



# Performance

## ONTAP Select

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# Table of Contents

- Performance. .... 1
  - Performance general considerations. .... 1
  - ONTAP Select 9.4 performance: Premium HA direct-attached SSD storage. .... 1
  - ONTAP Select 9.5 performance: Premium HA direct-attached SSD storage. .... 4
  - ONTAP Select 9.6 performance: Premium HA direct-attached SSD storage. .... 6

# Performance

## Performance general considerations

Performance varies based on hardware configuration.

The performance numbers described in this section are intended as a rough estimate of the performance of an ONTAP Select cluster and are not a performance guarantee.

The performance of an ONTAP Select cluster can vary considerably due to the characteristics of the underlying hardware and configuration. As a matter of fact, the specific hardware configuration is the biggest factor in the performance of a particular ONTAP Select instance. Here are some of the factors that affect the performance of a specific ONTAP Select instance:

- **Core frequency.** In general, a higher frequency is preferable.
- **Single socket versus multsocket.** ONTAP Select does not use multsocket features, but the hypervisor overhead for supporting multsocket configurations accounts for some amount of deviation in total performance.
- **RAID card configuration and associated hypervisor driver.** The default driver provided by the hypervisor might need to be replaced by the hardware vendor driver.
- **Drive type and number of drives in the RAID group(s).**
- **Hypervisor version and patch level.**

This section includes performance comparisons only when the testing was performed on the exact same test bed to highlight the impact of a specific feature. In general, we document the hardware environment and run the highest performance configuration possible on that platform.

## ONTAP Select 9.4 performance: Premium HA direct-attached SSD storage

ONTAP Select 9.4 performance with premium HA direct-attached SSD storage.

### Reference platform

ONTAP Select 9.4 (Premium) hardware (per node):

- Cisco UCS C240 M4S2:
  - Intel Xeon CPU E5-2697 at 2.60GHz
  - 2 x sockets; 14 x CPUs per socket
  - 56 x logical CPUs (HT enabled)

- 256GB RAM
- VMware ESXi 6.5
- Drives per host: 24 X371A NetApp 960GB SSD

Client hardware:

- 4 x NFSv3 IBM 3550m4 clients

Configuration information:

- 1,500 MTU for data path between clients and Select cluster
- No storage efficiency features in use (compression, deduplication, Snapshot copies, SnapMirror, and so on)

The following table lists the throughput measured against read/write workloads on an HA pair of ONTAP Select Premium nodes. Performance measurements were taken using the SIO load-generating tool.

**Performance results for a single node (part of a four-node medium instance) ONTAP Select 9.4 cluster on DAS (SSD)**

Description	Sequential Read 64KiB	Sequential Write 64KiB	Random Read 8KiB	Random Write 8KiB	Random WR/RD (50/50) 8KiB
ONTAP 9.4 Select Medium instance with DAS (SSD)	1045MBps 16,712 IOPS	251MBps 4016 IOPS	492MBps 62,912 IOPS	141MBps 18,048 IOPS	218MBps 27,840 IOPS

**64K sequential read**

Details:

- SIO direct I/O enabled
- 2 x data NIC
- 1 x data aggregate (2TB)
- 64 volumes; 64 SIO procs/threads
- 32 volumes per node (64 total)
- 1 x SIO procs per volume; 1 x SIO thread per file
- 1 x files per volume; files are 12000MB each

**64K sequential write**

Details:

- SIO direct I/O enabled
- 2 x data NIC
- 1 x data aggregate (2TB):
- 64 volumes; 128 SIO procs/threads
- 32 volumes per node (64 total)
- 2 x SIO procs per volume; 1 x SIO thread per file
- 2 x files per volume; files are 30720MB each

### **8K random read**

Details:

- SIO direct I/O enabled
- 2 x data NIC
- 1 x data aggregate (2TB):
- 64 volumes; 64 SIO procs/threads
- 32 volumes per node (64 total)
- 1 x SIO procs per volume; 8 x SIO thread per file
- 1 x files per volume; files are 12288MB each

### **8K random write**

Details:

- SIO direct I/O enabled
- 2 x data NIC
- 1 x data aggregate (2TB)
- 64 volumes; 64 SIO procs/threads
- 32 volumes per node (64 total)
- 1 x SIO procs per volume; 8 x SIO thread per file
- 1 x files per volume; files are 8192MB each

### **8K random 50% write 50% read**

Details:

- SIO direct I/O enabled
- 2 x data NIC

- 1 x data aggregate (2TB)
- 64 volumes; 64 SIO procs/threads
- 32 volumes per node (64 total)
- 1 x SIO procs per volume; 20 x SIO thread per file
- 1 x files per volume; files are 12228MB each

## ONTAP Select 9.5 performance: Premium HA direct-attached SSD storage

ONTAP Select 9.5 performance with premium HA direct-attached SSD storage.

