macle GmbH
IBM System x3650 M4

Executive summary

After performing all tests, the Certification Document macle GmbH IBM System x3650 M4 system 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 macle GmbH IBM System x3650 M4 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 macle GmbH IBM System x3650 M4 good iSCSI storage:

  - Sixteen high capacity SAS drives ensure a lot of fast storage space.
  - Four 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 macle GmbH IBM System x3650 M4 a great NAS filer solution:

  - Sixteen high capacity SAS hard drives provide a plenty of space for user files.
  - Hardware RAID5 for fault tolerance and the most efficient use of available disk space.
  - Two 10GbE and four 1GbE interfaces for independent connection to different networks or link aggregation for improved throughput.

- ✓ **Storage for Virtualization**

  For this application the following can be used:

  - Sixteen fast SAS drives with HW RAID5 for good virtual machine density.
  - Two 10GbE interfaces for efficient network connections to virtualization systems.
  - Four 1GbE interfaces, which may be aggregated, for connections with virtualized systems.
  - Redundant power supply for system reliability.
  - RAID controller flash memory with supercapacitor module for data safety in power outage scenario.

Certification notes

It is recommended to use balance-alb bonding mode.

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IBM System x3650 M4 hardware components

Technical specifications about the certified system are listed below:

Model	IBM System x3650 M4
Operating system	Open-E DSS V7 build 10529
Enclosure/chassis	IBM X3650 M4
CPU	Intel® Xeon ® CPU E5-2609 2,4GHz
Motherboard	IBM X3650 M4 7915B2A
Memory	4x 4GB PC3L 10600R-9-11 1066 MHz
Network	4x Intel Ethernet Server Adapter I350-T2
Network	Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)
HW RAID	IBM Serveraid M5100 1GB Flash
Hard disk drives	16x 1TB IBM 7.2K 6G NL SFF SAS HDD

