

# macle GmbH GRAFENTHAL-S1212M Storage system



## Executive summary

After performing all tests, the macle GmbH GRAFENTHAL-S1212M 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 GRAFENTHAL-S1212M 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 GRAFENTHAL-S1212M good iSCSI storage:

- Various hardware RAID levels with SSD cache for high performance and data safety.
- 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 GRAFENTHAL-S1212M a good NAS filer solution:

- Eleven high capacity SATA hard drives with SSD cache provide a lot of space for user files and ensure fast random access.
- Hardware RAID5, RAID10 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 CCTV

For this application the following can be used:

- Eleven high capacity SATA drives with high level RAID5 provide lots of redundant storage for CCTV records.
- Four 1GbE and two 10GbE interfaces for independent connection to different networks or link aggregation for improved throughput.
- Redundant power supply for system reliability.

## Certification notes

For link aggregation, it is recommended to use balance-alb bonding mode.

<b>macle GmbH GRAFENTHAL-S1212M hardware components</b> .....	4
<b>macle GmbH GRAFENTHAL-S1212M photos</b> .....	5
<b>Auxiliary systems hardware components</b> .....	6
<b>Administration functionality</b> .....	7
<b>Network functionality</b> .....	8
Network test topology .....	8
Balance-alb bonding mode test .....	9
Balance-rr bonding mode test .....	11
Single NIC performance test .....	13
<b>RAID functionality</b> .....	15
RAID test topology.....	15
Hardware RAID0 test .....	16
Hardware RAID1 test .....	17
Hardware RAID5 test .....	18
Hardware RAID10 test.....	19
<b>NAS functionality</b> .....	20
NAS test topology.....	20
SMB test .....	21
<b>iSCSI functionality</b> .....	22
iSCSI Initiator test topology.....	22
iSCSI Target test topology .....	22
iSCSI Initiator test .....	23
iSCSI Target test .....	24
<b>SSD Cache performance</b> .....	25
SSD Cache test topology.....	25
SSD Cache with real life pattern test .....	26
SSD Cache with random read/write pattern test.....	27

## macle GmbH GRAFENTHAL-S1212M hardware components

Technical specifications about the certified system are listed below:

Model	macle GmbH GRAFENTHAL-S1212M
Operating system	Open-E DSS V7 build 10529
Enclosure/chassis	macle GmbH GRAFENTHAL-S1212M Storage
CPU	Intel® Xeon® Processor E3 1230 v3 3.30 GHz
Motherboard	Gigabyte™ GA-6LXSV
Memory	8Gb Micron MT18KSF1G72AZ-1G4E1 ECC 1333
Network	4x Intel® Ethernet Server Adapter i210-T1
Network	Broadcom® NetXtreme II 10Gigabit Ethernet
HW RAID	LSI MegaRaid 9380-4i4e
Hard disk drives	128GB SanDisk® SDSSDP-128G-G25
Hard disk drives	11x 4TB WD Se™ WD4000F9YZ

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



## macle GmbH GRAFENTHAL-S1212M 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.

<b>Model</b>	Custom
<b>Operating system</b>	MS Windows Server 2012 R2
<b>Enclosure/chassis</b>	GRAFENTHAL Compact Performance Server
<b>Motherboard</b>	ASROCK E3C226D2I
<b>CPU</b>	Intel® Xeon® Processor E3-1220 v3 3.10 GHz
<b>Memory</b>	8Gb Micron MT18KSF1G72AZ-1G4E1 ECC 1333
<b>Network</b>	Broadcom® NetXtreme II 10Gigabit Ethernet
<b>Network</b>	2x Intel® Ethernet Server Adapter i210-T1
<b>Hard disk drives</b>	1TB HGST HTS721010A9E630 SATA

TABLE 2: Hardware components of first Workstation with MS Windows

<b>Model</b>	Custom
<b>Operating system</b>	MS Windows Server 2012 R2
<b>Enclosure/chassis</b>	GRAFENTHAL Compact Performance Server
<b>Motherboard</b>	ASROCK E3C226D2I
<b>CPU</b>	Intel® Xeon® Processor E3-1220 v3 3.10 GHz
<b>Memory</b>	8Gb Micron MT18KSF1G72AZ-1G4E1 ECC 1333
<b>Network</b>	Broadcom® NetXtreme II 10Gigabit Ethernet
<b>Network</b>	2x Intel® Ethernet Server Adapter i210-T1
<b>Hard disk drives</b>	1TB HGST HTS721010A9E630 SATA

TABLE 3: Hardware components of second Workstation with MS Windows

<b>Model</b>	macle GmbH GRAFENTHAL-S1212M
<b>Operating system</b>	Open-E DSS V7 build 10529
<b>Enclosure/chassis</b>	macle GmbH GRAFENTHAL-S1212M Storage
<b>Motherboard</b>	Intel® Xeon® Processor E3-1230 v3 3.30 GHz
<b>CPU</b>	Gigabyte™ GA-6LXSV
<b>Memory</b>	8Gb Micron MT18KSF1G72AZ-1G4E1 ECC 1333
<b>Network</b>	4x Intel® Ethernet Server Adapter i210-T1
<b>Network</b>	Broadcom® NetXtreme II 10Gigabit Ethernet
<b>Hard disk controller</b>	LSI MegaRaid 9380-4i4e
<b>Hard disk drives</b>	128GB SanDisk SDSSDP-128G-G25
<b>Hard disk drives</b>	11x 4TB WD Se™ WD4000F9YZ

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

Model	Netgear® ProSafe Plus XS708E
Description	8 ports 100/1000/10000 Mbps RJ45 with 1 combo port 10GbE SFP + fiber

