



CORETO AG RECT ST-3682R8-N Storage system





Executive summary

After performing all tests, the CORETO AG RECT ST-3682R8-N has been officially certified according to the Open-E Hardware Certification Program Guide 2.0.

During the tests, it was found that the system is functional and efficient. With the Open-E DSS V7 operating system installed, the CORETO AG RECT ST-3682R8-N 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 CORETO AG RECT ST-3682R8-N good iSCSI storage:

- HW RAID5, RAID6 or RAID10 for high performance and data safety.
- Four 1GbE and four 10GbE interfaces for fast MPIO connection and flexible network topology.
- Redundant power supply for system reliability.

✓ Storage for backup

The following features make CORETO AG RECT ST-3682R8-N great storage for a backup:

- Four 1GbE and four 10GbE network interfaces provides enough throughput for demanding backup networks and ensure flexibility in backup network topology.
- Combination of six high capacity SAS hard drives and RAID50 or RAID60, ensures a safe storage space for backups.

✓ Storage for CCTV

For this application the following can be used:

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

Certification notes

It is recommended to use Balance-alb bonding mode.

During all tests performance Intel I/O AT was enabled.





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CORETO AG RECT ST-3682R8-N hardware components

Technical specifications about the certified system are listed below:

Model	CORETO AG RECT ST-3682R8-N
Operating system	Open-E DSS V7 build 10529
Enclosure/chassis	Chenbro 19" chassis RM23608
СРИ	2x Intel® Xeon® Processor E5-2609 v2
Motherboard	Tyan S7050GM4NR
Memory	4x 4GB Kingston KVR16R11S8/4KF
Network	Intel® Ethernet Controller I350-AM2 (Dual port)
Network	2x Intel® 82574L Gigabit Ethernet Controller
Network	Intel® Ethernet Converged Network Adapter X520-DA2
Network	Intel® Ethernet Converged Network Adapter X540-T2
HW RAID	Adaptec RAID 7805Q
Hard disk drives	6x 1.2TB GST Ultrastar C10K1200 HUC101212CSS600
Hard disk drives	2x 240GB Intel® SSD DC S3500 Series (SSDSC2BB240G401)

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



CORETO AG RECT ST-3682R8-N photos



FIGURE 1: Front photo



FIGURE 2: Rear photo

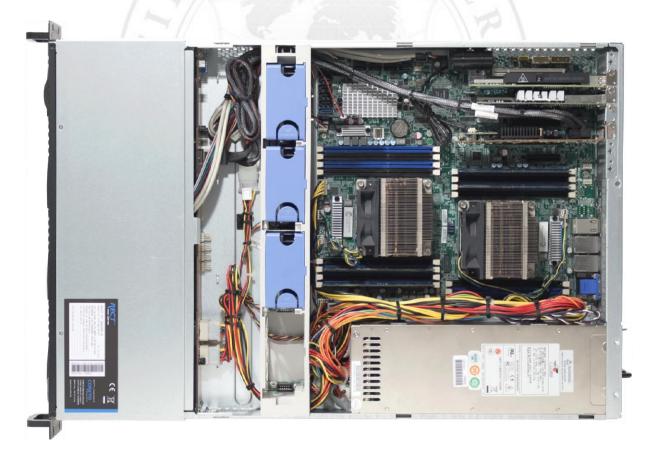


FIGURE 3: Top photo





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	Custom
Motherboard	Supermicro X10SLM+-F
CPU	Intel® Xeon® Processor E3-1220 v3
Memory	2x 4GB Kingston DDR3 1600MHz ECC
Network	2x Intel® Gigabit Server Adapter i210AT
Network	Intel® Ethernet Converged Network Adapter X520-DA2
Network	Intel® Ethernet Converged Network Adapter X540-T2
Hard disk controller	2x Intel® C220
Hard disk drives	1TB WD RE4 WD1003FBYX

TABLE 2: Hardware components of first Workstation with MS Windows

Model	Custom		
Operating system	MS Windows Server 2012 R2		
Enclosure/chassis	Custom		
Motherboard	Supermicro X10SLM+-F		
CPU	Intel® Xeon® Processor E3-1220 v3		
Memory	2x 4GB Kingston DDR3 1600MHz ECC		
Network	2x Intel® Gigabit Server Adapter i210AT		
Network	Intel® Ethernet Converged Network Adapter X520-DA2		
Network	Intel® Ethernet Converged Network Adapter X540-T2		
Hard disk controller	2x Intel® C220		
Hard disk drives	1TB WD RE4 WD1003FBYX		