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

IBM System x3650 M4 photos

FIGURE 1: Front photo

FIGURE 2: Rear photo

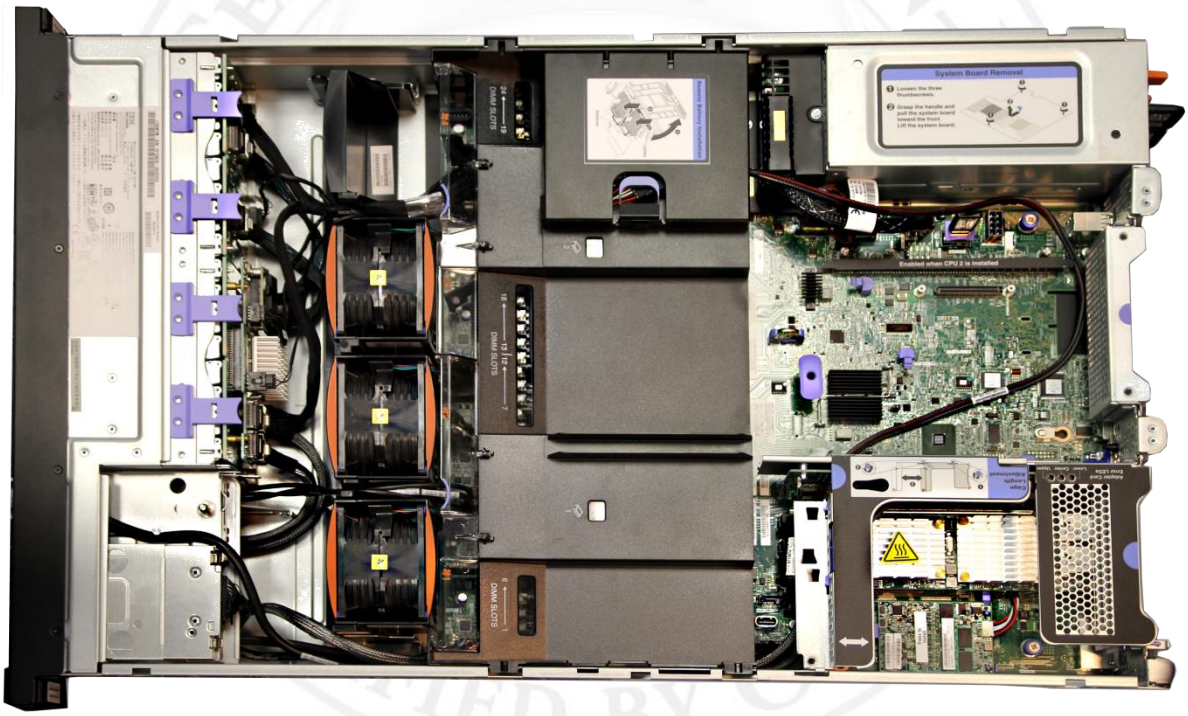

FIGURE 3: Top photo

Auxiliary systems hardware components

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

Model	IBM System x3550 M4
Operating system	MS Windows Server 2008 R2
Enclosure/chassis	IBM x3550 M4
Motherboard	System x3550 M4
CPU	2x 2.50 GHz Intel® Xeon® Processor E5-2640
Memory	2x 8GB IBM 1333MHZ PC3-10600 240-PIN CL9 ECC DUAL RANK X4
Network	4x Intel Ethernet Server Adapter I350-T2
Network	Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)
Hard disk drives	300GB IBM 10K 6G SAS 2.5 HDD G2 HS

TABLE 2: Hardware components of first Workstation with MS Windows

Model	IBM System x3550 M4
Operating system	MS Windows Server 2012
Enclosure/chassis	IBM x3550 M4
Motherboard	System x3550 M4
CPU	2x 2.50 GHz Intel® Xeon® Processor E5-2640
Memory	2x 8GB IBM 1333MHZ PC3-10600 240-PIN CL9 ECC DUAL RANK X4
Network	4x Intel Ethernet Server Adapter I350-T2
Network	Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)
Hard disk drives	300GB IBM 10K 6G SAS 2.5 HDD G2 HS

TABLE 3: Hardware components of second Workstation with MS Windows

Model	IBM System x3650 M4
Operating system	Open-E DSS V7 build 10529
Enclosure/chassis	IBM X3650 M4
CPU	Intel® Xeon ® CPU E5-2609 2,4GHz
Motherboard	IBM X3650 M4 7915B2A
Memory	4x 4GB PC3L 10600R-9-11 1066 MHz
Network	4x Intel Ethernet Server Adapter I350-T2
Network	Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)
HW RAID	IBM Serveraid M5100 1GB Flash
Hard disk drives	16x 1TB IBM 7.2K 6G NL SFF SAS HDD

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

Model	ProSafe Plus XS708E
Description	8 ports 100/1000/10000 Mbps RJ45 ports and one 10GbE SFP+ fiber

TABLE 5: Network switch details for 1GbE and 10 GbE connections

Administration functionality

The following functionality has been tested.

Drive identifier	OK
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.