TABLE 5: Network switch details for connection with 10GbE

## 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.

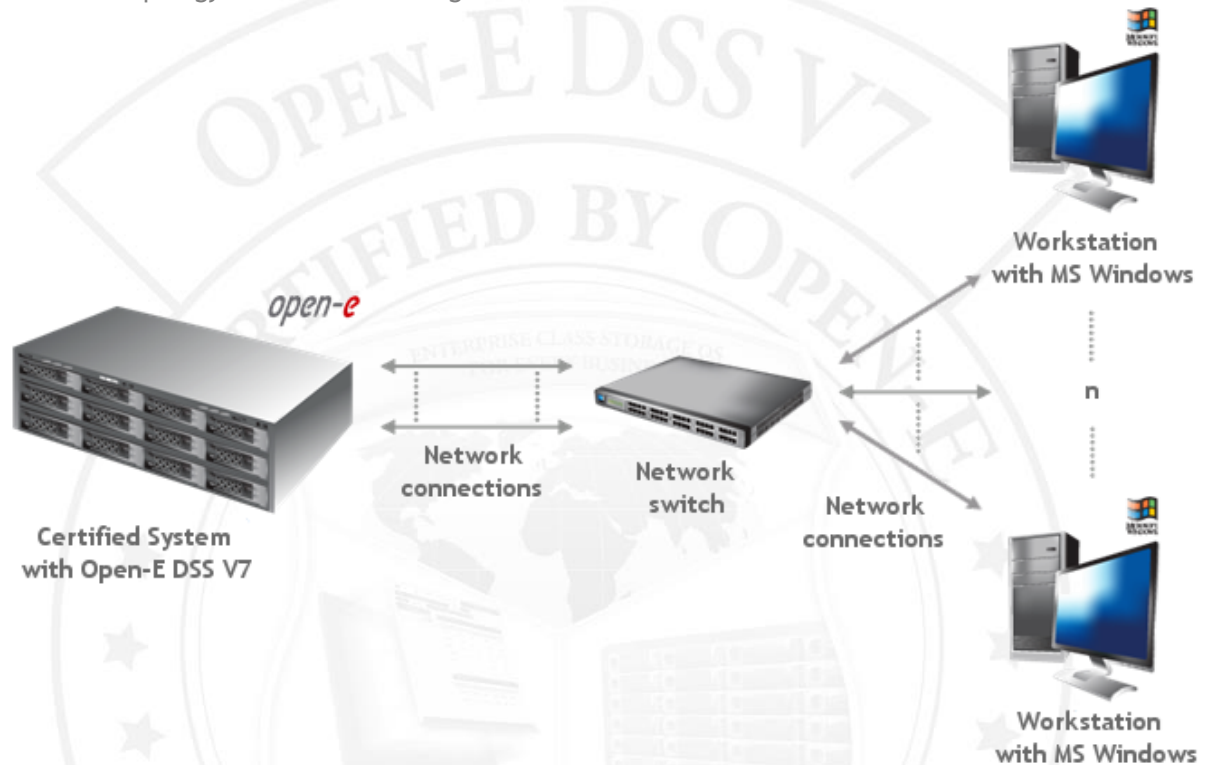


FIGURE 4: Network topology for Network testing



## 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 i210-T1

Balance-alb bonding mode performance test results			
NIC model	Intel® Ethernet Server Adapter i210-T1		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1 <sup>st</sup> Workstation	109.52	97.17	passed
2 <sup>nd</sup> Workstation	111.88	97.59	passed

TABLE 7: Balance-alb bonding mode performance test results table for Intel® Ethernet Server Adapter i210-T1

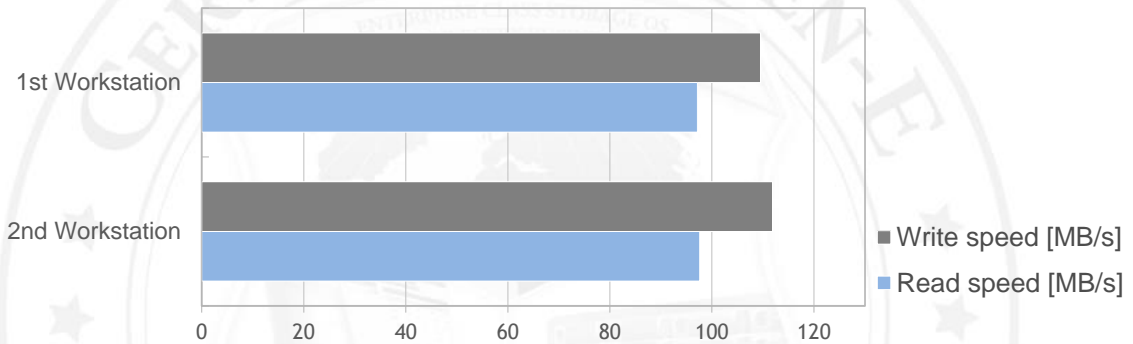


FIGURE 5: Balance-alb bonding mode performance test results chart for Intel® Ethernet Server Adapter i210-T1

### 3. Test results for Balance-alb bonding mode test performed on Broadcom® NetXtreme II 10Gigabit Ethernet

Balance-alb bonding mode performance test results			
NIC model	Broadcom® NetXtreme II 10Gigabit Ethernet		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1 <sup>st</sup> Workstation	435.28	903.50	passed
2 <sup>nd</sup> Workstation	441.91	904.76	passed

TABLE 8: Balance-alb bonding mode performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

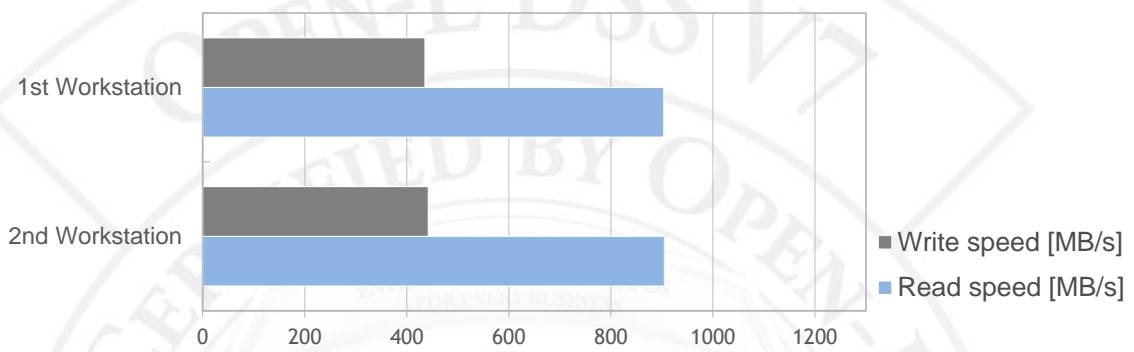


FIGURE 6: Balance-alb bonding mode performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## 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 Server Adapter i210-T1