TABLE 3: Hardware components of second Workstation with MS Windows



Model	Custom
Operating system	Open-E DSS V7 build 10529
Enclosure/chassis	Custom
Motherboard	Asus P8B-WS
CPU	Intel® Core™ i3-3210 Processor
Memory	2x 4GB Kingston KVR1333D3N9/4G
Network	2x Intel® 82574L Gigabit Ethernet Controller
Network	Intel® Ethernet Converged Network Adapter X520-DA2
Network	Intel® Ethernet Converged Network Adapter X540-T2
Hard disk controller	Intel® C206
Hard disk drives	300GB WD VelociRaptor WD3000HLFS
Hard disk drives	2x 1TB WD RE4 WD1003FBYX

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

Model	Netgear ProSafe GS728TXS-100NES
Description	24 ports 1GbE and 4 ports SFP+ 10GbE

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

Model	Netgear ProSafe XS712T-100NES
Description	12 ports 10GbE and 2 ports SFP+ 10GbE

 TABLE 6: Network switch details for connection with Intel® Ethernet Converged Network Adapter X540-T2

Administration functionality

The following functionality has been tested.

Drive identifier	OK
Power button	OK
Front and rear LEDs	OK
Intel I/O AT	OK

TABLE 7: 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.

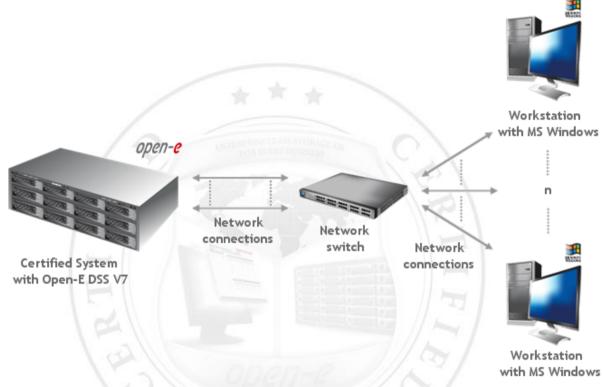


FIGURE 4: Network topology for Network testing



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 lometer testing tool.

2. Test results for 802.3ad bonding mode test performed on Intel® 82574L Gigabit Ethernet Controller

802.3ad bonding mode performance test results			
NIC model	Intel® 82574L Gigabit Ethernet Controller		
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results		
1 st Workstation	110.57	62.58	passed
2 nd Workstation	110.40 49.79 passed		

TABLE 8: 802.3ad bonding mode performance test results table for Intel® 82574L Gigabit Ethernet Controller

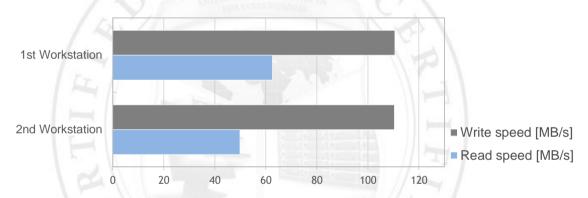


FIGURE 5: 802.3ad bonding mode performance test results chart for Intel® 82574L Gigabit Ethernet Controller





3. 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 Read speed Performance test [MB/s] [MB/s] results		
1 st Workstation	110.17	59.97	passed
2 nd Workstation	110.64	53.55	passed

TABLE 9: 802.3ad bonding mode performance test results table for Intel® Ethernet Controller I350-AM2

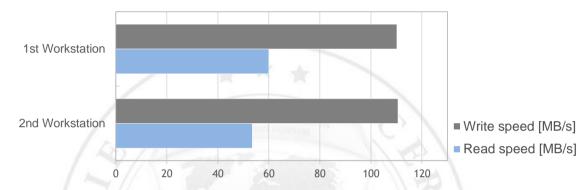


FIGURE 6: 802.3ad bonding mode performance test results chart for Intel® Ethernet Controller 1350-AM2



4. Test results for 802.3ad bonding mode test performed on Intel® Ethernet Converged Network Adapter X540-T2

802.3ad bonding mode performance test results				
NIC model	Intel® Ethernet Converged Network Adapter X540			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	386.63	358.86	passed	
2 nd Workstation	419.03	402.83	passed	

TABLE 10: 802.3ad bonding mode performance test results table for Intel® Ethernet Converged Network Adapter X540-T2

