Intel R2224GZ4GC4 storage system

Executive summary

After performing all tests, the Intel Server System R2224GZ4GC4 has been officially certified according to the Open-E Hardware Certification Program.

During the tests, it was found that the system is functional and efficient. With the Open-E DSS V7 operating system installed, the Intel Server System R2224GZ4GC4 is stable and performs well.

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

✓ HA storage cluster

For this setup, two identical systems are required. The following features make Intel Server System R2224GZ4GC4 suitable for an HA cluster:

- Hardware RAID5, RAID6, RAID10, RAID50, RAID60 for greater node availability and increased performance.
- Two 10GbE interfaces for very fast data replication. May be aggregated to ensure extra layer of redundancy and improved throughput.
- Four 1GbE for fast and redundant MPIO connections.
- Redundant power supply for system reliability.

✓ NAS filer

The following features make Intel Server System R2224GZ4GC4 a good NAS filer solution:

- Twenty-four high class SAS hard drives provide a lot of space for user files and ensure fast random access.
- Hardware RAID5, RAID6, RAID10, RAID50, RAID60 for fault tolerance and the most efficient use of available disk space.
- Two 10GbE interfaces for independent connection to different networks or link aggregation for improved throughput.
- Four 1GbE interfaces for flexible network topology.

✓ Storage for database

For this application the following server features are useful:

- Server platform with fast CPU for high transaction rate
- HW RAID5, RAID6, RAID10, RAID50, RAID60 for high performance and data safety.
- Twenty-four high class SAS drives for great I/O performance
- Two 10GbE interfaces, which may be aggregated for fast connection to most demanding databases.

Certification notes

For link aggregation, it is recommended to use balance-alb bonding mode. It's recommended to disable NUMA in BIOS to avoid stability issues.

Intel Server System R2224GZ4GC4 hardware components

Technical specifications about the certified system are listed below:

Model	Intel Server System R2224GZ4GC4
Operating system	Open-E DSS V7 build 6645
Enclosure/chassis	Intel R2224 2U Chassis
CPU	Intel Xeon E5-2643 3.30GHz
Motherboard	Intel Server Board S2600GZ4
Memory	8x 4GB DDR3 1600 ECC-REG Kingston KVR16R11D8/4
Network	1GbE Intel I350 Quad Port Ethernet Controller (on-board)
Network	10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)
HW RAID	Intel Integrated RAID Module RMS25PB080
Hard disk drives	24x 900GB Western Digital WD9001BKHG-02D22V1
Hard disk drives	100GB Intel 710 Series SSDSA2BZ100G301

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

All components were detected and properly recognized.