Balance-rr bonding mode performance test results			
NIC model	Intel® Ethernet Server Adapter i210-T1		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1 <sup>st</sup> Workstation	52.80	69.79	passed
2 <sup>nd</sup> Workstation	55.89	59.62	passed

TABLE 9: Balance-rr bonding mode performance test results table for Intel® Ethernet Server Adapter i210-T1

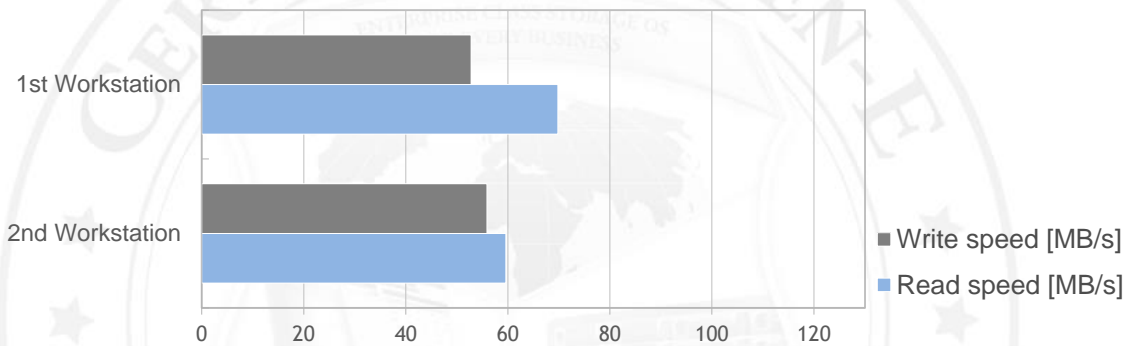


FIGURE 7: Balance-rr bonding mode performance test results chart for Intel® Ethernet Server Adapter i210-T1

### 3. Test results for Balance-rr bonding mode test performed on Broadcom® NetXtreme II 10Gigabit Ethernet

Balance-rr bonding mode performance test results			
NIC model	Broadcom® NetXtreme II 10Gigabit Ethernet		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1 <sup>st</sup> Workstation	214.62	77.97	passed
2 <sup>nd</sup> Workstation	223.01	100.05	passed

TABLE 10: Balance-rr bonding mode performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

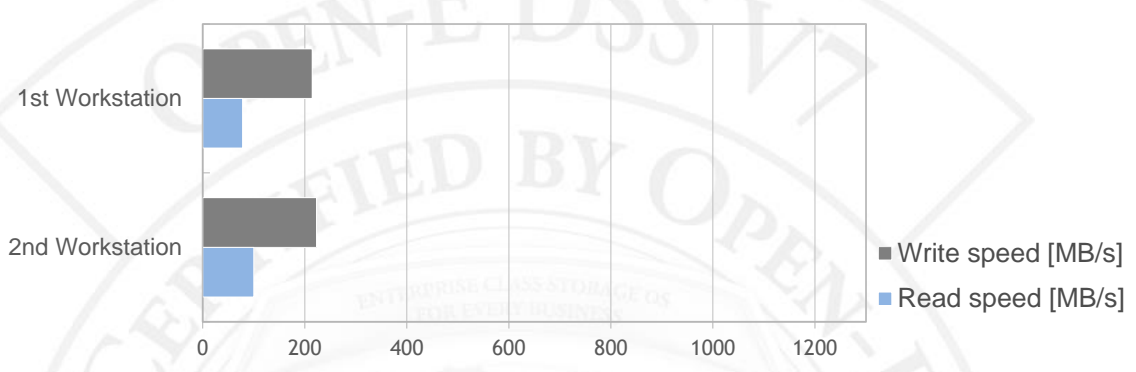


FIGURE 8: Balance-rr bonding mode performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## 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 Server Adapter i210-T1

Single NIC performance test results			
NIC model	Intel® Ethernet Server Adapter i210-T1		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1 <sup>st</sup> Workstation	112.20	112.07	passed

TABLE 11: Single NIC performance test results table for Intel® Ethernet Server Adapter i210-T1

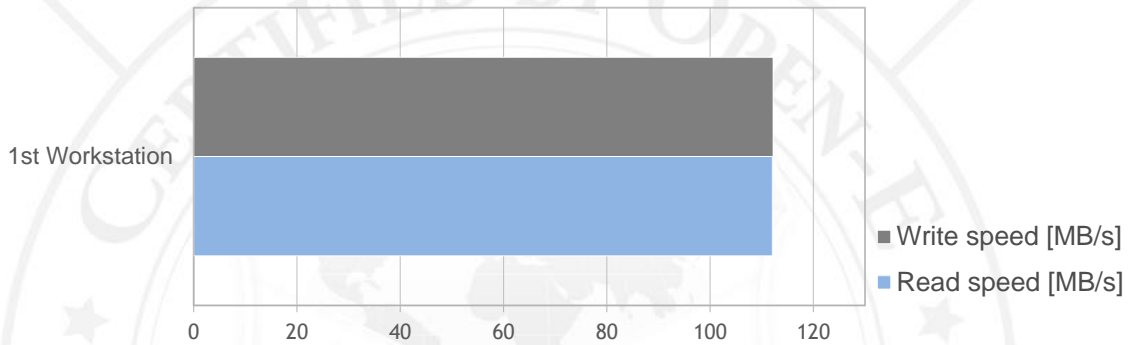


FIGURE 9: Single NIC performance test results chart for Intel® Ethernet Server Adapter i210-T1

### 3. Test results for single NIC test performed on Broadcom® NetXtreme II 10Gigabit Ethernet

Single NIC performance test results			
NIC model	Broadcom® NetXtreme II 10Gigabit Ethernet		
Workstations with MS Windows	Write speed [MB/s]	Read speed [MB/s]	Performance test results
1 <sup>st</sup> Workstation	1067.99	985.38	passed