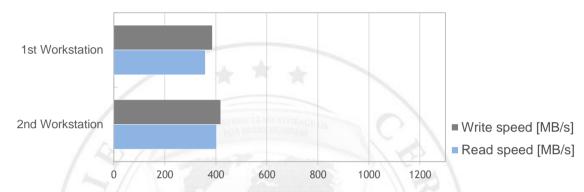


FIGURE 7: 802.3ad bonding mode performance test results chart for Intel® Ethernet Converged Network Adapter X540-T2



5. Test results for 802.3ad bonding mode test performed on Intel® Ethernet Converged Network Adapter X520-DA2

802.3ad bonding mode performance test results				
NIC model	Intel® Ethernet Converged Network Adapter X520			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	306.06	345.18	passed	
2 nd Workstation	station 601.86 536.46 passed			

TABLE 11: 802.3ad bonding mode performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

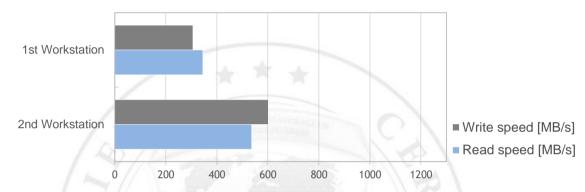


FIGURE 8: 802.3ad bonding mode performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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 lometer testing tool.

2. Test results for Balance-alb bonding mode test performed on Intel® 82574L Gigabit Ethernet Controller

Balance-alb bonding mode performance test results				
NIC model	Intel® 82574L Gigabit Ethernet Controller			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	112.08	109.45	passed	
2 nd Workstation	112.13	109.85	passed	

TABLE 12: Balance-alb bonding mode performance test results table for Intel® 82574L Gigabit Ethernet Controller

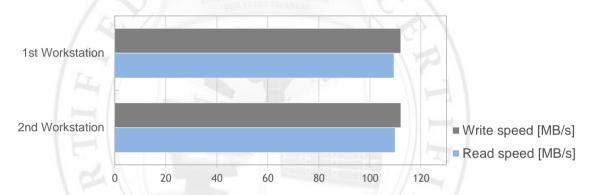


FIGURE 9: Balance-alb bonding mode performance test results chart for Intel® 82574L Gigabit Ethernet Controller



3. 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 Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	111.01	111.80	passed	
2 nd Workstation	111.46	112.22	passed	

TABLE 13: Balance-alb bonding mode performance test results table for Intel® Ethernet Controller I350-AM2

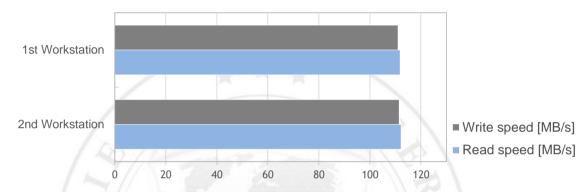


FIGURE 10: Balance-alb bonding mode performance test results chart for Intel® Ethernet Controller I350-AM2





4. Test results for Balance-alb bonding mode test performed on Intel® Ethernet Converged Network Adapter X540-T2

Balance-alb bonding mode performance test results				
NIC model	Intel® Ethernet Converged Network Adapter X540			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	338.59	384.20	passed	
2 nd Workstation	367.02	416.01	passed	

TABLE 14: Balance-alb bonding mode performance test results table for Intel® Ethernet Converged Network Adapter X540-T2

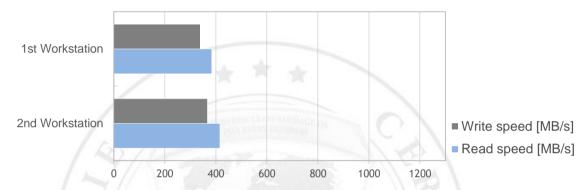


FIGURE 11: Balance-alb bonding mode performance test results chart for Intel® Ethernet Converged Network Adapter X540-T2



5. Test results for Balance-alb bonding mode test performed on Intel® Ethernet Converged Network Adapter X520-DA2

Balance-alb bonding mode performance test results				
NIC model	Intel® Ethernet Converged Network Adapter X520			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	343.94	413.47	passed	
2 nd Workstation	374.42	471.14	passed	

TABLE 15: Balance-alb bonding mode performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

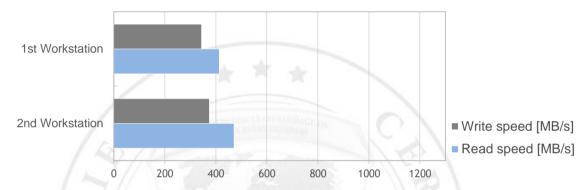


FIGURE 12: Balance-alb bonding mode performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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 lometer testing tool.

