Balance-alb bonding mode performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Balance-rr bonding mode test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from many *Workstations with MS Windows* through a Balance-rr bonding mode network connection with a 4MB block size using the Iometer testing tool.

2. Test results for Balance-rr bonding mode test performed on Intel® Ethernet Controller I350-AM2

Balance-rr bonding mode performance test results			
NIC model	Intel® Ethernet Controller I350-AM2		
Workstations with MS Windows	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
1st Workstation	113.06	112.06	passed
2nd Workstation	112.90	111.86	passed

TABLE 11: Balance-rr bonding mode performance test results table for Intel® Ethernet Controller I350-AM2

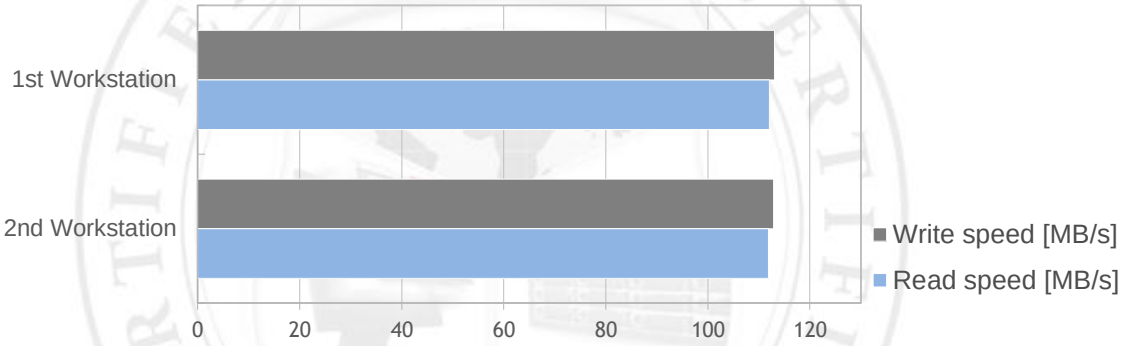

FIGURE 9: Balance-rr bonding mode performance test results chart for Intel® Ethernet Controller I350-AM2

3. Test results for Balance-rr bonding mode test performed on FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Balance-rr bonding mode performance test results			
NIC model	FUJITSU PRIMERGY 10Gb Network Controller		
Workstations with MS Windows	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
1st Workstation	675.86	456.95	passed
2nd Workstation	951.21	405.57	passed

TABLE 12: Balance-rr bonding mode performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

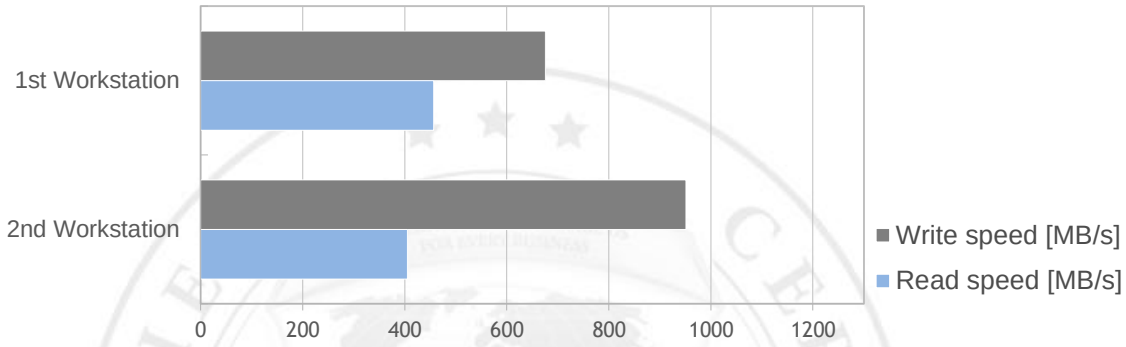

FIGURE 10: Balance-rr bonding mode performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Single NIC performance test

1. Test description

The test relies on configuring the iSCSI targets and copying the data from *Workstations with MS Windows* through single NIC with a 4MB block size using the Iometer testing tool.