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

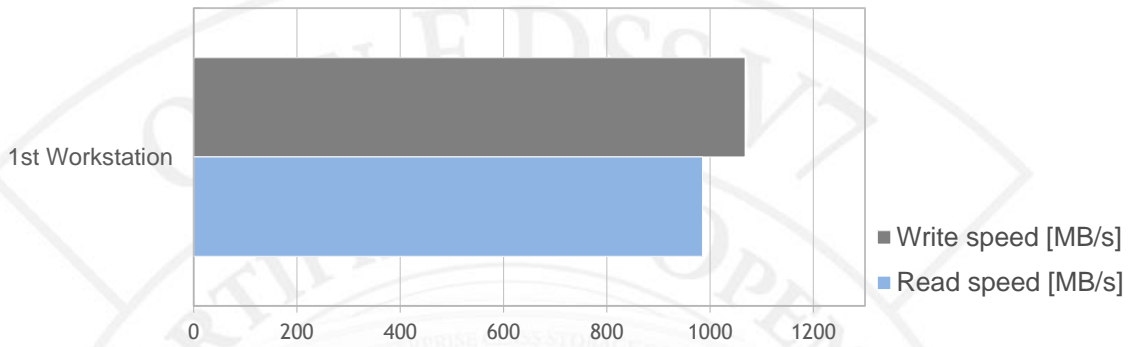
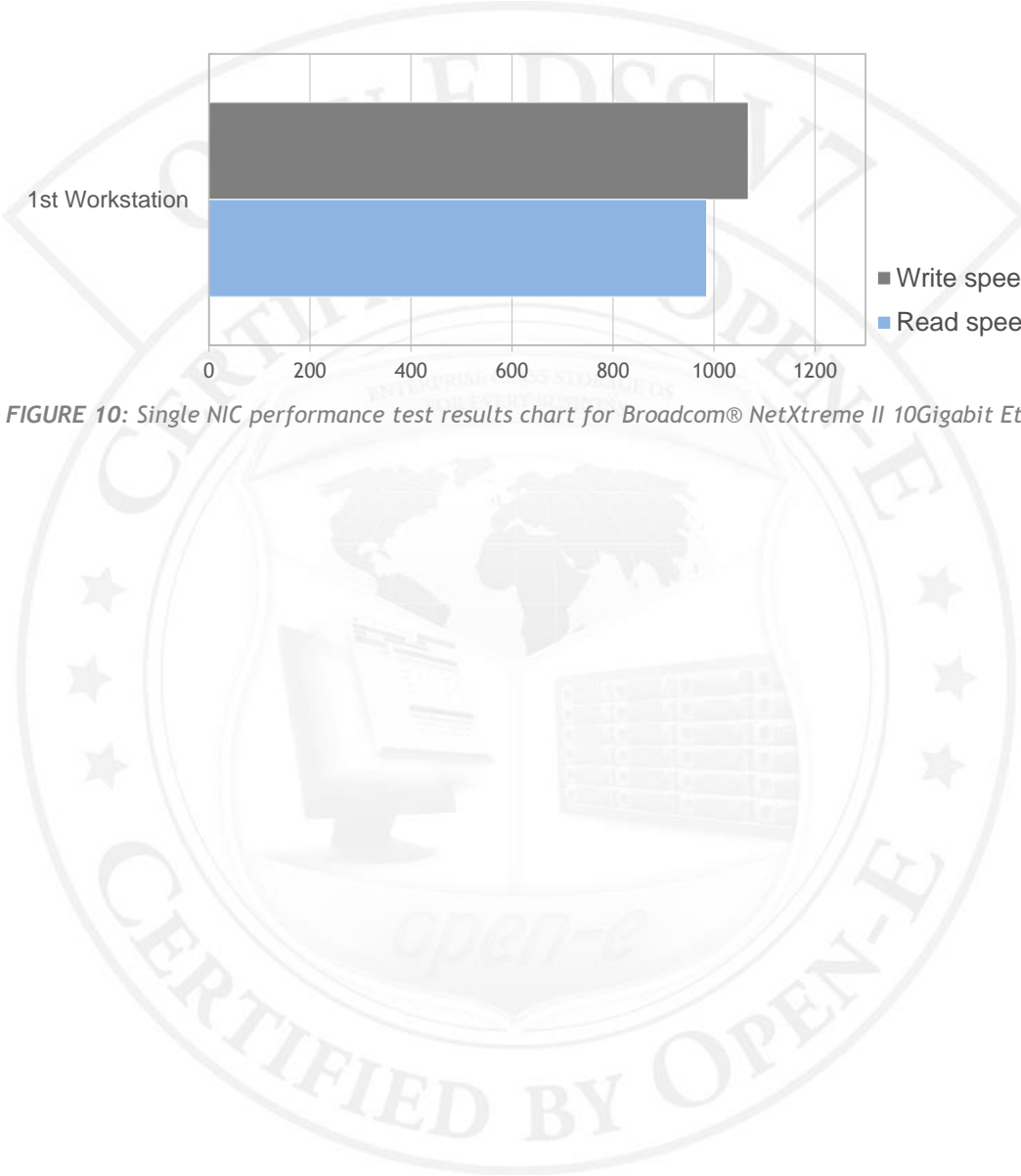


FIGURE 10: Single NIC performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet



## 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, 5 and 10 levels, configuring the iSCSI target and copying the data from a *Workstation with MS Windows* via network connection with various block sizes using the lometer testing tool.

### RAID test topology

Network test topology for RAID testing is shown below

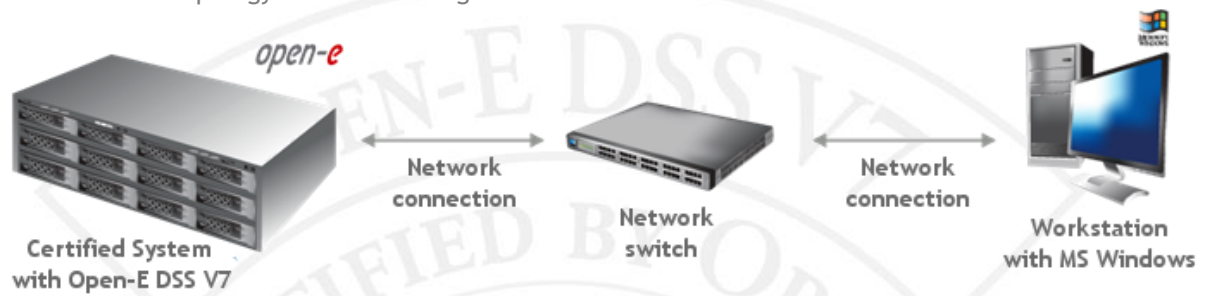


FIGURE 11: Network test topology for RAID testing

## 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 lometer testing tool.

### 2. Test results for RAID0 and Broadcom® NetXtreme II 10Gigabit Ethernet

RAID0 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	54.51	71.73	passed
32	316.24	289.89	passed
64	505.38	373.76	passed
128	677.96	709.25	passed
256	827.52	1050.84	passed
512	939.26	1080.98	passed
1024	1028.11	1046.44	passed
4096	1055.14	990.94	passed

