

napp-it

ZFS Epyc ESXi/ Storage Server

Some short performance tests  
to compare

- Xeon Silver 4110 vs Epyc 7302
- Disk vs Flash vs Optane
- OmniOS 151034 vs 151036
  
- barebone vs virtualized

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## 1.0 Intel Xeon vs AMD Epyc

This benchmark sequence was intended to answer some basic questions about how the new Epyc platform performs my current Intel Xeon silver on a disk pool vs Optane/Flash pool. Additionally we check encryption performance and OmniOS 151036 vs 151036 with FPU accelerated raid-Z. The Xeon system was my typical VM and storage server up to this year (without disks typically from the 3000 Euro region), the Epyc may become my next standard platform in this price range. While it is clear that a system from this year will always outperform one from last year at same price, I want to know how much and especially how fast is ZFS encryption now as encryption is a mandatory feature under the European data protection rules.

All tests are done via a filebench run that checks random io vs sequential io with sync and enc on/off and barebone vs virtualised in napp-it menu Pools > Benchmark. Intension is to get a feeling about behaviours.

### Intel Hardware:

SuperMicro X11SPH-NCTF, Xeon Silver 4110, 64 GB RAM, SAS 3008  
7 x WD Ultrastar 8TB, 3 x Optane 900, 3 x Intel DC 750 (traditional Flash NVMe)

### AMD Hardware:

SuperMicro H12SSL-C, Epyc 7302 128 GB RAM, SAS 3008 (BTO system)  
7 x WD Ultrastar 8TB, 3 x Optane 900, 3 x Intel DC 750 (traditional Flash NVMe)

## 2.0: TLDR

### First write results on Intel

151034	async	sync	sync+slog	async/enc	sync/enc	sync+slog/enc
Disk Pool	770-1195MB/s	40-50MB/s	640-783MB/s	907-935MB/s	22-24MB/s	19-24MB/s
Flash pool	1112-1388MB/s	430-613MB/s	-	950-954MB/s	112-129MB/s	-
Optane pool	1600-2000MB/s	550-770MB/s	-	930-960MB/s	118-130MB/s	-
151036	async	sync	sync+slog	async/enc	sync/enc	sync+slog/enc
Disk Pool	930-1170MB/s	48-50MB/s	779-1195MB/s	907-935MB/s	34-36MB/s	22-24MB/s
Flash pool	1112-1388MB/s	430-613MB/s	-	950-954MB/s	112-129MB/s	-
Optane pool	1600-2000MB/s	550-750MB/s	-	930-960MB/s	107-130MB/s	-

### First result on AMD

151036	async	sync	sync+slog	async/enc	sync/enc	sync+slog/enc
Disk Pool	1178-1197 MB/s	51-55 MB/s	908-956 MB/s	1203-1230 MB/s	36-40 MB/s	31-32 MB/s
Flash pool	1591-1877 MB/s	943-1134 MB/s	-	1541-1592 MB/s	201-206 MB/s	-
Optane pool	3339-3707 MB/s	1445-1471 MB/s	-	1720-1730 MB/s	202-207 MB/s	-

### Some principles

Encryption is much faster than on my last tests

Storage + Encryption is perfect up to 10G,

Storage + sync is perfect up to 10G,

Storage + encryption + sync is much slower due encryption

OmniOS 1510034/36 perform quite similar (despite hardware accelerated Raid-Z)

Improvements due a faster CPU (Epyc): 150-200%

## 2.1: Disk pool, Intel Xeon on OmniOS 151034

Disk Pool: without slog, enc off

```

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.13.2020
pool: hd-z1
NAME      STATE  READ WRITE CKSUM
hd-z1    ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c015000CC408BCE3C00 ONLINE 0 0 0
c015000CC408BCE6A00 ONLINE 0 0 0
c015000CC408BCE6B00 ONLINE 0 0 0
c015000CC408BCE6C00 ONLINE 0 0 0
c015000CC408BCE6D00 ONLINE 0 0 0
c015000CC408BCE6E00 ONLINE 0 0 0
c015000CC408BCE6F00 ONLINE 0 0 0
c1415000CA2006911A00 ONLINE 0 0 0
c015000CC42621A3A9100 ONLINE 0 0 0

host      omniocse_034
pool      hd-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slog      -
encryption -
remark    -

FB3       sync=always      sync=disabled
FB4 singlestreamwrite.f
sync=always      sync=disabled
233 ops
46.597 ops/s
17935us cpu/op
21.4ms latency
46.4 MB/s

pri/sec cache=all      randomread.f  randomw.f  singlestream
148.8 MB/s          331.4 MB/s  3.4 GB/s
  