2. Test results for single NIC test performed on Intel® Ethernet Controller I350-AM2

Single NIC performance test results			
NIC model	Intel® Ethernet Controller I350-AM2		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	113.01	112.88	passed

TABLE 13: Single NIC performance test results table for Intel® Ethernet Controller I350-AM2

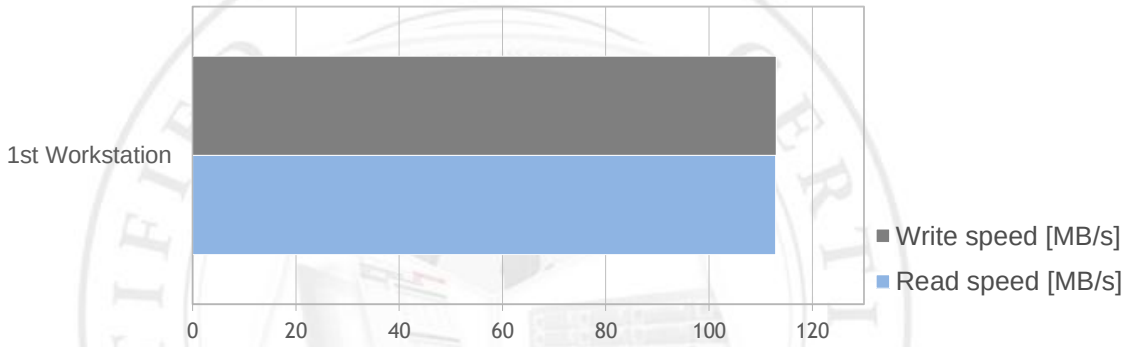

FIGURE 11: Single NIC performance test results chart for Intel® Ethernet Controller I350-AM2

3. Test results for single NIC test performed on FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Single NIC performance test results			
NIC model	FUJITSU PRIMERGY 10Gb Network Controller		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	1046.43	590.13	passed

TABLE 14: Single NIC performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

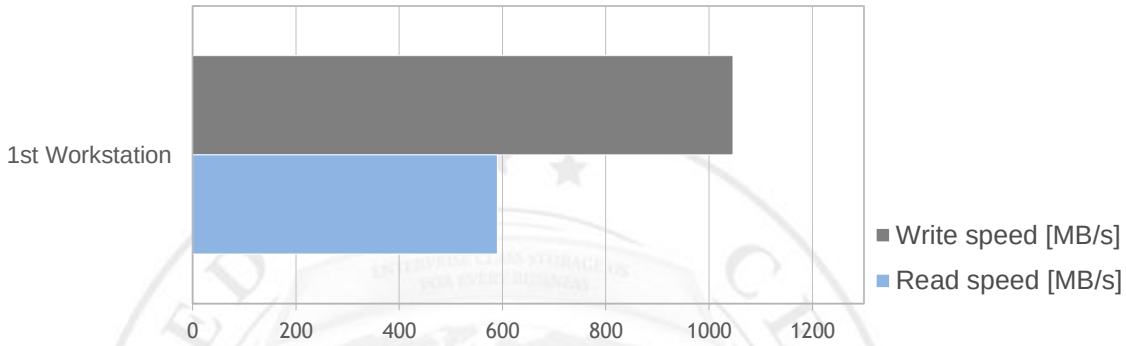

FIGURE 12: Single NIC performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

RAID functionality

Tests performed in this section check the functionality, performance and stability of Open-E DSS V7 storage devices on the certified system.

Tests in this section rely on the creation of the RAID units on 0, 5, 6, 10, 50 and 60 levels, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

RAID test topology

Network test topology for RAID testing is shown below

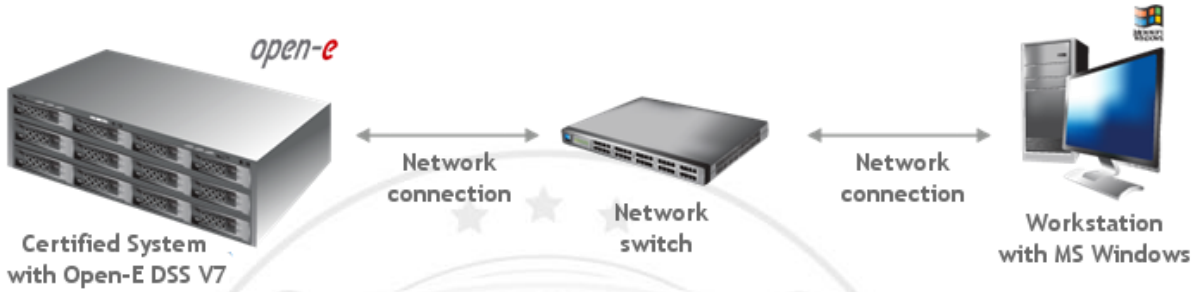

FIGURE 13: Network test topology for RAID testing

Hardware RAID0 test

1. Test description

The test relies on creation of the RAID0 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID0 and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