TABLE 13: RAID0 performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

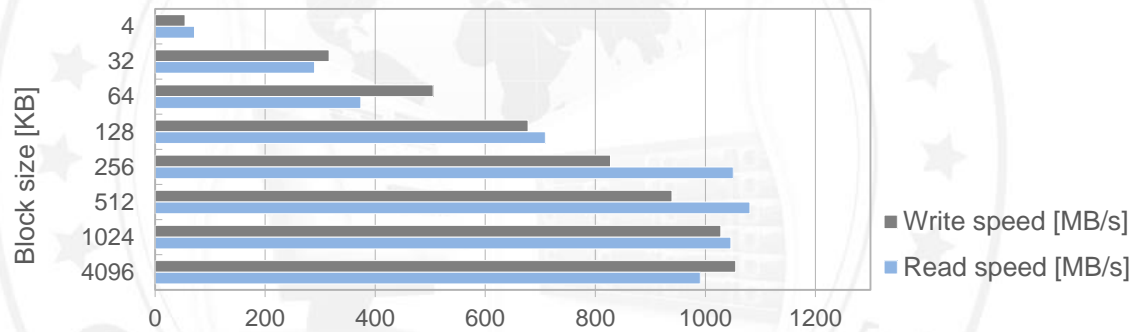


FIGURE 12: RAID0 performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet



## Hardware RAID1 test

### 1. 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 lometer testing tool.

### 2. Test results for RAID1 and Broadcom® NetXtreme II 10Gigabit Ethernet

RAID1 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	78.93	113.97	passed
32	416.53	208.66	passed
64	701.69	189.71	passed
128	1081.09	280.26	passed
256	995.12	640.79	passed
512	1015.74	614.82	passed
1024	1065.97	643.18	passed
4096	1045.65	614.94	passed

TABLE 14: RAID1 performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

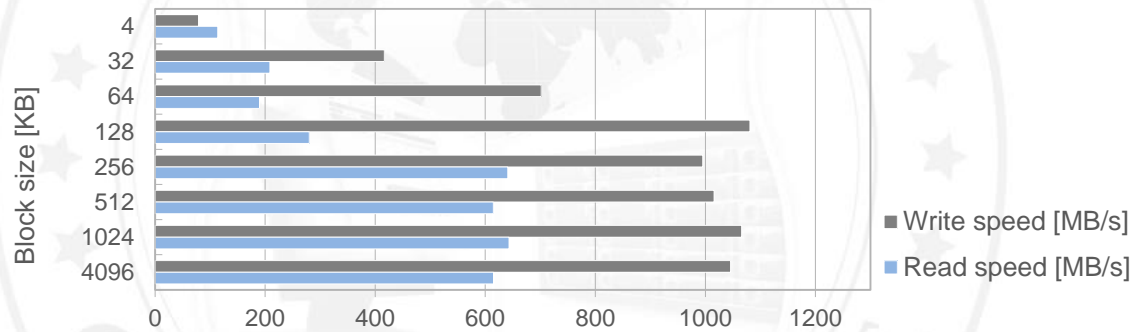


FIGURE 13: RAID1 performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## 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 lometer testing tool.

### 2. Test results for RAID5 and Broadcom® NetXtreme II 10Gigabit Ethernet

RAID5 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	53.14	73.10	passed
32	308.99	285.42	passed
64	505.62	377.39	passed
128	677.77	714.07	passed
256	826.73	1055.11	passed
512	934.01	1075.63	passed
1024	1039.58	1046.24	passed
4096	1052.93	1041.23	passed

TABLE 15: RAID5 performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

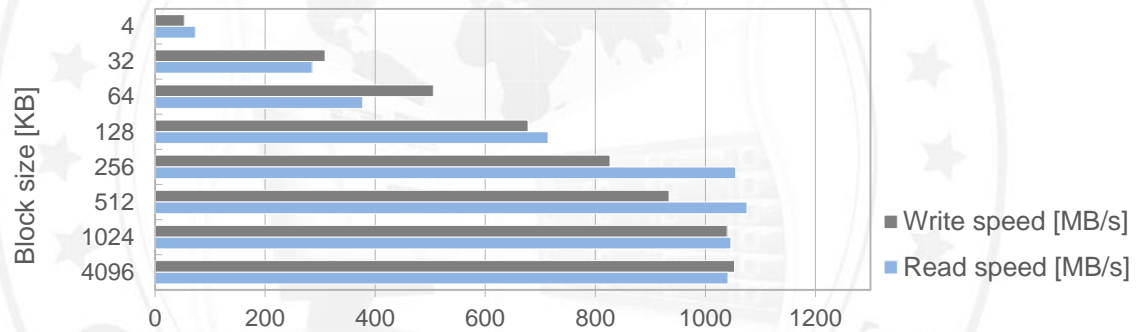


FIGURE 14: RAID5 performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## 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 lometer testing tool.

### 2. Test results for RAID10 and Broadcom® NetXtreme II 10Gigabit Ethernet

RAID10 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	54.58	72.20	passed
32	314.51	287.48	passed
64	501.91	372.12	passed
128	674.34	697.92	passed
256	824.34	1092.41	passed
512	872.30	1079.15	passed
1024	950.65	1068.20	passed
4096	1043.76	1068.05	passed

TABLE 16: RAID10 performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

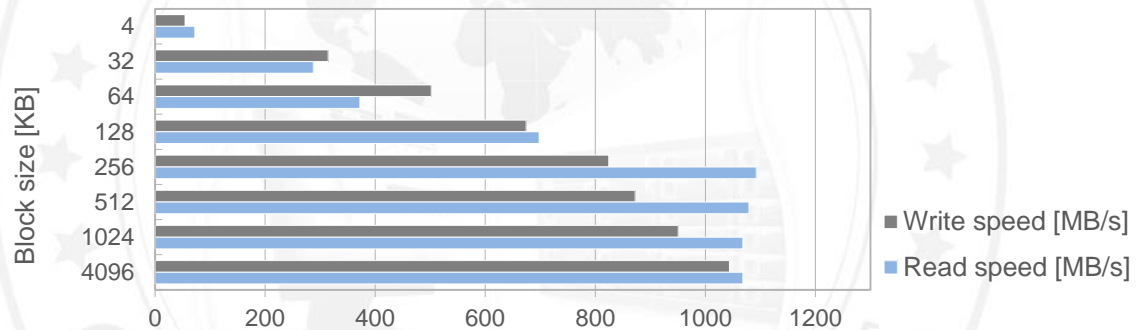


FIGURE 15: RAID10 performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## 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.