Intel Server System R2224GZ4GC4 photos

FIGURE 1: Front photo

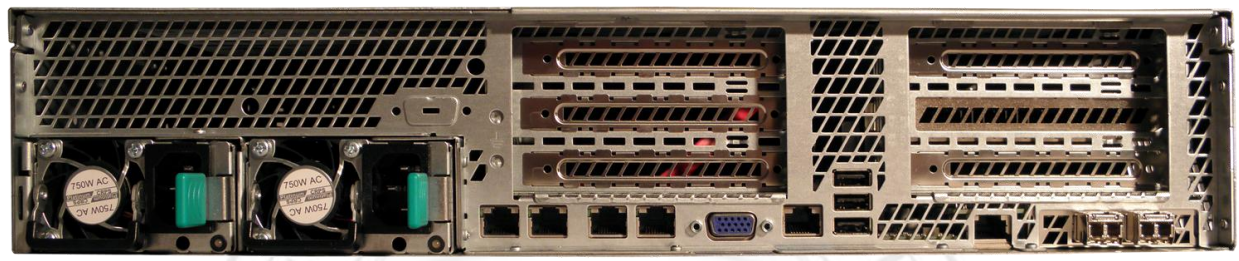

FIGURE 2: Rear photo

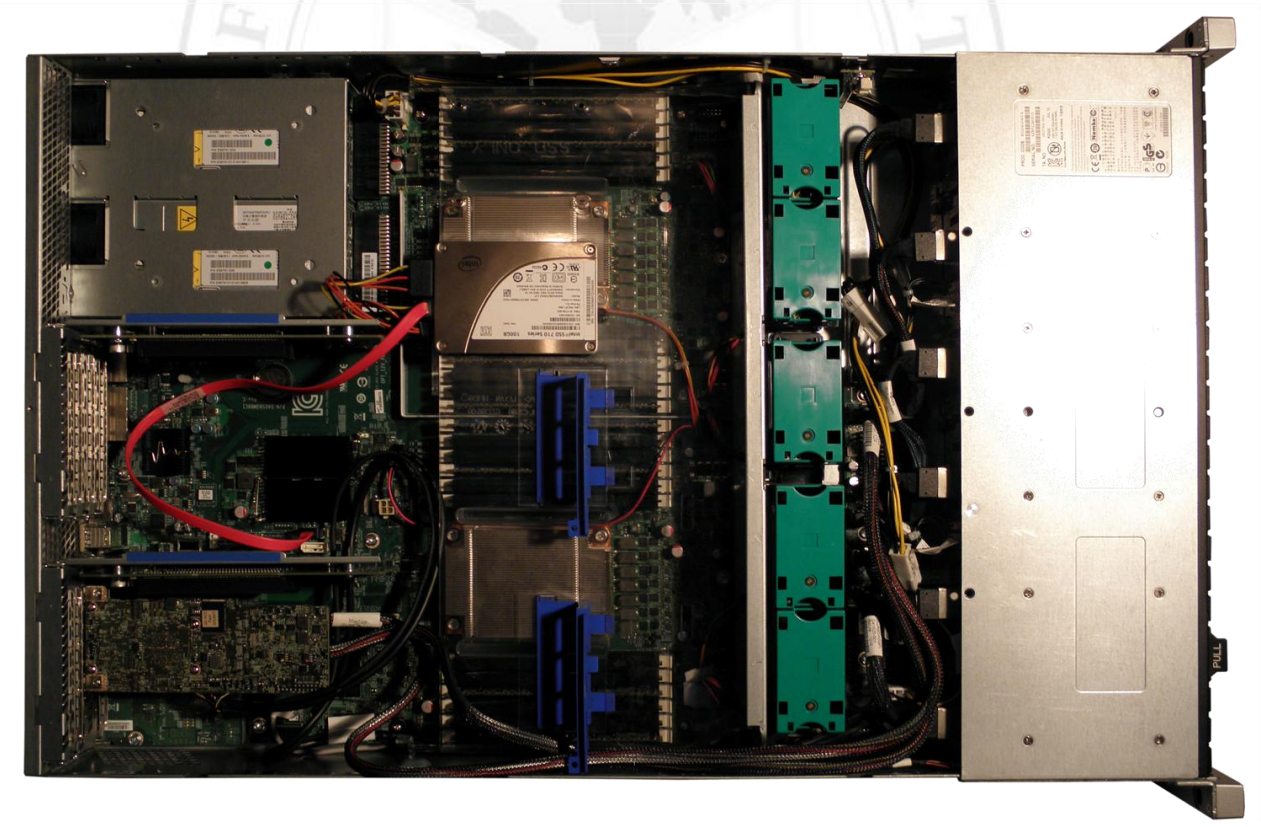

FIGURE 3: Top photo

Auxiliary systems hardware components

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

Model	Supermicro SYS-6026TT-BIBQRF
Operating system	MS Windows Server 2008 R2
Enclosure/chassis	Supermicro CSE-827H-R1400B
Motherboard	Supermicro X8DTT-IBQF
CPU	Intel Xeon E5620 2.40GHz
Memory	6x 4GB DDR3 1333 ECC-REG ATP AL12M72E4BJH9S
Network	1GbE Intel ET Dual-Port Server Adapter (i82576) (on-board)
Network	10GbE Intel Ethernet Server Adapter X520-SR2 (i82599EB)
Hard disk drives	1x 750GB Seagate Barracuda ST3750330NS

TABLE 2: *Hardware components of first Workstation with MS Windows*

Model	Supermicro SYS-6026TT-BIBQRF
Operating system	MS Windows Server 2008 R2
Enclosure/chassis	Supermicro CSE-827H-R1400B
Motherboard	Supermicro X8DTT-IBQF
CPU	Intel Xeon E5620 2.40GHz
Memory	6x 4GB DDR3 1333 ECC-REG ATP AL12M72E4BJH9S
Network	1GbE Intel ET Dual-Port Server Adapter (i82576) (on-board)
Network	1GbE Quad port Intel Ethernet Controller I350 (on-board)
Hard disk drives	1x 750GB Seagate Barracuda ST3750330NS

TABLE 3: *Hardware components of second Workstation with MS Windows*

Model	Supermicro SYS-1026T-6RFT+
Operating system	Open-E DSS V7 build 6491
Enclosure/chassis	Supermicro CSE-119TQ-R700UB
Motherboard	Supermicro X8DTU-6TF+
CPU	Intel Xeon E5620 2.40GHz
Memory	6x 4GB DDR3 1333 ECC-REG ATP AL12M72E4BJH9S
Network	1GbE Intel ET Dual-Port Server Adapter (i82576) (on board)
Network	1GbE Quad port Intel Ethernet Controller I350 (on-board)
HW RAID controller	LSI MPTSAS 2108 (on board)
Hard disk drives	8x 73.5GB Toshiba MBC2073RC

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

Model	Supermicro SSE-G24-TG4
Description	24-ports 1GbE and 4-ports 10GbE switch

TABLE 5: *Network switch details*

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.

