



Performance

ONTAP Select

NetApp
October 12, 2020

This PDF was generated from https://docs.netapp.com/us-en/ontap-select/concept_perf_general.html on October 12, 2020. Always check docs.netapp.com for the latest.

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

| 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 |
| ONTAP 9.6 Select Medium instance with DAS (SSD) software RAID | 2090 MiBps | 592 MiBps | 677 MiBps | 335 MiBps | 441 3MiBps |

| 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) 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

Copyright Information

Copyright © 2020 NetApp, Inc. All rights reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means-graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system-without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

RESTRICTED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.277-7103 (October 1988) and FAR 52-227-19 (June 1987).

Trademark Information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.