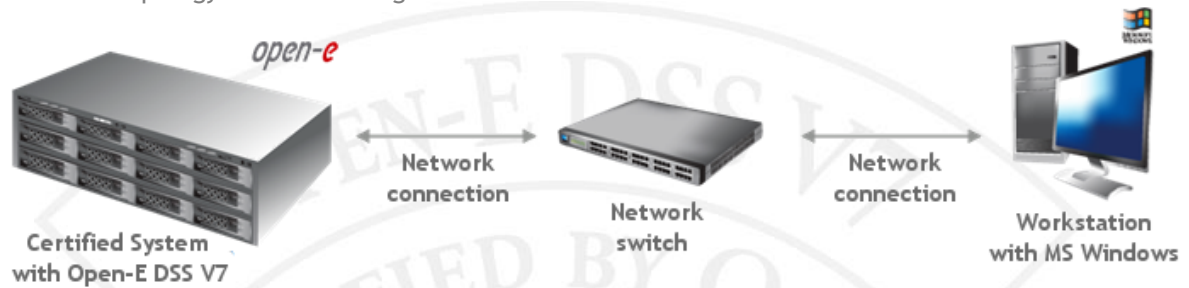


FIGURE 16: Network topology for NAS testing

## 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 lometer testing tool.

### 2. Test results for SMB and Broadcom® NetXtreme II 10Gigabit Ethernet

SMB performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	74.19	64.71	passed
32	409.25	312.54	passed
64	841.78	334.74	passed
128	1030.44	387.77	passed
256	1057.53	444.83	passed
512	1034.74	481.61	passed
1024	1086.23	480.09	passed
4096	1081.88	478.91	passed

TABLE 17: SMB performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

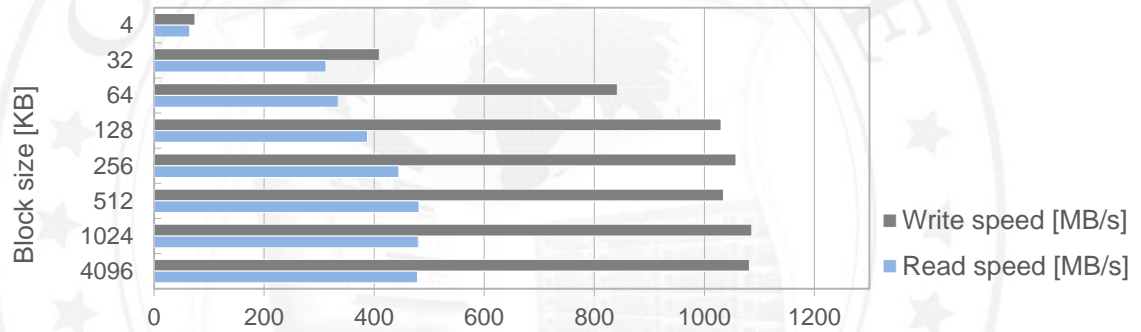


FIGURE 17: SMB performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## 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.

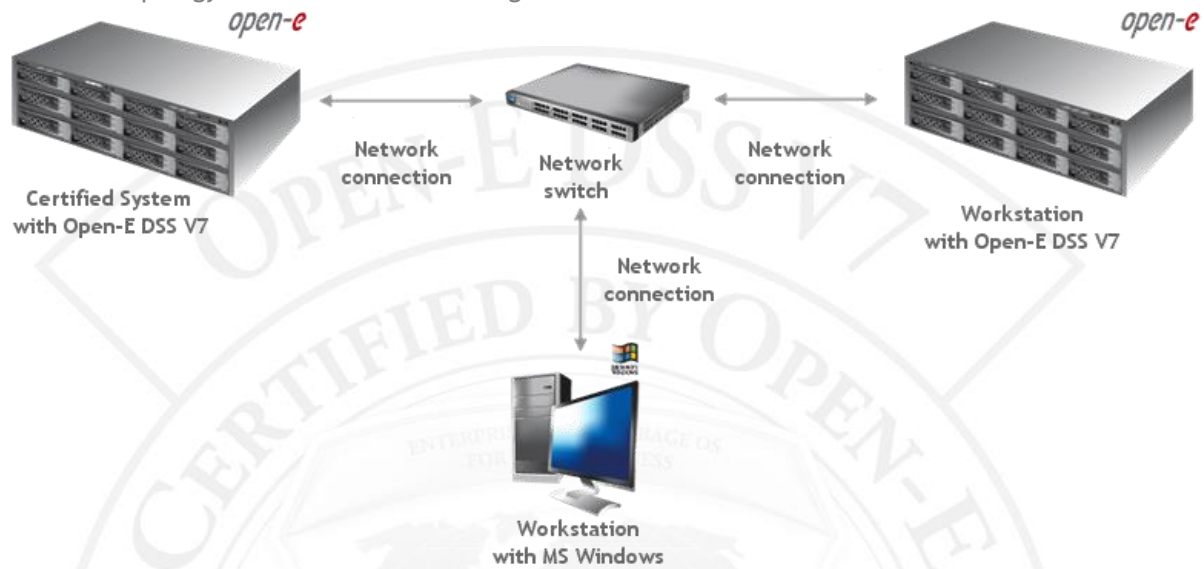


FIGURE 18: Network topology for iSCSI Initiator testing

### iSCSI Target test topology

Network topology for iSCSI Target testing is shown below.