### Reference platform

ONTAP Select 9.5 (Premium) hardware (per node):

- Cisco UCS C240 M4SX:
  - Intel Xeon CPU E5-2620 at 2.1GHz
  - 2 x sockets; 16 x CPUs per socket
  - 128GB RAM
  - VMware ESXi 6.5
  - Drives per host: 24 900GB SSD

Client hardware:

- 5 x NFSv3 IBM 3550m4 clients

Configuration information:

- 1,500 MTU for data path between clients and Select cluster
- No storage efficiency features in use (compression, deduplication, Snapshot copies, SnapMirror, and so on)

The following table lists the throughput measured against read/write workloads on an HA pair of ONTAP Select Premium nodes using both software RAID and hardware RAID. Performance measurements were taken using the SIO load-generating tool.

**Performance results for a single node (part of a four-node medium instance) ONTAP Select 9.5 cluster on DAS (SSD) with software RAID and hardware RAID**

<b>Description</b>	<b>Sequential Read 64KiB</b>	<b>Sequential Write 64KiB</b>	<b>Random Read 8KiB</b>	<b>Random Write 8KiB</b>	<b>Random WR/ RD (50/50) 8KiB</b>
ONTAP 9.5 Select Medium instance with DAS (SSD) hardware RAID	1,714MiBps	412MiBps	391MiBps	1251MiBps	309MiBps
ONTAP 9.5 Select Medium instance with DAS (SSD) software RAID	1,674MiBps	360MiBps	451MiBps	223MiBps	293MiBps

### **64K sequential read**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (8TB software RAID)
- 64 SIO procs, 1 thread per proc
- 32 volumes per node
- 1 x files per proc; files are 12000MB each

### **64K sequential write**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)
- 128 SIO procs, 1 thread per proc
- volumes per node 32 (hardware RAID), 16 (software RAID)
- 1 x files per proc; files are 30720MB each

### **8K random read**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)
- 64 SIO procs, 8 threads per proc
- volumes per node 32
- 1 file per proc; files are 12228MB each

### **8K random write**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)
- 64 SIO procs, 8 threads per proc
- volumes per node 32
- 1 file per proc; files are 8192MB each

### **8K random 50% write 50% read**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)
- 64 SIO procs, 20 threads per proc
- volumes per node 32
- 1 file per proc; files are 12228MB each

## **ONTAP Select 9.6 performance: Premium HA direct-attached SSD storage**

Performance information for the reference platform.



# Reference platform

## ONTAP Select 9.6 (Premium XL) Hardware (per Node)

- FUJITSU PRIMERGY RX2540 M4:
  - Intel® Xeon® Gold 6142b CPU at 2.6 GHz
  - 32 physical cores (16 x 2 sockets), 64 logical
  - 256 GB RAM
  - Drives per host: 24 960GB SSD
  - ESX 6.5U1

## Client hardware

- 5 x NFSv3 IBM 3550m4 clients

## Configuration information

- SW RAID 1 x 9 + 2 RAID-DP (11 drives)
- 22+1 RAID-5 (RAID-0 in ONTAP) / RAID cache NVRAM
- No storage efficiency features in use (compression, deduplication, Snapshot copies, SnapMirror, and so on)

The following table lists the throughput measured against read/write workloads on an HA pair of ONTAP Select Premium nodes using both software RAID and hardware RAID. Performance measurements were taken using the SIO load-generating tool.

## Performance results for a single node (part of a four-node medium instance) ONTAP Select 9.5 cluster on DAS (SSD) with software RAID and hardware RAID

Description	Sequential Read 64KiB	Sequential Write 64KiB	Random Read 8KiB	Random Write 8KiB	Random WR/ RD (50/50) 8KiB
ONTAP 9.6 Select Large instance with DAS (SSD) software RAID	2171 MiBps	559 MiBps	954 MiBps	394 MiBps	564 MiBps
ONTAP 9.6 Select Medium instance with DAS (SSD) software RAID	2090 MiBps	592 MiBps	677 MiBps	335 MiBps	441 3MiBps

<b>Description</b>	<b>Sequential Read 64KiB</b>	<b>Sequential Write 64KiB</b>	<b>Random Read 8KiB</b>	<b>Random Write 8KiB</b>	<b>Random WR/ RD (50/50) 8KiB</b>
ONTAP 9.6 Select Medium instance with DAS (SSD) hardware RAID	2038 MiBps	520 MiBps	578 MiBps	325 MiBps	399 MiBps

## **64K sequential read**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (8TB software RAID)
- 64 SIO procs, 1 thread per proc
- 32 volumes per node
- 1 x files per proc; files are 12000MB each

## **64K sequential write**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)
- 128 SIO procs, 1 thread per proc
- volumes per node 32 (hardware RAID), 16 (software RAID)
- 1 x files per proc; files are 30720MB each

## **8K random read**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)

- 64 SIO procs, 8 threads per proc
- volumes per node 32
- 1 x files per proc; files are 12228MB each

### **8K random write**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)
- 64 SIO procs, 8 threads per proc
- volumes per node 32
- 1 x files per proc; files are 8192MB each

### **8K random 50% write 50% read**

Details:

- SIO direct I/O enabled
- 2 nodes
- 2 x data NIC per node
- 1 x data aggregate per node (2TB hardware RAID), (4TB software RAID)
- 64 SIO proc208 threads per proc
- volumes per node 32
- 1 x files per proc; files are 12228MB each

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