```

I started the write benchmark multiple times:  
 sync was between 40 MB/s and 50 MB/s  
 non-sync between 770 MB/s and 1195 MB/s

without slog, enc on (aes-256ccm)

```

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.13.2020
pool: hd-z1
NAME      STATE  READ WRITE CKSUM
hd-z1    ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c015000CC408BCE3C00 ONLINE 0 0 0
c015000CC408BCE6A00 ONLINE 0 0 0
c015000CC408BCE6B00 ONLINE 0 0 0
c015000CC408BCE6C00 ONLINE 0 0 0
c015000CC408BCE6D00 ONLINE 0 0 0
c015000CC408BCE6E00 ONLINE 0 0 0
c015000CC408BCE6F00 ONLINE 0 0 0
c1415000CA2006911A00 ONLINE 0 0 0
c015000CC42621A3A9100 ONLINE 0 0 0

host      omniocse_034
pool      hd-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slog      -
encryption aes-256-ccm
remark    Error passphrase: Re-enter passphrase:

FB3       sync=always      sync=disabled
FB4 singlestreamwrite.f
sync=always      sync=disabled
179 ops
33.990 ops/s
33.990 ops/s
46692us cpu/op
29.1ms latency
33.8 MB/s

pri/sec cache=all      randomread.f  randomw.f  singlestream
17.8 MB/s          36.9 MB/s  88.0 MB/s
  
```

sync was between 22 MB/s and 24 MB/s and  
 non-sync was between 907 MB/s and 935 MB/s

Disk Pool: with Optane 900 slog, enc off

```

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.13.2020
pool: hd-z1
NAME      STATE  READ WRITE CKSUM
hd-z1    ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c015000CC408BCE3C00 ONLINE 0 0 0
c015000CC408BCE6A00 ONLINE 0 0 0
c015000CC408BCE6B00 ONLINE 0 0 0
c015000CC408BCE6C00 ONLINE 0 0 0
c015000CC408BCE6D00 ONLINE 0 0 0
c015000CC408BCE6E00 ONLINE 0 0 0
c015000CC408BCE6F00 ONLINE 0 0 0
c1415000CA2006911A00 ONLINE 0 0 0
c015000CC42621A3A9100 ONLINE 0 0 0

logs     c2100      ONLINE 0 0 0

host      omniocse_034
pool      hd-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slog      -
encryption -
remark    -

FB3       sync=always      sync=disabled
FB4 singlestreamwrite.f
sync=always      sync=disabled
328 ops
647.512 ops/s
3425us cpu/op
1.5ms latency
647.4 MB/s

pri/sec cache=all      randomread.f  randomw.f  singlestream
149.6 MB/s          338.0 MB/s  3.5 GB/s
  
```

I started the write benchmark multiple times:  
 sync was between 640 MB/s and 783 MB/s  
 non-sync was between 1002 MB/s and 1195 MB/s

with Optane 900 slog, enc on (aes-256ccm)

```

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.13.2020
pool: hd-z1
NAME      STATE  READ WRITE CKSUM
hd-z1    ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c015000CC408BCE3C00 ONLINE 0 0 0
c015000CC408BCE6A00 ONLINE 0 0 0
c015000CC408BCE6B00 ONLINE 0 0 0
c015000CC408BCE6C00 ONLINE 0 0 0
c015000CC408BCE6D00 ONLINE 0 0 0
c015000CC408BCE6E00 ONLINE 0 0 0
c015000CC408BCE6F00 ONLINE 0 0 0
c1415000CA2006911A00 ONLINE 0 0 0
c015000CC42621A3A9100 ONLINE 0 0 0

logs     c2100      ONLINE 0 0 0

host      omniocse_034
pool      hd-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slog      -
encryption aes-256-ccm
remark    -

FB3       sync=always      sync=disabled
FB4 singlestreamwrite.f
sync=always      sync=disabled
191 ops
20.199 ops/s
82069us cpu/op
19.0ms latency
19.0 MB/s

pri/sec cache=all      randomread.f  randomw.f  singlestream
465.2 MB/s          314.8 MB/s  86.6 MB/s
  
```

sync was between 19 MB/s and 24 MB/s and  
 non-sync was between 745 MB/s and 767 MB/s

A Xeon SMB filer with sync=disabled is a perfect solution for a 10G network.

If you need to force sync either because you use it for VM/databases or want an SMB filer with a perfect behaviour in a crash/ power outage scenario, you need a good Slog like the Optane or a WD S5530 (12G SAS).