RAID0 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	202.48	305.50	passed
32	813.68	649.00	passed
64	874.82	607.56	passed
128	895.77	731.15	passed
256	906.15	728.44	passed
512	891.74	655.62	passed
1024	888.36	603.06	passed
4096	927.46	625.61	passed

TABLE 15: RAID0 performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

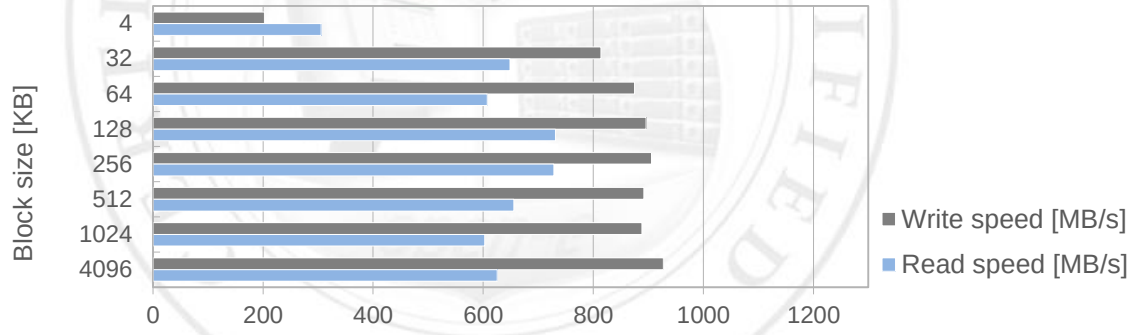

FIGURE 14: RAID0 performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Hardware RAID5 test

1. Test description

The test relies on creation of the RAID5 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID5 and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

RAID5 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	92.46	68.30	passed
32	549.12	498.77	passed
64	802.02	830.89	passed
128	825.61	950.01	passed
256	877.55	972.08	passed
512	957.25	746.68	passed
1024	935.20	483.41	passed
4096	961.87	654.70	passed

TABLE 16: RAID5 performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

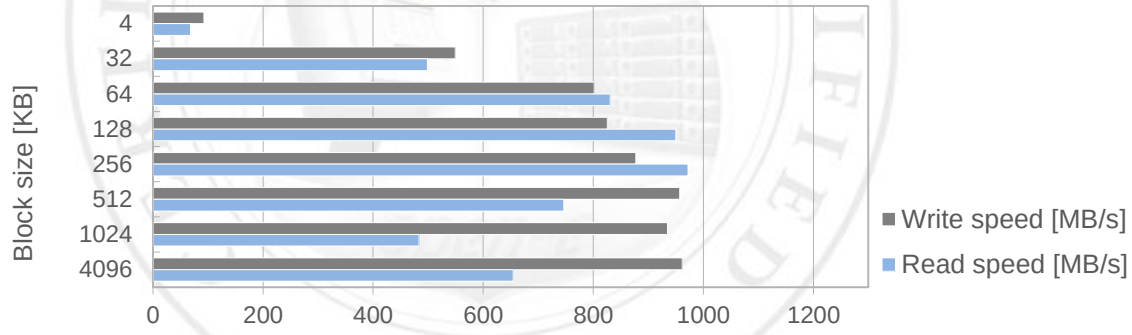

FIGURE 15: RAID5 performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Hardware RAID6 test

1. Test description

The test relies on creation of the RAID6 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID6 and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

RAID6 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	93.26	65.31	passed
32	600.25	509.03	passed
64	824.03	711.55	passed
128	874.40	719.52	passed
256	948.11	691.82	passed
512	1028.39	637.99	passed
1024	1081.47	396.94	passed
4096	1075.12	707.10	passed