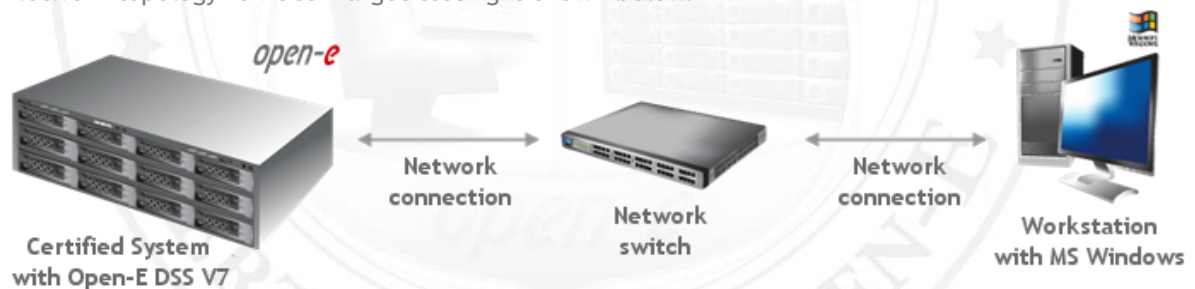


FIGURE 19: Network topology for iSCSI Target testing

## 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 lometer testing tool.

### 2. Test results for iSCSI Initiator and Broadcom® NetXtreme II 10Gigabit Ethernet

iSCSI Initiator performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	54.58	72.20	passed
32	314.51	287.48	passed
64	501.91	372.12	passed
128	674.34	697.92	passed
256	824.34	1092.41	passed
512	872.30	1079.15	passed
1024	950.65	1068.20	passed
4096	1043.76	1068.05	passed

TABLE 18: iSCSI Initiator performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

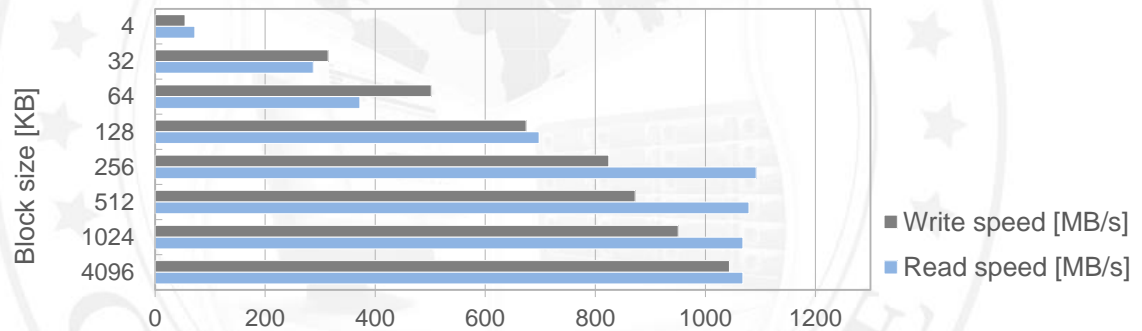


FIGURE 20: iSCSI Initiator performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## 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 *lometer* tool.

### 2. Test results for iSCSI Target and Broadcom® NetXtreme II 10Gigabit Ethernet

iSCSI Target performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	79.78	114.38	passed
32	417.60	262.57	passed
64	705.99	324.94	passed
128	1086.23	685.92	passed
256	964.01	1003.26	passed
512	1021.44	1026.83	passed
1024	1052.89	1030.06	passed
4096	1068.04	1021.82	passed

TABLE 19: iSCSI Target performance test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

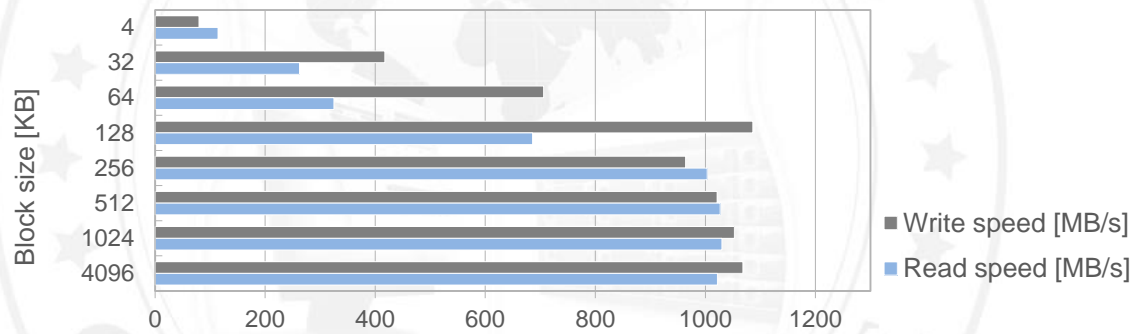


FIGURE 21: iSCSI Target performance test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet



## SSD Cache performance

Tests performed in this section check the performance of SSD cache in the Open-E DSS V7 product on the certified system.

### SSD Cache test topology

Network topology for SSD Cache testing is shown below.