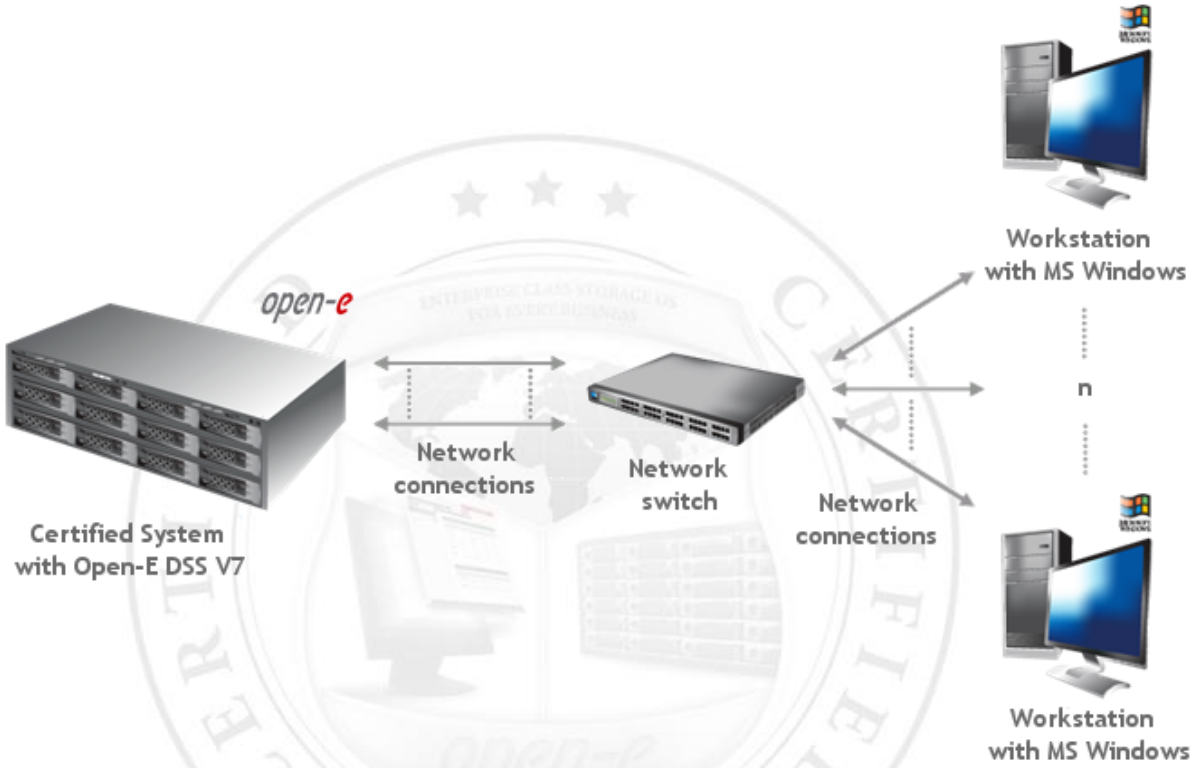

FIGURE 4: Network topology for Network testing

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

802.3ad bonding mode performance test results			
NIC model	10GbE Intel AXX10GBNIAIOM Dual Port (i82599EB)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	639.98	504.95	passed
2nd Workstation	448.90	388.29	passed

TABLE 7: 802.3ad bonding mode performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

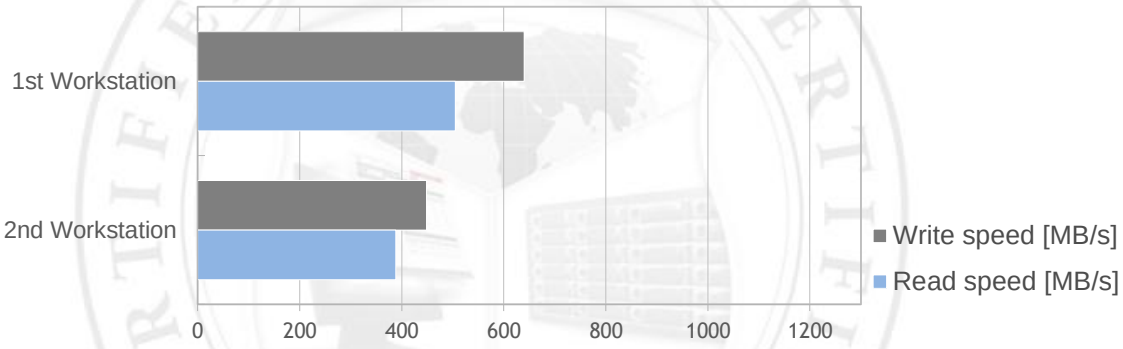

FIGURE 5: 802.3ad bonding mode performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

3. Test results for 802.3ad bonding mode test performed on 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

802.3ad bonding mode performance test results			
NIC model	1GbE Intel I350 Quad Port Controller (on-board)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	45.76	65.29	passed
2nd Workstation	46.23	60.17	passed
3rd Workstation	42.5	48.72	passed
4td Workstation	43.24	54.87	passed

TABLE 8: 802.3ad bonding mode performance test results table for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

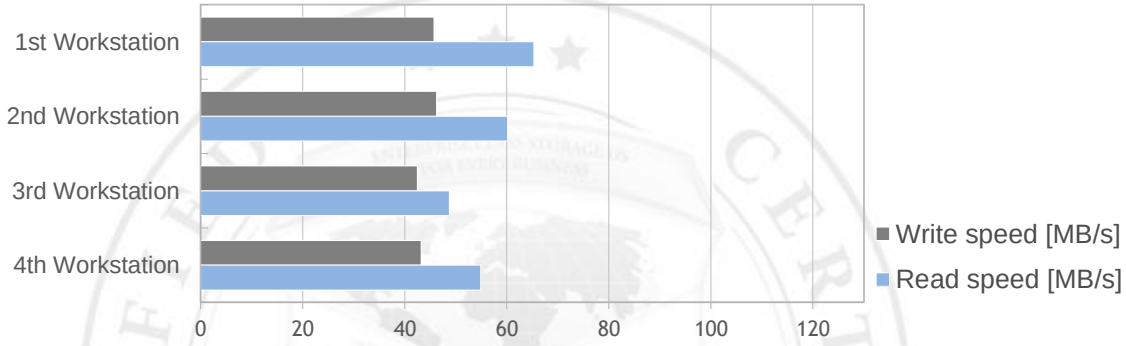

FIGURE 6: 802.3ad bonding mode performance test results chart for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

Balance-alb bonding mode performance test results			
NIC model	10GbE Intel AXX10GBNIAIOM Dual Port (i82599EB)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	492.00	440.87	passed
2nd Workstation	478.94	436.86	passed

TABLE 9: Balance-alb bonding mode performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

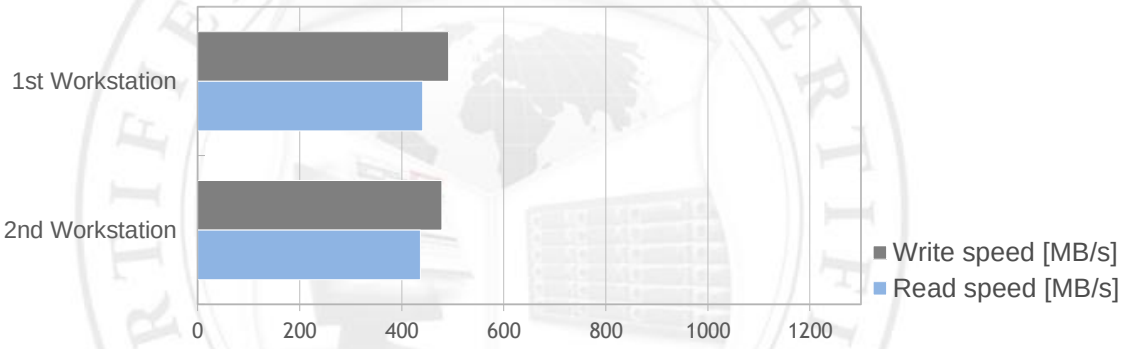

FIGURE 7: Balance-alb bonding mode performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