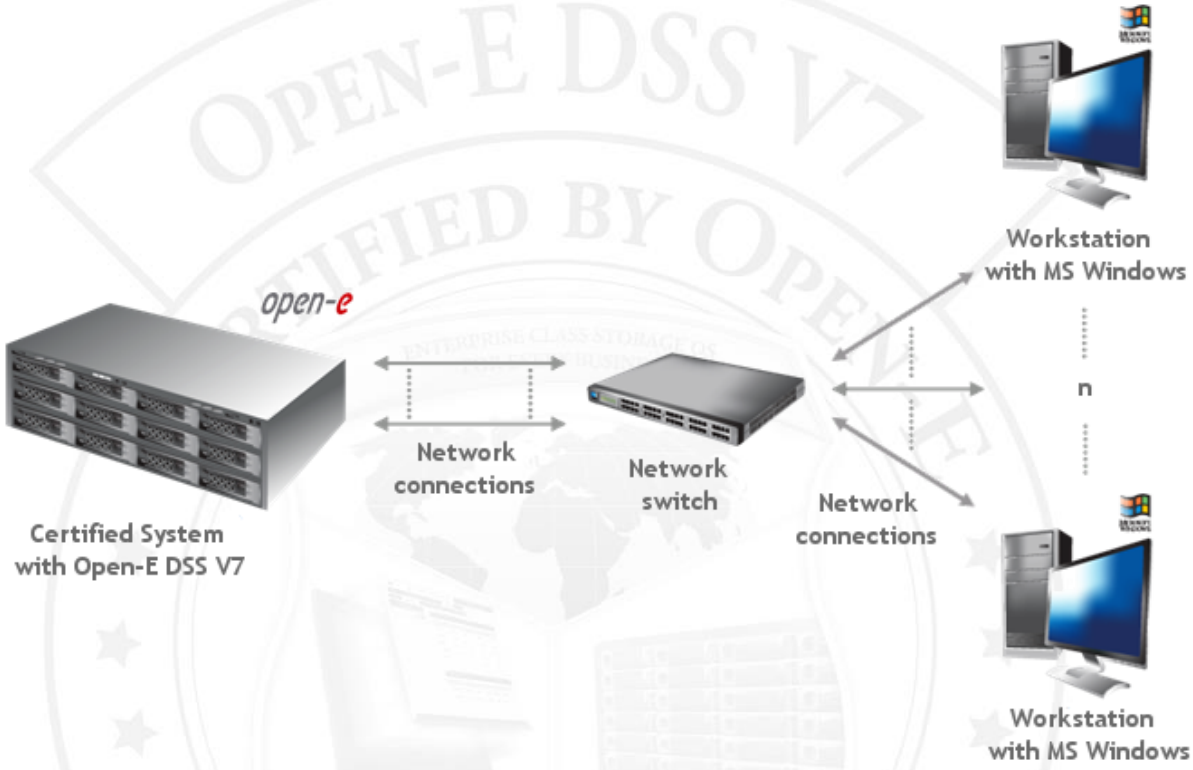

FIGURE 4: Network topology for Network testing

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 Server Adapter I350-T2

802.3ad bonding mode performance test results			
NIC model	Intel Ethernet Server Adapter I350-T2		
Workstations with MS Windows	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
1st Workstation	57.17	62.82	passed
2nd Workstation	59.49	66.20	passed

TABLE 7: 802.3ad bonding mode performance test results table for Intel Ethernet Server Adapter I350-T2

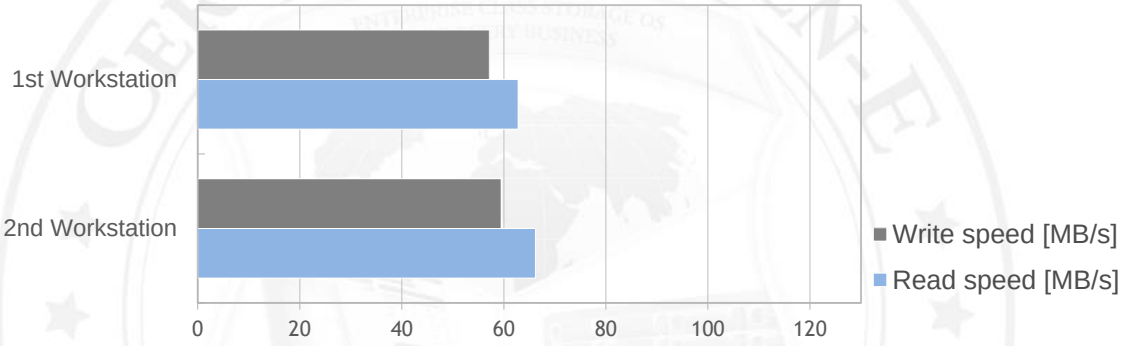

FIGURE 5: 802.3ad bonding mode performance test results chart for Intel Ethernet Server Adapter I350-T2

3. Test results for 802.3ad bonding mode test performed on Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

802.3ad bonding mode performance test results			
NIC model	Broadcom NetXtreme II 10GbE (BCM57712)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	567,26	563,50	passed
2nd Workstation	568,99	558,60	passed

TABLE 8: 802.3ad bonding mode performance test results table for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

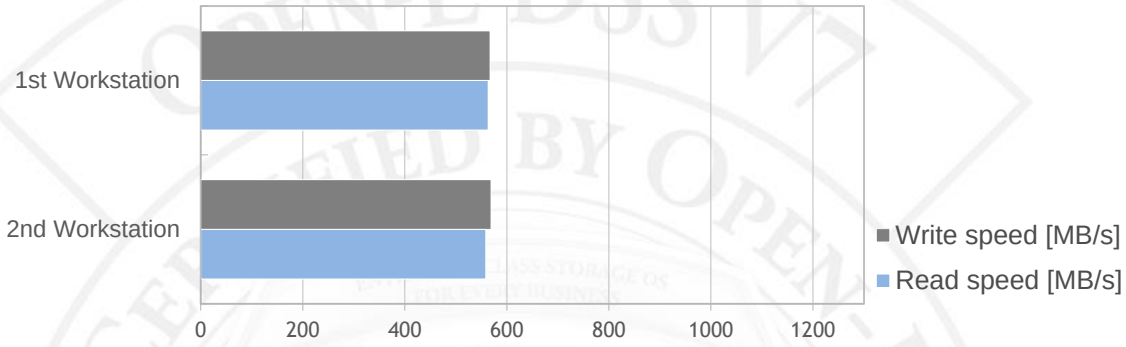

FIGURE 6: 802.3ad bonding mode performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

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 Server Adapter I350-T2

Balance-alb bonding mode performance test results			
NIC model	Intel Ethernet Server Adapter I350-T2		
Workstations with MS Windows	**Write speed [MB/s]**	**Read speed [MB/s]**	**Performance test results**
1st Workstation	109.69	112.18	passed
2nd Workstation	109.84	112.20	passed