2. Test results for Balance-rr bonding mode test performed on Intel® 82574L Gigabit Ethernet Controller

Balance-rr bonding mode performance test results				
NIC model	Intel® 82574L Gigabit Ethernet Controller			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	112.19	76.23	passed	
2 nd Workstation	112.39	93.79	passed	

TABLE 16: Balance-rr bonding mode performance test results table for Intel® 82574L Gigabit Ethernet Controller

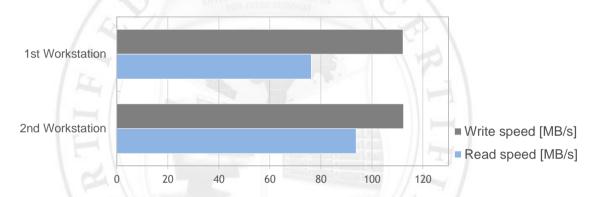


FIGURE 13: Balance-rr bonding mode performance test results chart for Intel® 82574L Gigabit Ethernet Controller



3. 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 Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	111.94 62.96 passed			
2 nd Workstation	112.31	77.59	passed	

TABLE 17: Balance-rr bonding mode performance test results table for Intel® Ethernet Controller I350-AM2

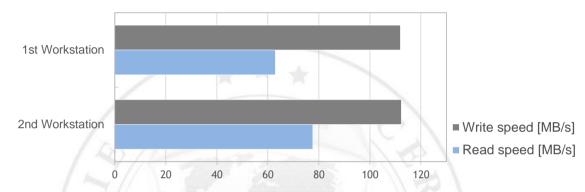


FIGURE 14: Balance-rr bonding mode performance test results chart for Intel® Ethernet Controller I350-AM2



4. Test results for Balance-rr bonding mode test performed on Intel® Ethernet Converged Network Adapter X540-T2

Balance-rr bonding mode performance test results				
NIC model	Intel® Ethernet Converged Network Adapter X540			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	444.53	137.21	passed	
2 nd Workstation	494.09	194.82	passed	

TABLE 18: Balance-rr bonding mode performance test results table for Intel® Ethernet Converged Network Adapter X540-T2

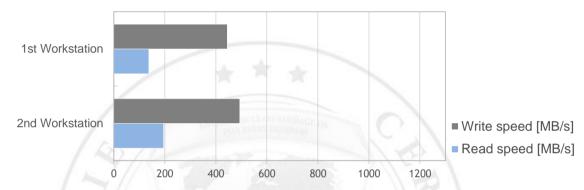


FIGURE 15: Balance-rr bonding mode performance test results chart for Intel® Ethernet Converged Network Adapter X540-T2





5. Test results for Balance-rr bonding mode test performed on Intel® Ethernet Converged Network Adapter X520-DA2

Balance-rr bonding mode performance test results				
NIC model	Intel® Ethernet Converged Network Adapter X520			
Workstations with MS Windows	Write speed Read speed Performance test [MB/s] [MB/s] results			
1 st Workstation	485.12	143.95	passed	
2 nd Workstation	479.34	203.05	passed	

TABLE 19: Balance-rr bonding mode performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

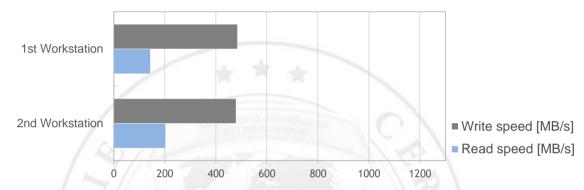


FIGURE 16: Balance-rr bonding mode performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2





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, 1E, 5, 6 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 17: Network test topology for RAID testing



Hardware RAIDO test

1. Test description

The test relies on creation of the RAIDO 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 RAIDO and Intel® Ethernet Converged Network Adapter X520-DA2

RAIDO performance test results				
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results	
4	15.86	45.03	passed	
32	121.53	224.50	passed	
64	221.45	366.74	passed	
128	317.20	564.60	passed	
256	472.20	618.37	passed	
512	498.53	677.29	passed	
1024	505.21	496.81	passed	
4096	496.30	488.64	passed	