TABLE 17: RAID6 performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

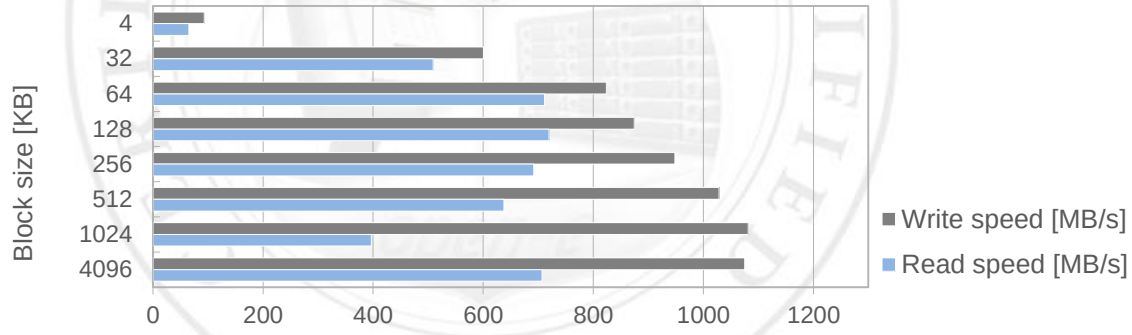

FIGURE 16: RAID6 performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Hardware RAID10 test

1. Test description

The test relies on creation of the RAID10 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID10 and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

RAID10 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	92.45	61.98	passed
32	537.26	406.93	passed
64	770.77	386.22	passed
128	823.66	366.78	passed
256	936.42	344.29	passed
512	942.35	302.53	passed
1024	919.98	348.44	passed
4096	920.10	460.35	passed

TABLE 18: RAID10 performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

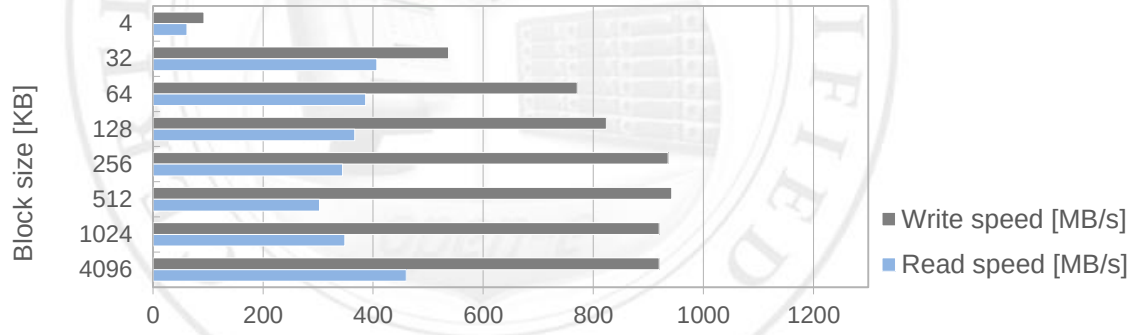

FIGURE 17: RAID10 performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Hardware RAID50 test

1. Test description

The test relies on creation of the RAID50 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID50 and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

RAID50 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	196.19	291.98	passed
32	791.35	445.59	passed
64	715.46	305.50	passed
128	669.52	344.00	passed
256	652.01	455.85	passed
512	648.10	467.01	passed
1024	653.83	470.48	passed
4096	678.42	495.55	passed

TABLE 19: RAID50 performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

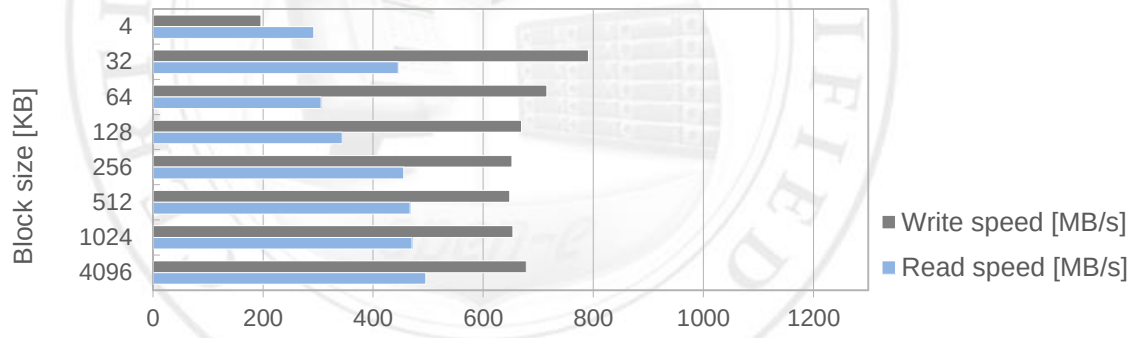

FIGURE 18: RAID50 performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

Hardware RAID60 test

1. Test description

The test relies on creation of the RAID60 unit on all hard disk drives, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for RAID60 and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