TABLE 9: Balance-alb bonding mode performance test results table for Intel Ethernet Server Adapter I350-T2

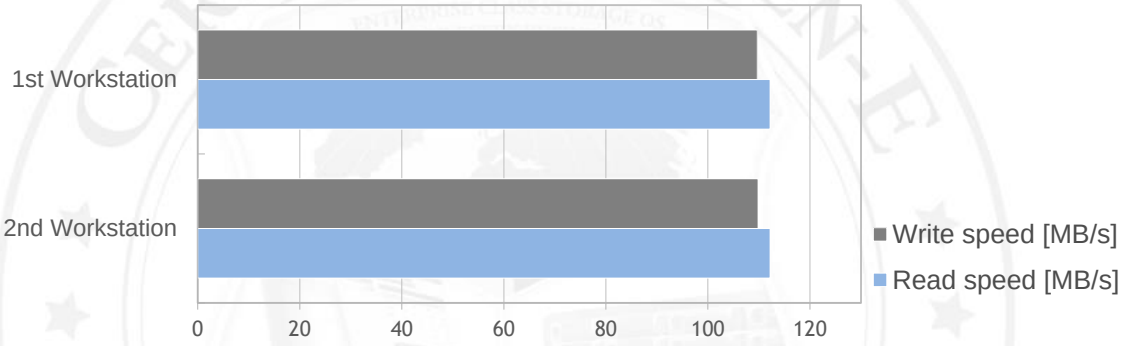

FIGURE 7: Balance-alb bonding mode performance test results chart for Intel Ethernet Server Adapter I350-T2

3. Test results for Balance-alb bonding mode test performed on Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

Balance-alb bonding mode performance test results			
NIC model	Broadcom NetXtreme II 10GbE (BCM57712)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	1 019,22	1 005,38	passed
2nd Workstation	990,18	817,59	passed

TABLE 10: Balance-alb bonding mode performance test results table for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

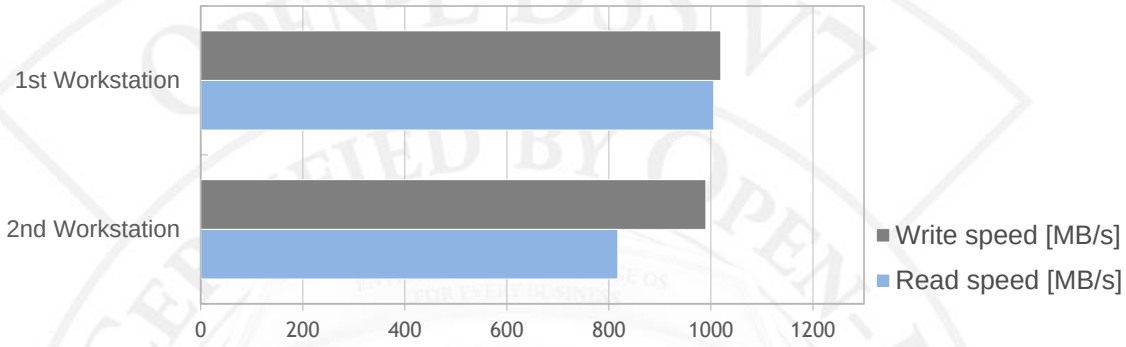

FIGURE 8: Balance-alb bonding mode performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

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 and Intel Ethernet Server Adapter I350-T2

Single NIC performance test results			
NIC model	Intel Ethernet Server Adapter I350-T2		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	108.42	112.11	passed

TABLE 11: Single NIC performance test results table for Intel Ethernet Server Adapter I350-T2

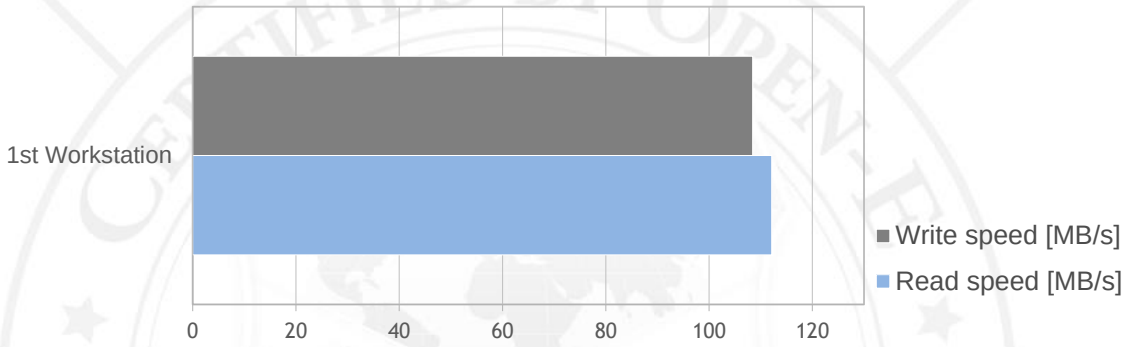

FIGURE 9: Single NIC performance test results chart for Intel Ethernet Server Adapter I350-T2