3. Test results for Balance-alb bonding mode test performed on 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

Balance-alb bonding mode performance test results			
NIC model	1GbE Intel I350 Quad Port Controller (on-board)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	108.90	108.52	passed
2nd Workstation	109.40	111.97	passed
3rd Workstation	108.25	112.11	passed
4td Workstation	108.93	112.01	passed

TABLE 10: Balance-alb bonding mode performance test results table for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

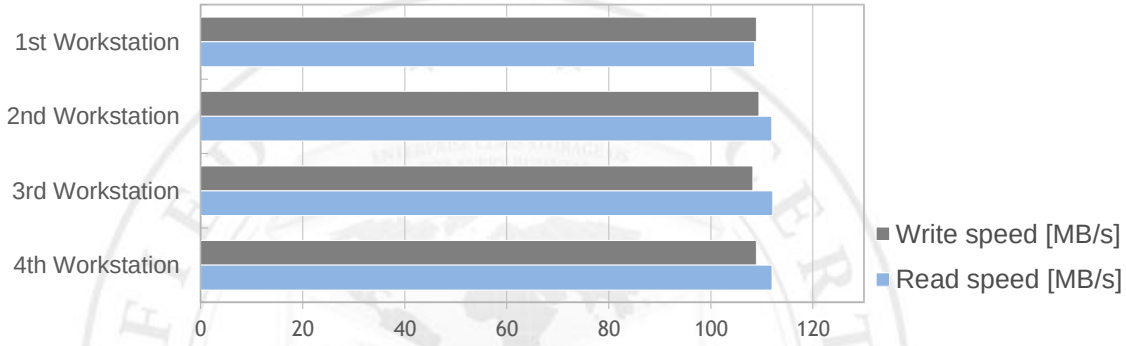

FIGURE 8: Balance-alb bonding mode performance test results chart for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

Balance-rr bonding mode performance test results			
NIC model	10GbE Intel AXX10GBNIAIOM Dual Port (i82599EB)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	554.61	227.31	passed
2nd Workstation	516.34	216.48	passed

TABLE 11: Balance-rr bonding mode performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

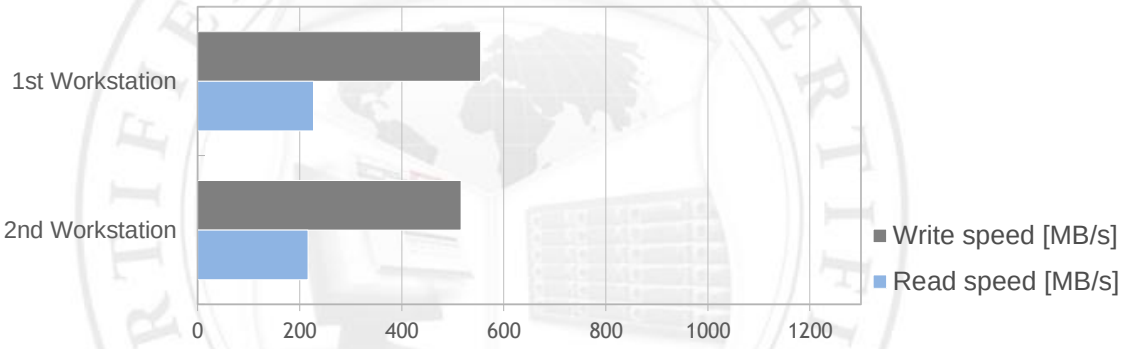

FIGURE 9: Balance-rr bonding mode performance test results chart 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

3. Test results for Balance-rr bonding mode test performed on 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

Balance-rr bonding mode performance test results			
NIC model	1GbE Intel I350 Quad Port Controller (on-board)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1st Workstation	109.12	58.20	passed
2nd Workstation	45.41	76.75	passed
3rd Workstation	108.34	56.30	passed
4td Workstation	45.73	76.76	passed

TABLE 12: Balance-rr bonding mode performance test results table for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

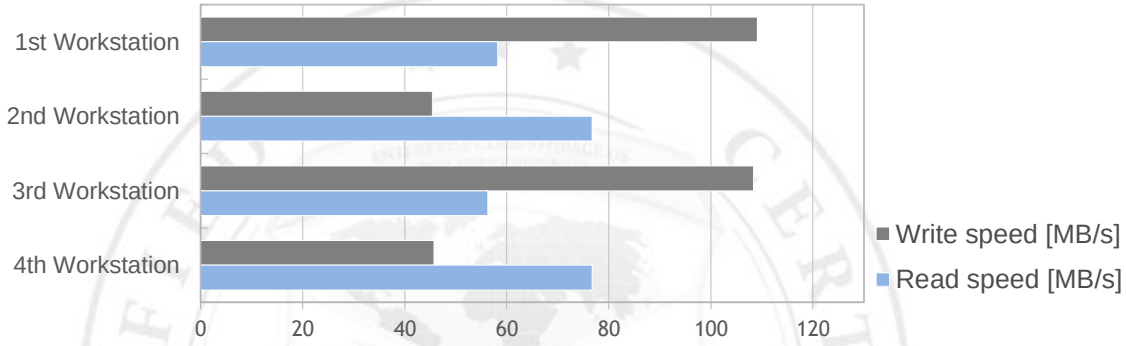

FIGURE 10: Balance-rr bonding mode performance test results chart for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

Single NIC performance test results			
NIC model	10GbE Intel AXX10GBNIAIOM Dual Port (i82599EB)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance [passed/failed]
1st Workstation	585.06	567.64	passed