RAID60 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	195.49	278.59	passed
32	709.66	297.71	passed
64	673.35	184.09	passed
128	501.22	227.24	passed
256	566.17	318.24	passed
512	557.32	338.91	passed
1024	567.48	384.53	passed
4096	585.42	436.12	passed

TABLE 20: RAID60 performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

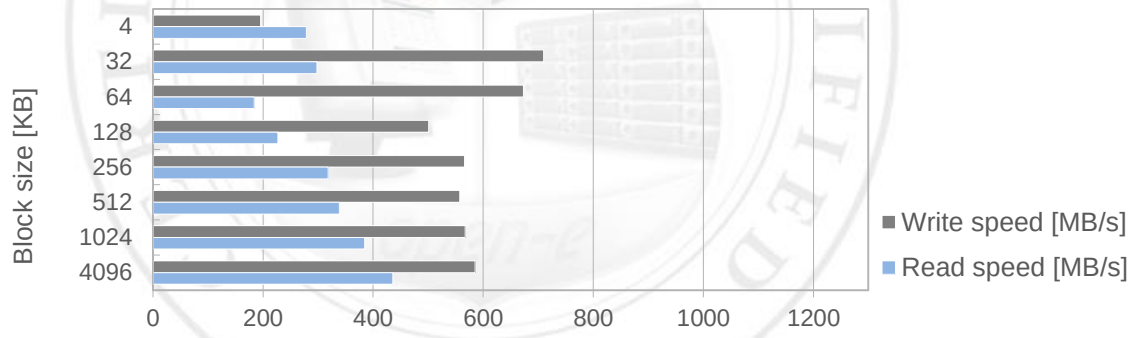

FIGURE 19: RAID60 performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

NAS functionality

Tests performed in this section check the functionality, performance and stability of the NAS protocols in the Open-E DSS V7 product on the certified system.

The tests rely on creating NAS shares and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

NAS test topology

Network topology for NAS testing is shown below.

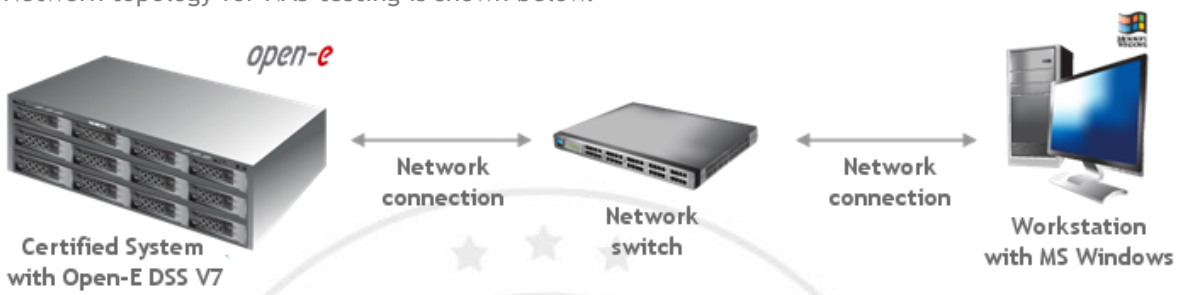

FIGURE 20: Network topology for NAS testing

SMB test

1. Test description

The tests rely on creating NAS shares and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the Iometer testing tool.

2. Test results for SMB and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

SMB performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	70.01	83.96	passed
32	275.31	634.44	passed
64	496.09	637.92	passed
128	394.44	838.90	passed
256	544.57	864.95	passed
512	547.67	892.26	passed
1024	446.89	885.13	passed
4096	597.14	898.48	passed