3. Test results for single NIC test performed on Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

Single NIC performance test results			
NIC model	Broadcom NetXtreme II 10GbE (BCM57712)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	921.78	558.05	passed

TABLE 12: Single NIC performance test results table for Broadcom Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

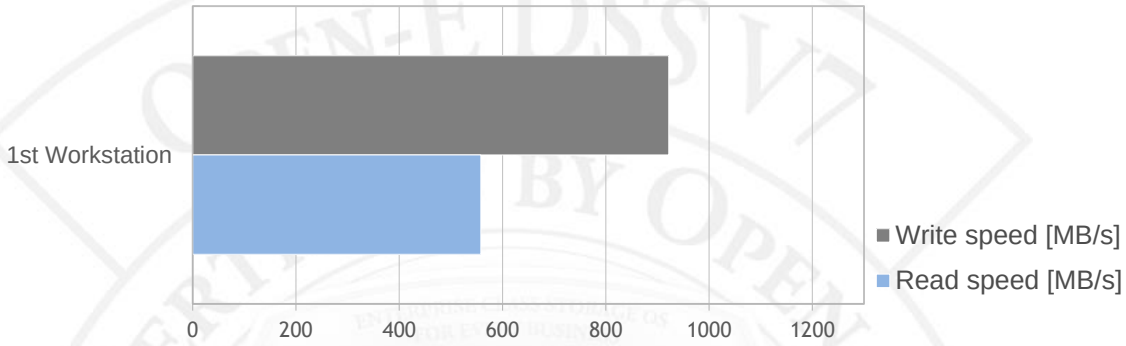

FIGURE 10: Single NIC performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

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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, 1 and 5 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

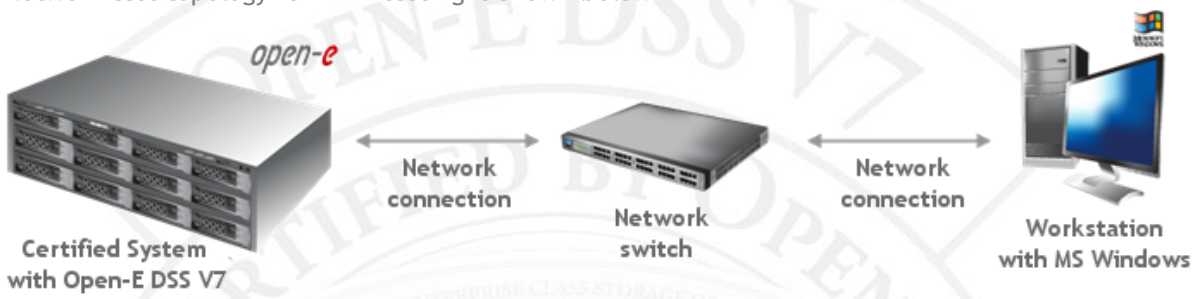

FIGURE 11: Network test topology for RAID testing

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 Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

RAID0 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	13.43	100.35	passed
32	99.30	374.59	passed
64	269.65	585.67	passed
128	546.42	983.13	passed
256	813.86	1 012.47	passed
512	819.47	1 114.11	passed
1024	835.90	1 113.96	passed
4096	809.85	1 109.55	passed

TABLE 13: RAID0 performance test results table for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

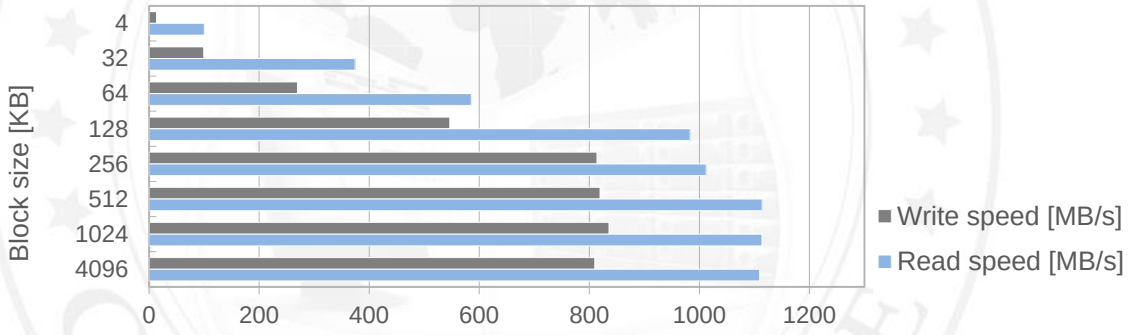

FIGURE 12: RAID0 performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

Hardware RAID1 test

3. Test description

The test relies on creation of the RAID1 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.