TABLE 13: Single NIC test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

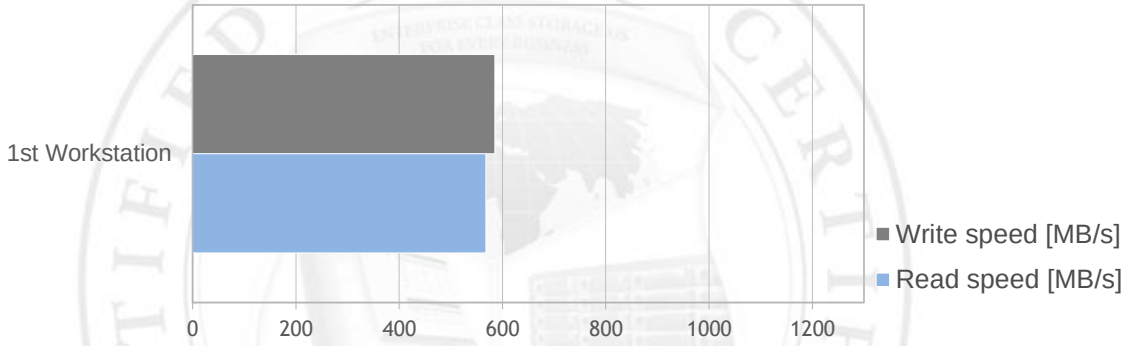

FIGURE 11: Single NIC performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

3. Test results for single NIC test performed on 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

Single NIC performance test results			
NIC model	1GbE Intel I350 Quad Port Controller (on-board)		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance [passed/failed]
1st Workstation	110.76	112.27	passed

TABLE 14: Single NIC test results table for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

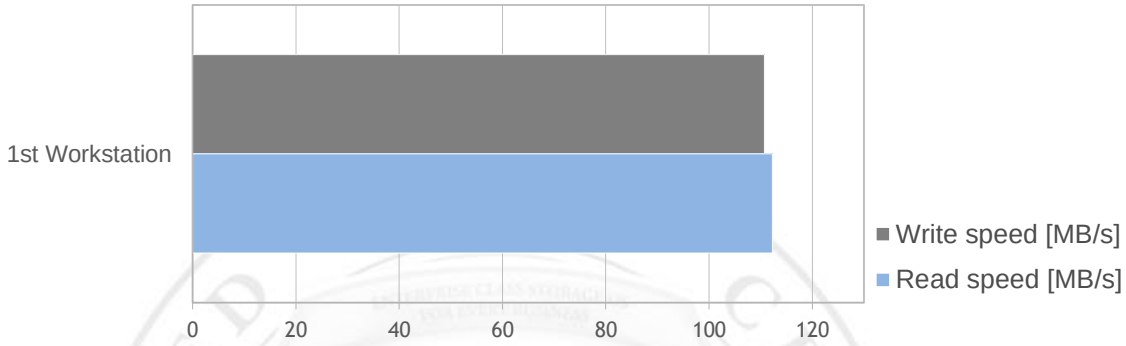

FIGURE 12: Single NIC performance test results chart for 1GbE Intel I350 Quad Port Ethernet Controller (on-board)

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

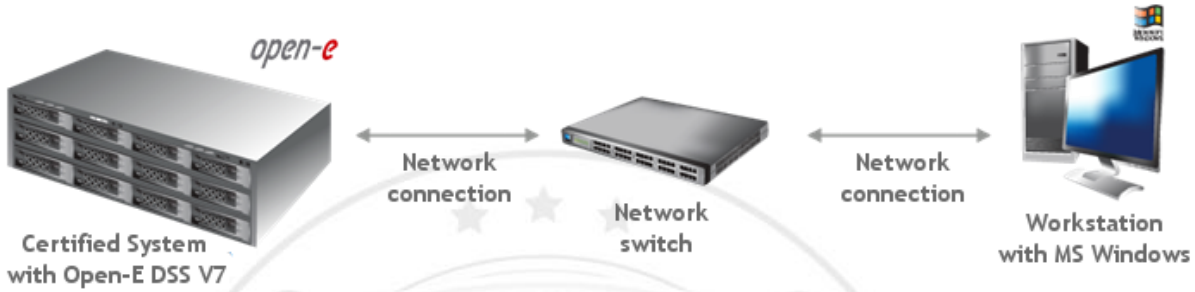

FIGURE 13: Network test topology for RAID testing

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

RAID0 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	6.48	96.83	passed
32	41.53	391.78	passed
64	161.74	475.19	passed
128	354.13	540.79	passed
256	520.79	604.80	passed
512	522.43	518.74	passed
1024	520.11	528.47	passed
4096	530.27	527.56	passed

TABLE 15: RAID0 performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

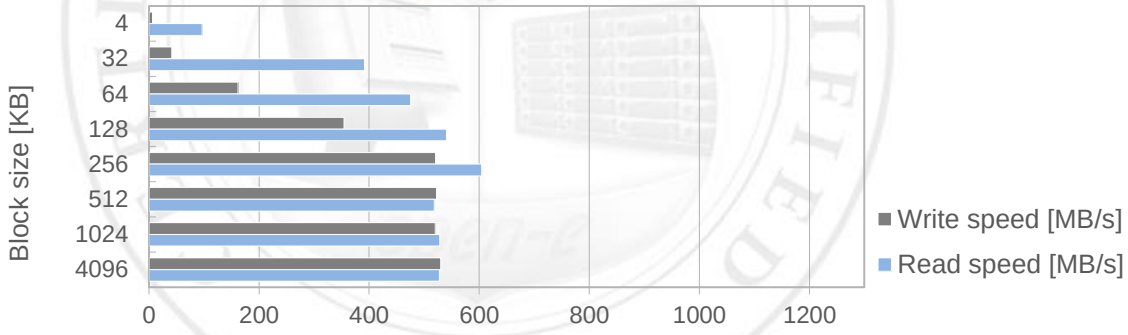

FIGURE 14: RAID0 performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

RAID5 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	6.12	98.01	passed
32	41.25	394.33	passed
64	141.53	476.88	passed
128	355.71	523.07	passed
256	519.89	610.98	passed
512	515.10	516.86	passed
1024	523.68	509.32	passed
4096	523.42	521.39	passed