If you need encryption

This is ok for a SMB filer without sync. If you need sync, do not pair with encryption.



## 2.3: Optane pool, Intel Xeon on OmniOS 151034 vs 151036

Optane Pool: 151034, enc off

```

napp-it@evcl: omniosce_034 ZFS appliance v. 20.0ev12 okt 2020 [logout: admin | ssh | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 18.62.05s Pool Cap Disk Net CPU Job
> filebench » isstore examples » isstore ig » bonnie » dd bench

test done

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.11.2020

pool: optane-z1

NAME STATE READ WRITE CKSUM
optane-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c2t100 ONLINE 0 0 0
c3t100 ONLINE 0 0 0
c4t100 ONLINE 0 0 0

host omniosce_034
pool optane-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slag -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
3496 ops 3284 ops
1219.157 ops/s 1054.739 ops/s
26173us cpu/op 59928us cpu/op
0.6us latency 0.6us latency
1219.6 MB/s 1054.5 MB/s

-----
pri/sec cache=all randomread.f randomw.f singlestream
145.4 MB/s 309.8 MB/s 1.5 GB/s

```

I started the write benchmark multiple times:  
 sync was between 550 and 770 MB/s  
 non-sync between 1600 and 2000 MB/s

Optane Pool: 151034, enc on (aes-256ccm)

```

napp-it@evcl: omniosce_034 ZFS appliance v. 20.0ev12 okt 2020 [logout: admin | ssh | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 17.51.56s Pool Cap Disk Net CPU Job
> filebench » isstore examples » isstore ig » bonnie » dd bench

test done

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.11.2020

pool: optane-z1

NAME STATE READ WRITE CKSUM
optane-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c2t100 ONLINE 0 0 0
c3t100 ONLINE 0 0 0
c4t100 ONLINE 0 0 0

host omniosce_034
pool optane-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slag -
encryption aes-256-ccm
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
633 ops 4799 ops
124.195 ops/s 941.773 ops/s
374679us cpu/op 139483us cpu/op
7.18s latency 1.1s latency
124.6 MB/s 941.6 MB/s

-----
pri/sec cache=all randomread.f randomw.f singlestream
16.6 MB/s 29.4 MB/s 86.6 MB/s

```

sync was between 118 and 130 MB/s  
 non-sync was between 930 and 960 MB/s

Optane Pool: 151036 enc off

```

napp-it@evcl: omniosce_036 ZFS appliance v. 20.0ev12 okt 2020 [logout: admin | ssh | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 18.23.47s
> filebench » isstore examples » isstore ig » bonnie » dd bench

test done

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.11.2020

pool: optane-z1

NAME STATE READ WRITE CKSUM
optane-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c2t100 ONLINE 0 0 0
c3t100 ONLINE 0 0 0
c4t100 ONLINE 0 0 0

host omniosce_036
pool optane-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slag -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
3760 ops 9946 ops
751.968 ops/s 1988.856 ops/s
27439us cpu/op 44816us cpu/op
1.1ms latency 0.5ms latency
751.8 MB/s 1988.7 MB/s

-----
pri/sec cache=all randomread.f randomw.f singlestream
177.8 MB/s 227.8 MB/s 1.8 GB/s

```

I started the write benchmark multiple times:  
 sync was between 550 and 770 MB/s  
 non-sync between 1600 and 2000 MB/s

Optane Pool: 151036, enc on (aes-256ccm)

```

napp-it@evcl: omniosce_036 ZFS appliance v. 20.0ev12 okt 2020 [logout: admin | ssh | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 17.31.54s Pool Cap Disk Net CPU Job
> filebench » isstore examples » isstore ig » bonnie » dd bench

test done

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.11.2020

pool: optane-z1

NAME STATE READ WRITE CKSUM
optane-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c2t100 ONLINE 0 0 0
c3t100 ONLINE 0 0 0
c4t100 ONLINE 0 0 0

host omniosce_036
pool optane-z1 (recsize=128K, sbs=, compr=off, readcache=all)
slag -
encryption aes-256-ccm
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
608 ops 4778 ops
122.596 ops/s 955.573 ops/s
332679us cpu/op 127448us cpu/op
8.28s latency 1.0s latency
122.4 MB/s 955.4 MB/s

-----
pri/sec cache=all randomread.f randomw.f singlestream
15.6 MB/s 26.2 MB/s 80.2 MB/s