TABLE 21: SMB performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

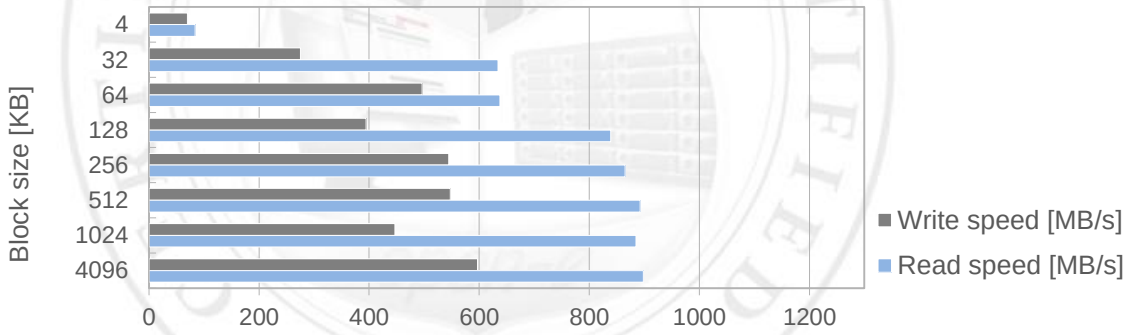

FIGURE 21: SMB performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

iSCSI functionality

Tests performed in this section check the functionality, performance and stability of the iSCSI protocol in the Open-E DSS V7 product on the certified system.

iSCSI Initiator test topology

Network topology for iSCSI Initiator testing is shown below.

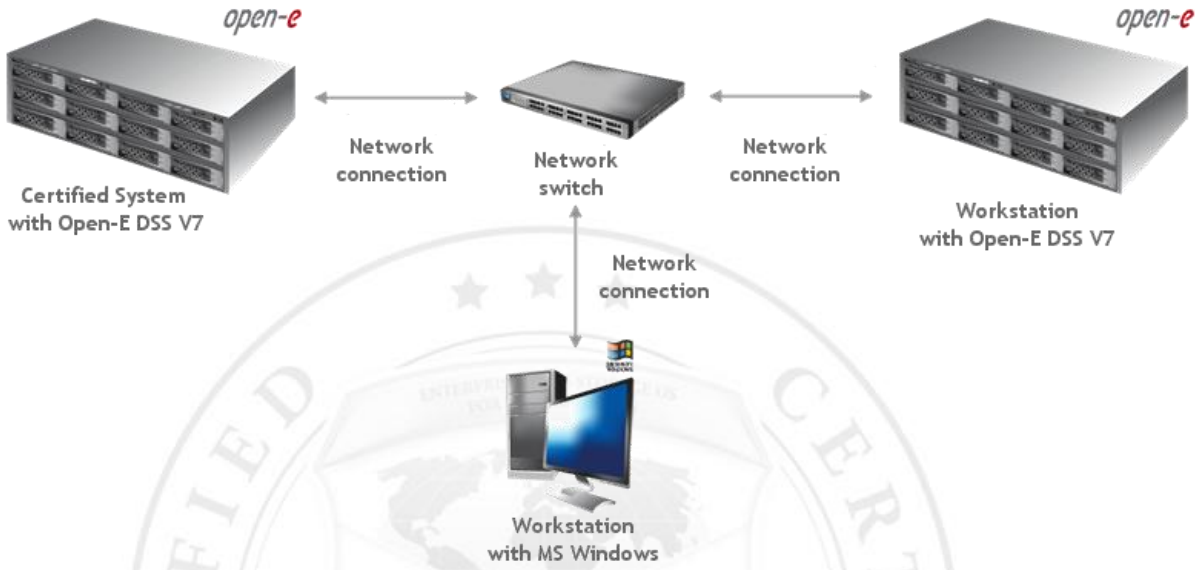

FIGURE 22: Network topology for iSCSI Initiator testing

iSCSI Target test topology

Network topology for iSCSI Target testing is shown below.

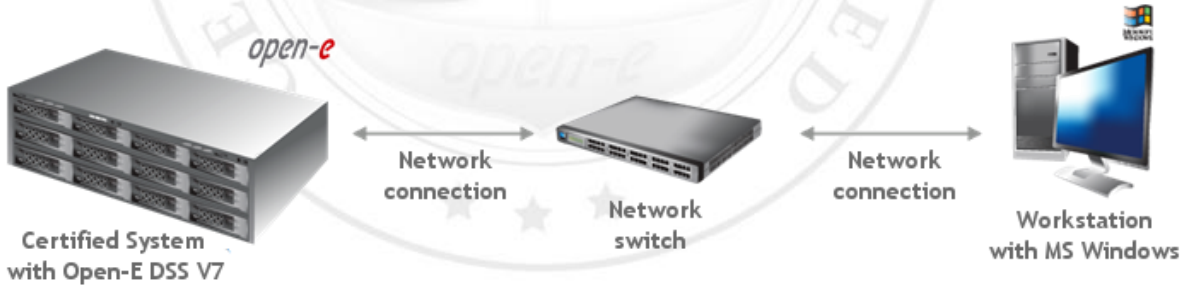

FIGURE 23: Network topology for iSCSI Target testing

iSCSI Initiator test

1. Test description

The test relies on using the storage connected via the built-in iSCSI Initiator for NAS volumes, creating SMB shares on these NAS volumes and copying data from a *Workstation with MS Windows* to them with various block sizes using the Iometer testing tool.