TABLE 16: RAID5 performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

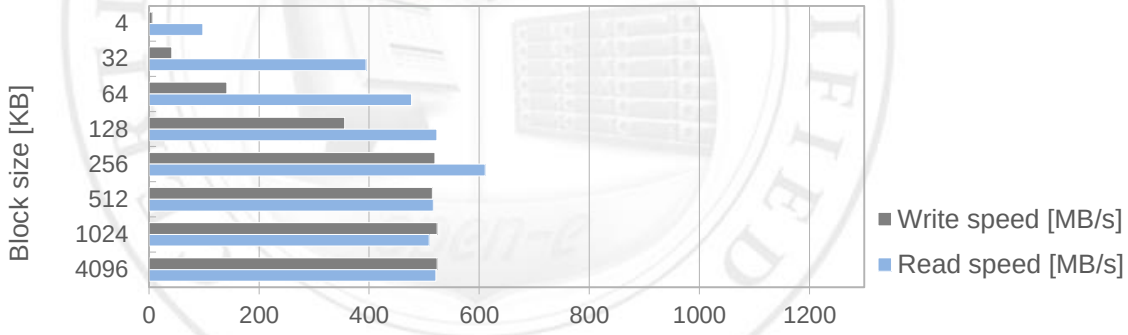

FIGURE 15: RAID5 performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

RAID6 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	6.36	96.85	passed
32	42.88	398.94	passed
64	139.49	475.61	passed
128	350.06	538.58	passed
256	523.63	614.86	passed
512	513.90	529.09	passed
1024	532.28	518.60	passed
4096	534.48	536.25	passed

TABLE 17: RAID6 performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

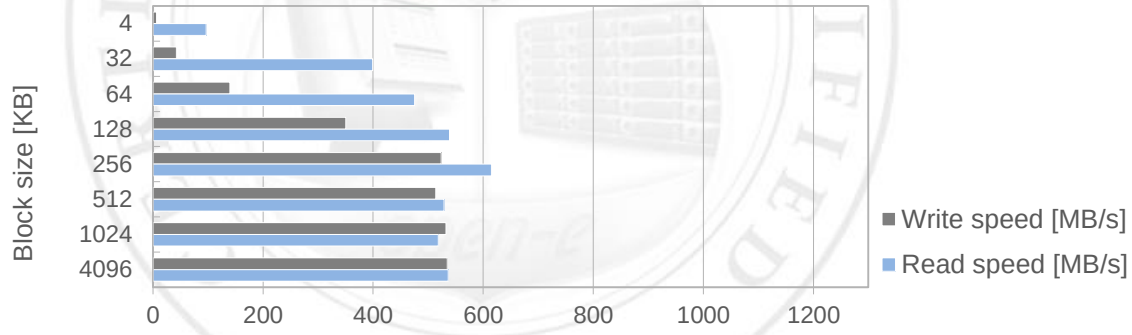

FIGURE 16: RAID6 performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

RAID10 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	5.90	97.46	passed
32	41.02	407.07	passed
64	144.84	487.91	passed
128	345.20	561.65	passed
256	515.02	602.93	passed
512	516.69	512.80	passed
1024	524.45	517.90	passed
4096	529.62	523.78	passed

TABLE 18: RAID10 performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

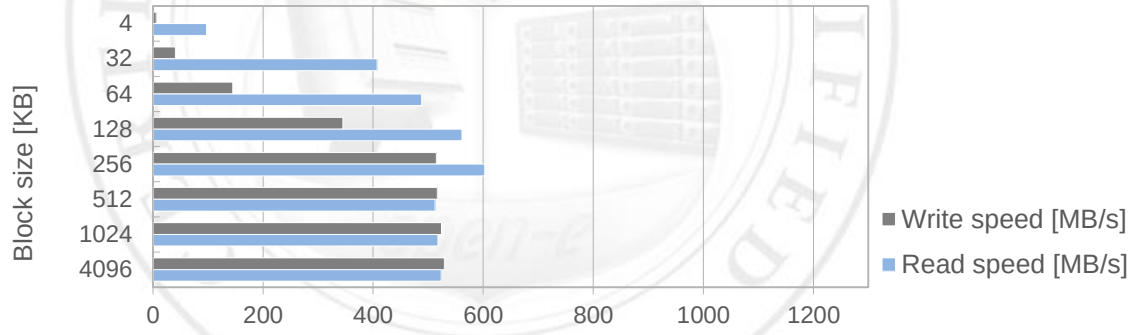

FIGURE 17: RAID10 performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

RAID50 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	5.66	95.26	passed
32	40.46	379.55	passed
64	138.31	451.51	passed
128	326.24	539.18	passed
256	493.62	623.00	passed
512	500.32	516.80	passed
1024	500.62	517.76	passed
4096	517.68	512.89	passed

TABLE 19: RAID50 performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

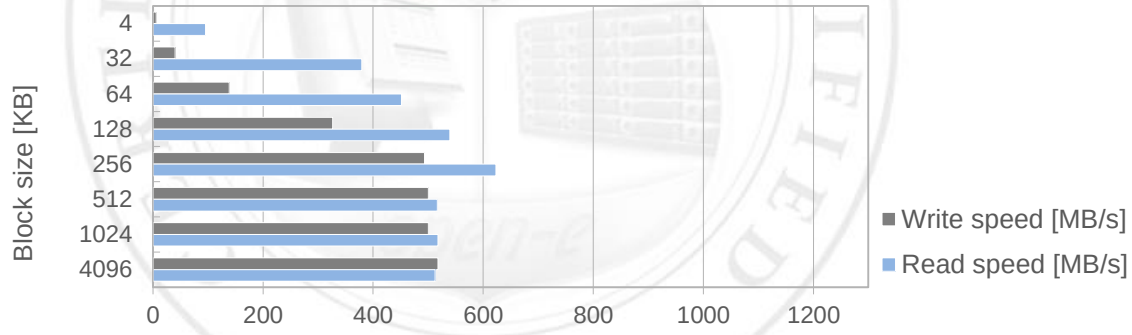

FIGURE 18: RAID50 performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

RAID60 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	5.56	96.74	passed
32	41.1	389.73	passed
64	135.82	458.75	passed
128	346.39	537.96	passed
256	508.03	617.77	passed
512	515.99	519.64	passed
1024	523.15	518.91	passed
4096	527.21	512.31	passed

