



# Performance

## ONTAP Select

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# 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 multisolet.** ONTAP Select does not use multisolet features, but the hypervisor overhead for supporting multisolet 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<br>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 12228MB 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**

| Description   | Sequential Read 64KiB | Sequential Write 64KiB | Random Read 8KiB | Random Write 8KiB | Random WR/RD (50/50) 8KiB |
|---|-----------------------|------------------------|------------------|-------------------|---------------------------|
| 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                 |



| Description   | Sequential Read 64KiB | Sequential Write 64KiB | Random Read 8KiB | Random Write 8KiB | Random WR/RD (50/50) 8KiB |
|---|-----------------------|------------------------|------------------|-------------------|---------------------------|
| ONTAP 9.6 Select Medium instance with DAS (SSD) software RAID | 2090 MiBps            | 592 MiBps              | 677 MiBps        | 335 MiBps         | 441 3MiBps                |
| 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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