TABLE 20: RAIDO performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

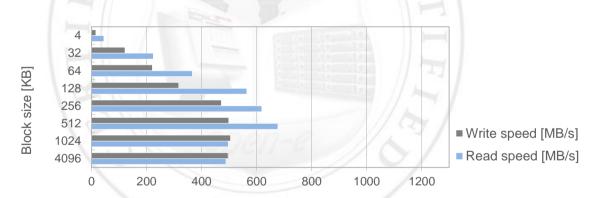


FIGURE 18: RAIDO performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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 Intel® Ethernet Converged Network Adapter X520-DA2

RAID1 performa	RAID1 performance test results				
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results		
4	14.69	44.60	passed		
32	122.76	223.54	passed		
64	221.10	364.91	passed		
128	298.49	559.59	passed		
256	359.15	632.56	passed		
512	305.11	665.99	passed		
1024	294.17	489.06	passed		
4096	481.13	492.59	passed		

TABLE 21: RAID1 performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

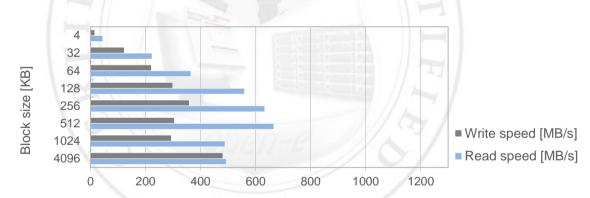


FIGURE 19: RAID1 performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



Hardware RAID1E test

1. Test description

The test relies on creation of the RAID1E 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 RAID1E and Intel® Ethernet Converged Network Adapter X520-DA2

RAID1E perform	RAID1E performance test results				
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results		
4	14.57	45.58	passed		
32	119.53	227.15	passed		
64	222.83	365.22	passed		
128	327.60	568.57	passed		
256	436.08	634.27	passed		
512	470.88	656.83	passed		
1024	478.19	495.93	passed		
4096	509.39	494.03	passed		

TABLE 22: RAID1E performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

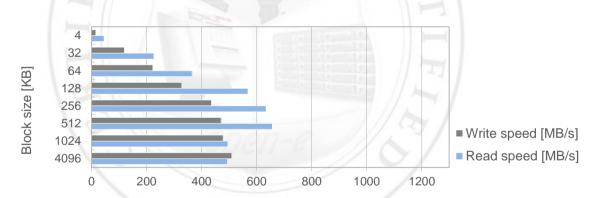


FIGURE 20: RAID1E performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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 Intel® Ethernet Converged Network Adapter X520-DA2

RAID5 performance test results				
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results	
4	14.30	20.61	passed	
32	92.64	116.94	passed	
64	164.01	225.14	passed	
128	248.54	273.90	passed	
256	348.28	480.31	passed	
512	463.03	451.23	passed	
1024	483.81	434.28	passed	
4096	507.01	498.41	passed	

TABLE 23: RAID5 performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

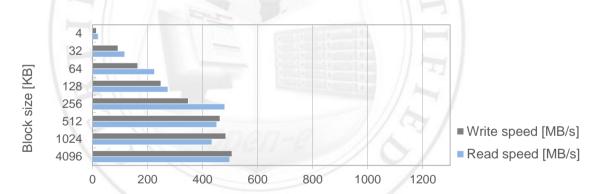


FIGURE 21: RAID5 performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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 lometer testing tool.

2. Test results for RAID6 and Intel® Ethernet Converged Network Adapter X520-DA2

RAID6 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	15.02	44.28	passed
32	120.04	227.06	passed
64	224.48	369.53	passed
128	322.75	579.33	passed
256	445.11	635.64	passed
512	485.70	673.89	passed
1024	486.33	498.12	passed
4096	502.56	491.88	passed

TABLE 24: RAID6 performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

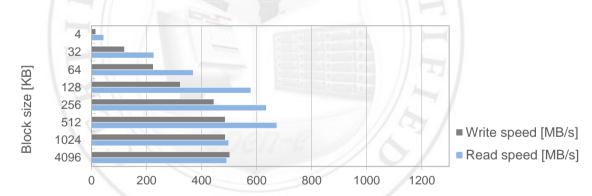


FIGURE 22: RAID6 performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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 Intel® Ethernet Converged Network Adapter X520-DA2

RAID10 performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	14.53	44.86	passed
32	121.99	225.60	passed
64	224.46	368.59	passed
128	326.74	565.56	passed
256	463.63	629.87	passed
512	488.54	654.56	passed
1024	497.05	492.45	passed
4096	500.89	498.23	passed

TABLE 25: RAID10 performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

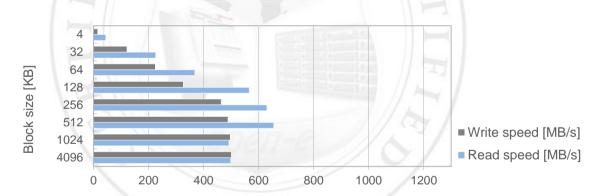


FIGURE 23: RAID10 performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2





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 lometer testing tool.