TABLE 20: RAID60 performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

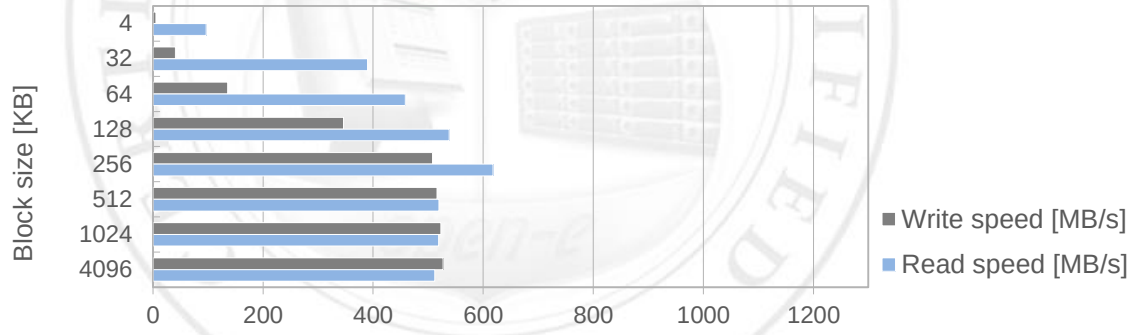

FIGURE 19: RAID60 performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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

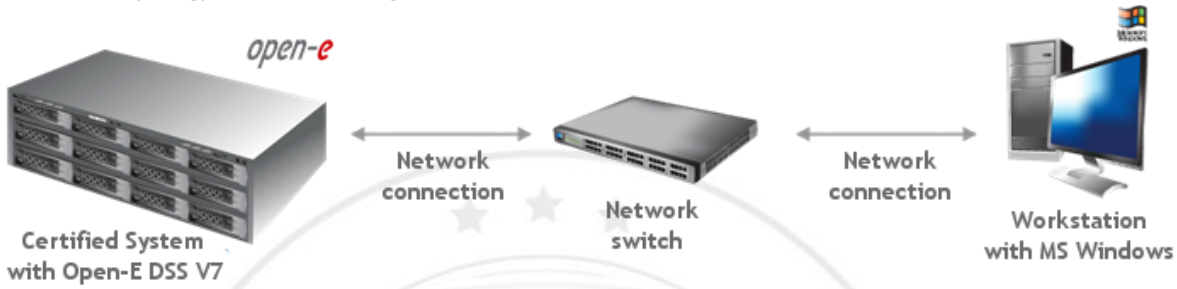

FIGURE 20: Network topology for NAS testing

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

SMB performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	110.7	123.36	passed
32	489.04	596.06	passed
64	529.09	373.81	passed
128	515.91	408.74	passed
256	518.23	437.72	passed
512	537.64	459.72	passed
1024	460.6	457.04	passed
4096	504.3	463.47	passed

TABLE 21: SMB performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

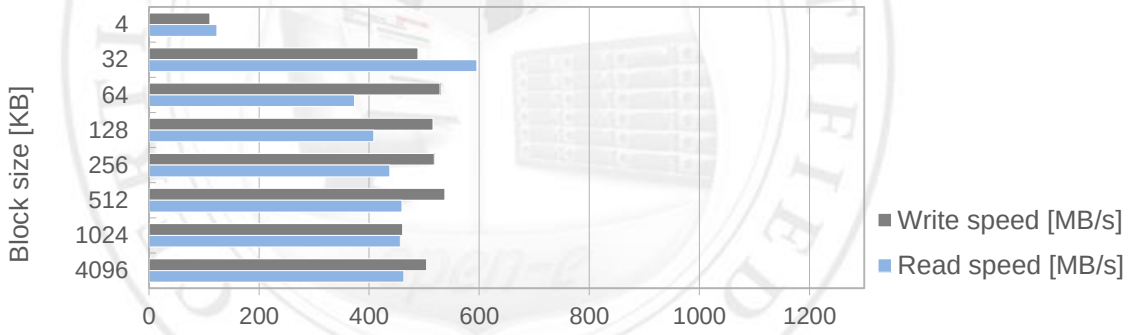

FIGURE 21: SMB performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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.