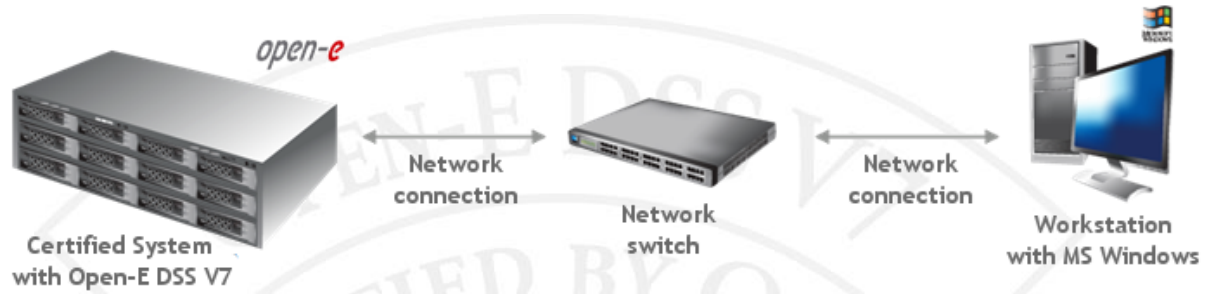
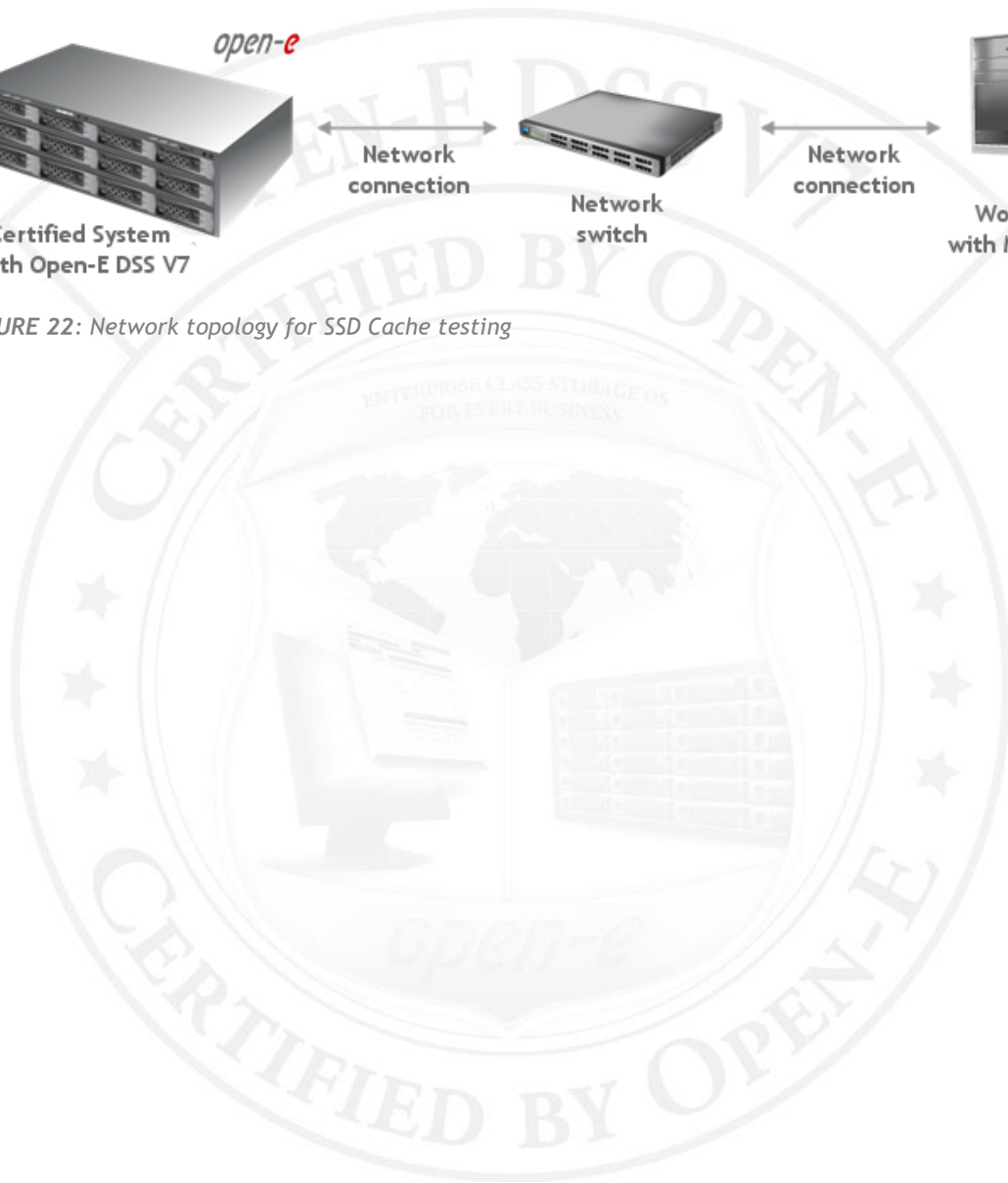


FIGURE 22: Network topology for SSD Cache testing



## SSD Cache with real life pattern test

### 1. Test description

The test relies on creating the iSCSI target on the certified system. writing (35%) and reading (65%) random data from a *Workstation with MS Windows* to it with various block sizes using the lometer tool.

### 2. Test results for SSD Cache with real life pattern and Broadcom® NetXtreme II 10Gigabit Ethernet

SSD Cache with real life pattern test results		
Block size [KB]	Performance [IOPS]	Performance test results
1	5784	passed
2	10047	passed
4	8855	passed

TABLE 20: SSD Cache with real life pattern test results table for Broadcom® NetXtreme II 10Gigabit Ethernet



FIGURE 23: SSD Cache with real life pattern test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet

## SSD Cache with random read/write pattern test

### 1. Test description

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

### 2. Test results for SSD cache with random read/write pattern Broadcom® NetXtreme II 10Gigabit Ethernet

SSD cache with random read/write pattern test results			
Block size [KB]	Write speed [IOPS]	Read speed [IOPS]	Performance test results
1	2172	33759	passed
2	2186	32053	passed
4	2277	21751	passed

TABLE 21: SSD cache with random read/write pattern test results table for Broadcom® NetXtreme II 10Gigabit Ethernet

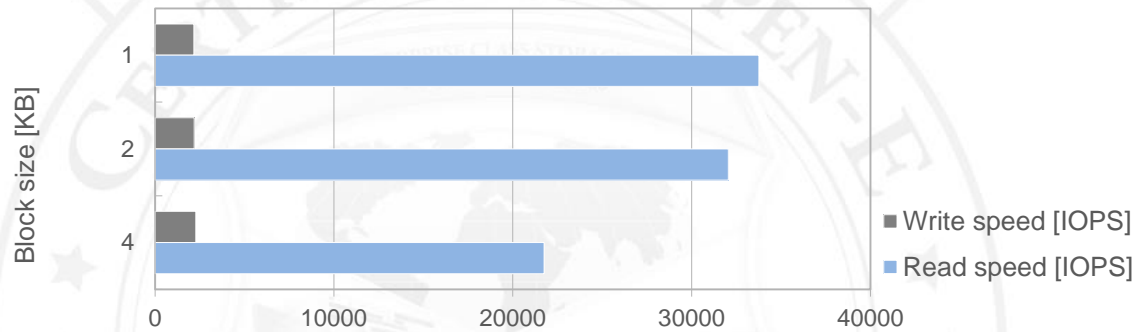


FIGURE 24: SSD cache with random read/write pattern test results chart for Broadcom® NetXtreme II 10Gigabit Ethernet