2. Test results for iSCSI Initiator and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

iSCSI Initiator performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	70.30	83.69	passed
32	197.61	626.97	passed
64	401.68	641.34	passed
128	307.18	830.95	passed
256	289.90	860.61	passed
512	296.77	867.04	passed
1024	338.11	858.41	passed
4096	439.64	876.29	passed

TABLE 22: iSCSI Initiator performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

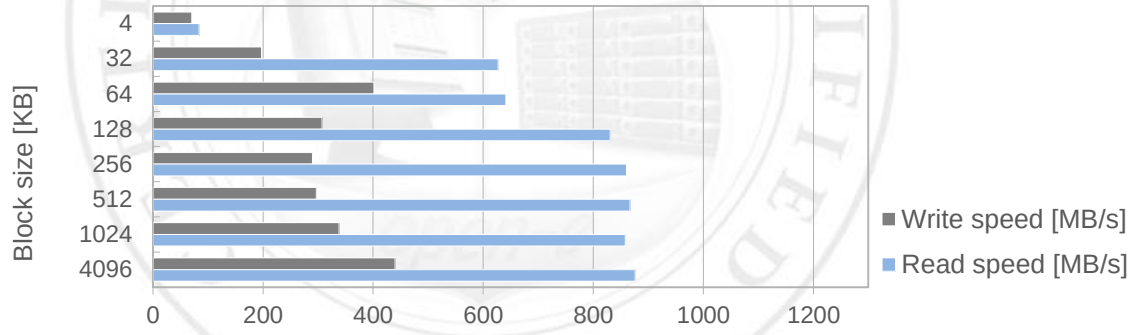

FIGURE 24: iSCSI Initiator performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

iSCSI Target test

1. Test description

The test relies on creating the iSCSI target on the certified system and copying the data from a *Workstation with MS Windows* to it with various block sizes using the Iometer tool.

2. Test results for iSCSI Target and FUJITSU PRIMERGY 10Gb Network Controller (D2755)

iSCSI Target performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	202.83	308.31	passed
32	867.33	648.41	passed
64	901.88	601.84	passed
128	914.29	739.94	passed
256	898.22	714.41	passed
512	896.49	667.82	passed
1024	892.75	608.00	passed
4096	921.40	643.34	passed

TABLE 23: iSCSI Target performance test results table for FUJITSU PRIMERGY 10Gb Network Controller (D2755)

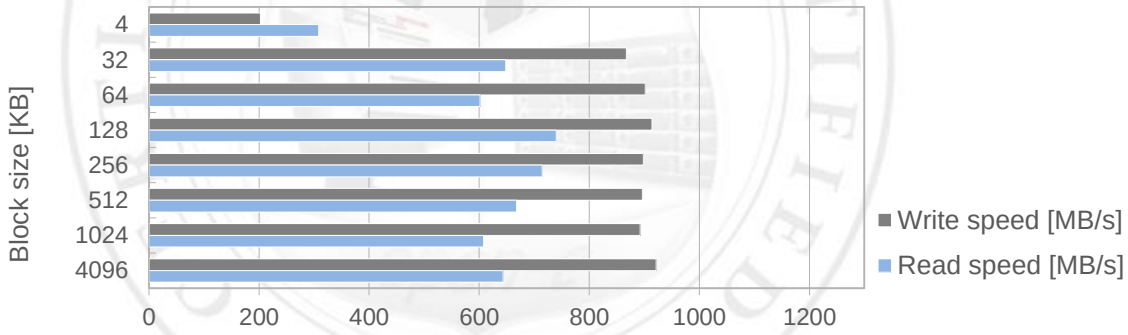

FIGURE 25: iSCSI Target performance test results chart for FUJITSU PRIMERGY 10Gb Network Controller (D2755)