4. Test results for RAID1 and Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

RAID1 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	14.30	99.87	passed
32	103.00	378.82	passed
64	260.92	600.43	passed
128	544.56	970.72	passed
256	771.89	914.53	passed
512	780.76	1 072.79	passed
1024	792.00	1 075.24	passed
4096	809.21	1 104.30	passed

*TABLE 14: RAID1 performance test results table for **Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)***

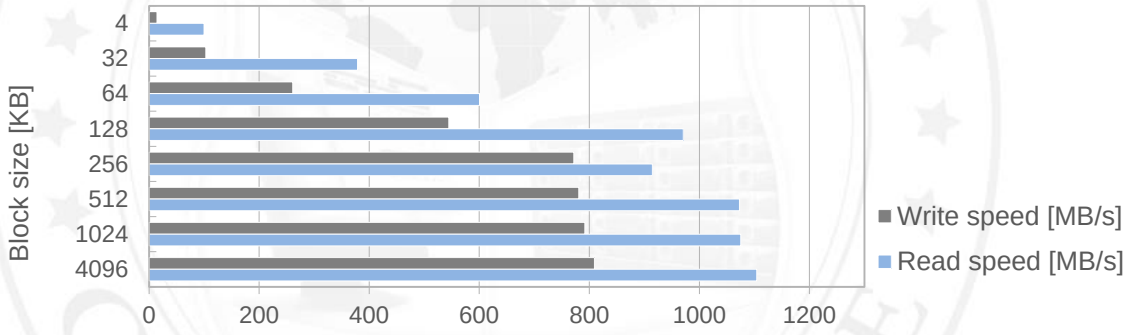

FIGURE 13: RAID1 performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

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 Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

RAID5 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	13.96	100.80	passed
32	101.65	374.23	passed
64	263.21	581.97	passed
128	527.27	967.64	passed
256	807.01	902.45	passed
512	774.37	985.85	passed
1024	778.75	973.85	passed
4096	805.82	1 024.29	passed

TABLE 15: RAID5 performance test results table for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

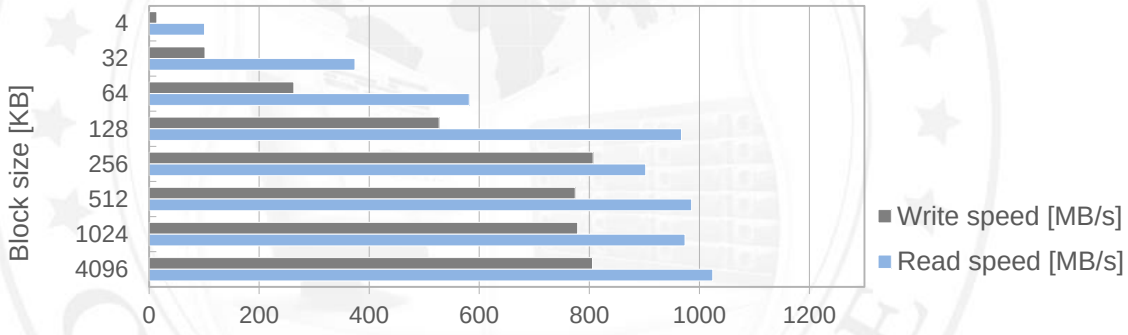

FIGURE 14: RAID5 performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

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.

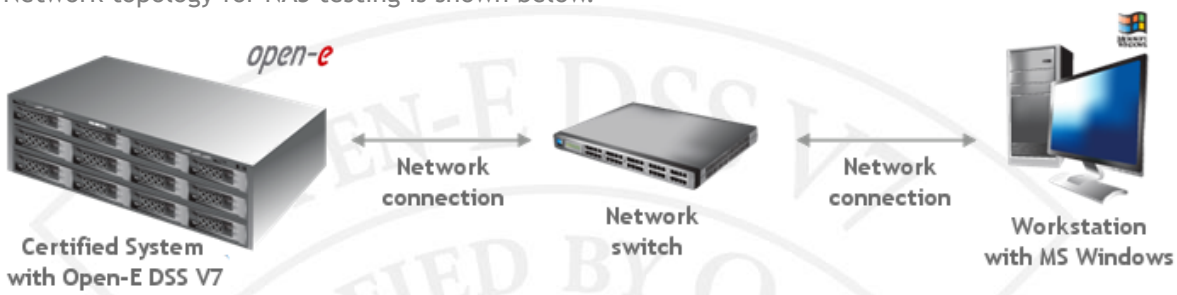

FIGURE 15: Network topology for NAS testing

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 Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