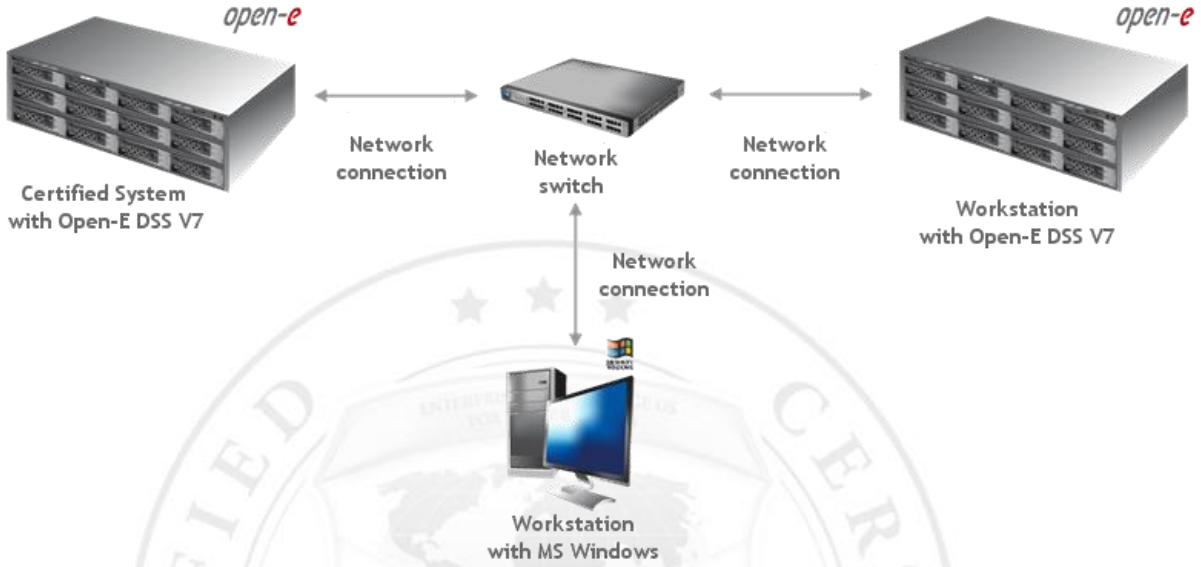

FIGURE 22: Network topology for iSCSI Initiator testing

iSCSI Target test topology

Network topology for iSCSI Target testing is shown below.

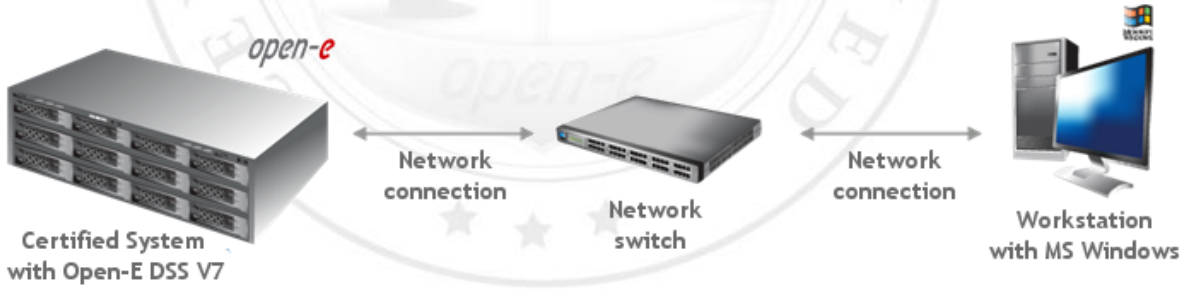

FIGURE 23: Network topology for iSCSI Target testing

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

iSCSI Initiator performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	112.41	123.67	passed
32	511.14	550.61	passed
64	630.64	387.42	passed
128	624.36	427.62	passed
256	588.36	459.07	passed
512	592.37	466.96	passed
1024	605.58	464.47	passed
4096	577.47	475.51	passed

TABLE 22: iSCSI Initiator performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

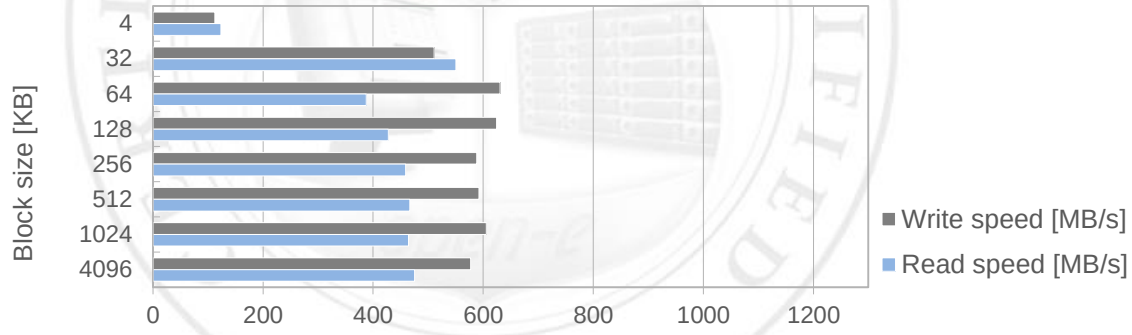

FIGURE 24: iSCSI Initiator performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

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 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

iSCSI Target performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	6.53	97.30	passed
32	43.91	384.04	passed
64	138.62	455.71	passed
128	337.00	534.06	passed
256	516.90	608.47	passed
512	516.52	521.45	passed
1024	513.54	512.12	passed
4096	545.95	515.86	passed

TABLE 23: iSCSI Target performance test results table for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)

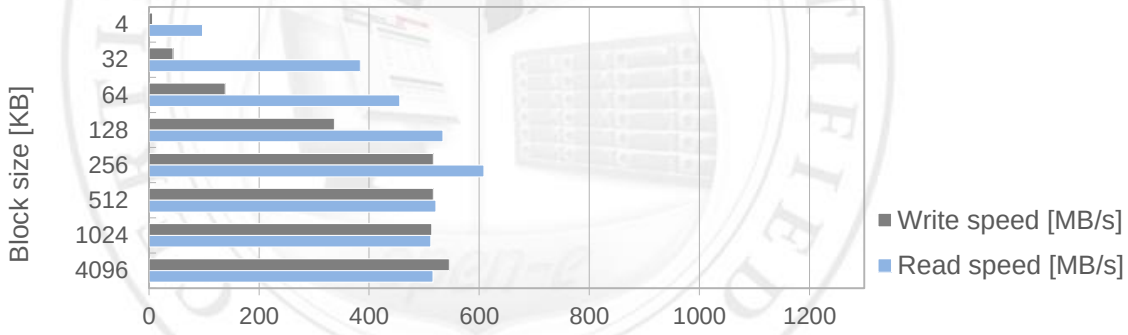

FIGURE 25: iSCSI Target performance test results chart for 10GbE Intel AXX10GBNIAIOM Dual Port I/O Module (i82599EB)