NAS test topology

Network topology for NAS testing is shown below.



FIGURE 24: 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 Intel® Ethernet Converged Network Adapter X520-DA2

SMB performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	29.87	31.08	passed
32	207.79	160.27	passed
64	330.86	173.01	passed
128	544.24	206.52	passed
256	730.17	243.65	passed
512	986.81	269.79	passed
1024	901.64	276.16	passed
4096	974.01	287.07	passed

TABLE 26: SMB performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

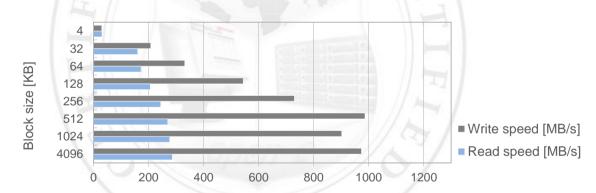


FIGURE 25: SMB performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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

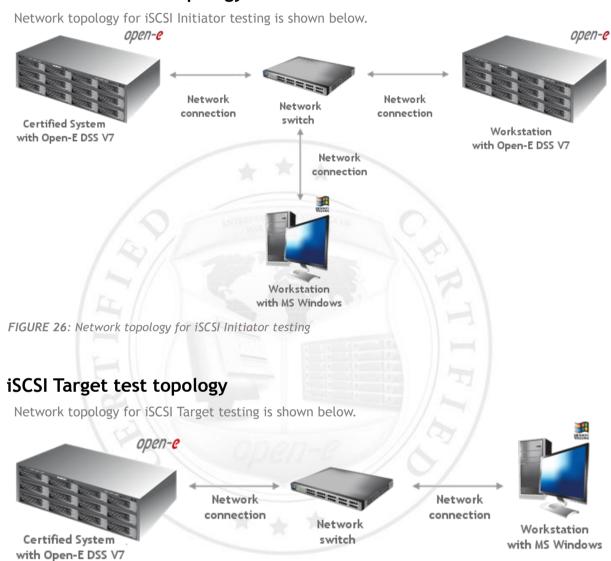


FIGURE 27: Network topology for iSCSI Target testing



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 Intel® Ethernet Converged Network Adapter X520-DA2

iSCSI Initiator performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	28.20	30.11	passed
32	182.58	143.14	passed
64	316.19	145.55	passed
128	513.20	184.97	passed
256	467.78	222.22	passed
512	456.41	245.59	passed
1024	457.33	252.89	passed
4096	462.47	268.60	passed

TABLE 27: iSCSI Initiator performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

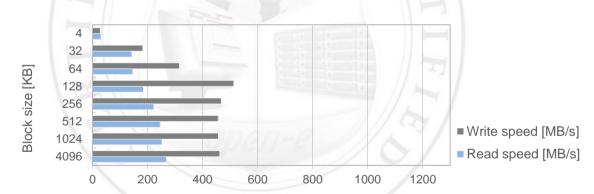


FIGURE 28: iSCSI Initiator performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2



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 Intel® Ethernet Converged Network Adapter X520-DA2

iSCSI Target performance test results			
Block size [KB]	Write speed [MB/s]	Read speed [MB/s]	Performance test results
4	15.08	20.79	passed
32	102.20	122.80	passed
64	177.79	196.55	passed
128	257.51	365.23	passed
256	348.58	412.35	passed
512	419.09	458.86	passed
1024	452.31	428.44	passed
4096	458.19	481.66	passed

TABLE 28: iSCSI Target performance test results table for Intel® Ethernet Converged Network Adapter X520-DA2

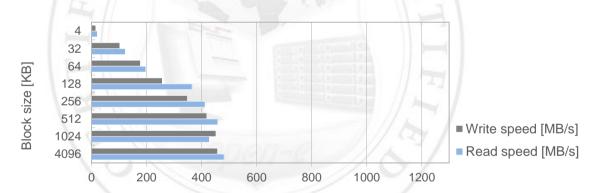


FIGURE 29: iSCSI Target performance test results chart for Intel® Ethernet Converged Network Adapter X520-DA2