SMB performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	114.35	76.17	passed
32	674.91	406.20	passed
64	1 000.30	467.35	passed
128	995.66	574.51	passed
256	983.90	650.81	passed
512	984.40	700.74	passed
1024	988.20	698.36	passed
4096	972.75	676.64	passed

TABLE 16: SMB performance test results table for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

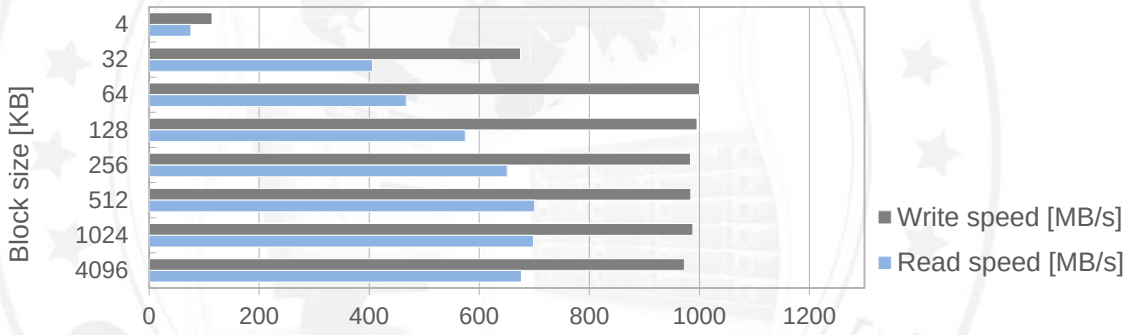

FIGURE 16: SMB performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

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.

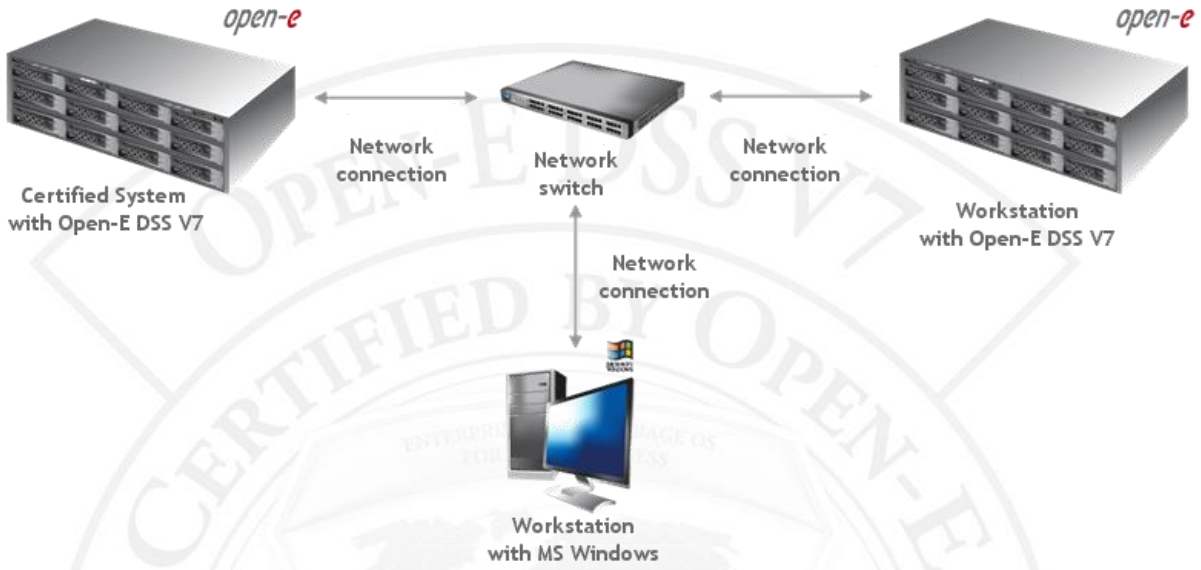

FIGURE 17: Network topology for iSCSI Initiator testing

iSCSI Target test topology

Network topology for iSCSI Target testing is shown below.

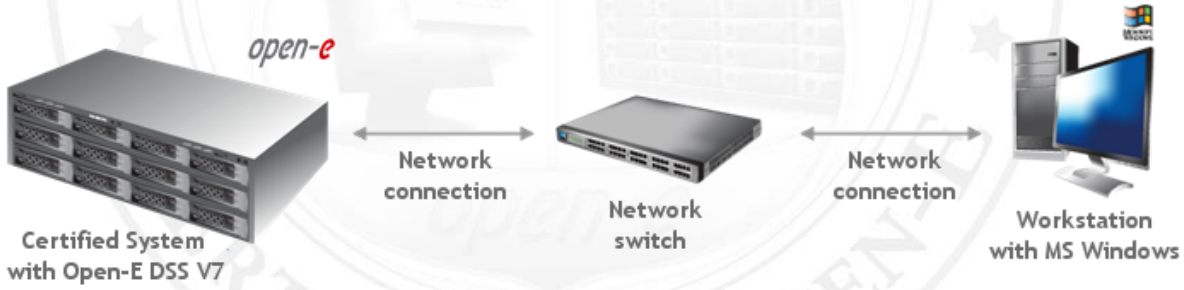

FIGURE 18: Network topology for iSCSI Target testing

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 Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

iSCSI Initiator performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	62.28	75.80	passed
32	408.68	339.27	passed
64	677.73	535.43	passed
128	927.75	857.09	passed
256	995.54	1 059.12	passed
512	1 087.48	1 061.76	passed
1024	1 089.04	1 069.55	passed
4096	1 085.83	985.15	passed

*TABLE 17: iSCSI Initiator performance test results table for **Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)***

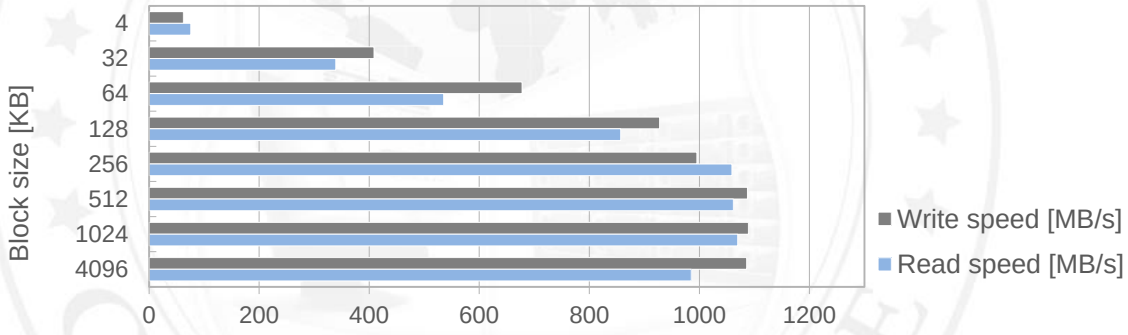

FIGURE 19: iSCSI Initiator performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

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 Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

iSCSI Target performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	14.28	98.92	passed
32	113.30	364.22	passed
64	249.31	601.32	passed
128	581.15	947.57	passed
256	835.97	1 018.42	passed
512	835.63	1 092.86	passed
1024	853.19	1 085.70	passed
4096	841.48	1 018.75	passed

TABLE 18: iSCSI Target performance test results table for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)

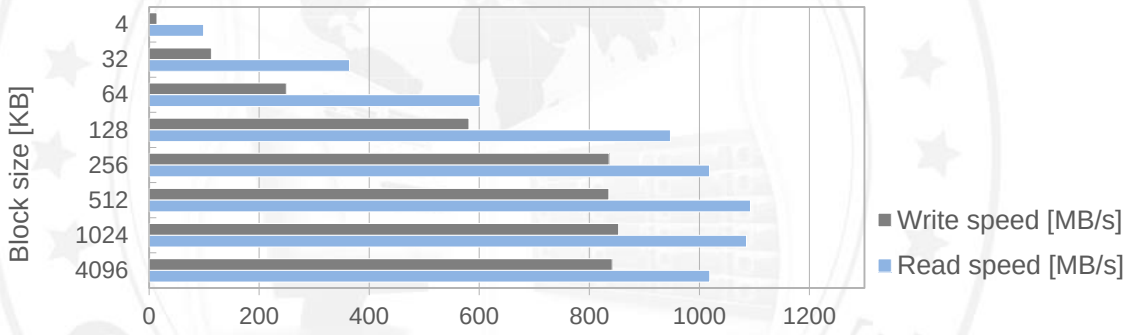

FIGURE 20: iSCSI Target performance test results chart for Broadcom NetXtreme II 10Gigabit Ethernet (BCM57712)