```

sync was between 107 and 130 MB/s  
 non-sync was between 930 and 960 MB/s

## 2.4: Traditional Flash NVMe (Intel DC750) pool, Intel Xeon on OmniOS 151034 vs 151036

DC 750 Pool: 151034, enc off

```

napp-it eval/ omniosce_034 ZFS appliance v. 20.0dev 12 okt 2020 [logout: admin | ssh | Edit | Man | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 28:49:540 Pool OK Cap OK Disk OK Net OK CPU OK Job OK
» filebench » iozone examples » iozone lg » bonnie » dd bench

test done [ctrl]

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.11.2020
pool: dc750-z1

NAME STATE READ WRITE CKSUM
dc750-z1 ONLINE 0 0 0
rs1021-0 ONLINE 0 0 0
<1471d0 ONLINE 0 0 0
<1511d0 ONLINE 0 0 0
<1611d0 ONLINE 0 0 0

host omniosce_034
pool dc750-z1 (recsize=128K, sdb-, compr=off, readcache=all)
slog -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
2217 ops 5561 ops
443.378 ops/s 1112.169 ops/s
496720us cpu/op 26660us cpu/op
2.2ms latency 0.9ms latency
443.2 MB/s 1112.0 MB/s

pri/sec cache=all randomread.f randomw.f singlestream
137.8 MB/s 347.5 MB/s 1.6 GB/s

```

DC 750 Pool: 151034, enc on (aes-256ccm)

```

napp-it eval/ omniosce_034 ZFS appliance v. 20.0dev 12 okt 2020 [logout: admin | ssh | Edit | Man | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 20:51:46s Pool OK Cap OK Disk OK Net OK CPU OK Job OK
» filebench » iozone examples » iozone lg » bonnie » dd bench

test done [ctrl]

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.11.2020
pool: dc750-z1

NAME STATE READ WRITE CKSUM
dc750-z1 ONLINE 0 0 0
rs1021-0 ONLINE 0 0 0
<1471d0 ONLINE 0 0 0
<1511d0 ONLINE 0 0 0
<1611d0 ONLINE 0 0 0

host omniosce_034
pool dc750-z1 (recsize=128K, sdb-, compr=off, readcache=all)
slog -
encryption aes-256-ccm
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
273 ops 5433 ops
54.598 ops/s 1086.569 ops/s
372918us cpu/op 111924us cpu/op
18.2ms latency 0.9ms latency
54.4 MB/s 1086.4 MB/s

pri/sec cache=all randomread.f randomw.f singlestream
6.6 MB/s 14.6 MB/s 82.5 MB/s

```

I startet the write benchmark multiple times:  
sync was between 359 and 570 MB/s  
non-sync between 1320 and 1490 MB/s

sync was between 52 and 56 MB/s  
non-sync was between 1086 and 1093 MB/s

DC 750 Pool: 151036, enc off

```

napp-it eval/ omniosce_036 ZFS appliance v. 20.0dev 12 okt 2020 [logout: admin | ssh | Edit | Man | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 11:06:53s Pool OK Cap OK Disk OK Net OK CPU OK Job OK
» filebench » iozone examples » iozone lg » bonnie » dd bench

test done [ctrl]

Benchmark: Write: filebench_sequential, Read: filebench, date: 11.11.2020
pool: dc750-z1

NAME STATE READ WRITE CKSUM
dc750-z1 ONLINE 0 0 0
rs1021-0 ONLINE 0 0 0
<1361d0 ONLINE 0 0 0
<1711d0 ONLINE 0 0 0
<1911d0 ONLINE 0 0 0

host omniosce_036
pool dc750-z1 (recsize=128K, sdb-, compr=off, readcache=all)
slog -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
2066 ops 5963 ops
113.186 ops/s 1112.951 ops/s
41200us cpu/op 21380us cpu/op
1.6ms latency 0.9ms latency
613.6 MB/s 1112.8 MB/s

pri/sec cache=all randomread.f randomw.f singlestream
228.2 MB/s 349.5 MB/s 1.9 GB/s

```

DC 750 Pool: 151036, enc on (aes-256ccm)

```

napp-it eval/ omniosce_036 ZFS appliance v. 20.0dev 12 okt 2020 [logout: admin | ssh | Edit | Man | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 21:11:16s Pool OK Cap OK Disk OK Net OK CPU OK Job OK
» filebench » iozone examples » iozone lg » bonnie » dd bench

test done [ctrl]

Benchmark: Write: filebench_sequential, Read: none, date: 11.11.2020
pool: dc750-z1

NAME STATE READ WRITE CKSUM
dc750-z1 ONLINE 0 0 0
rs1021-0 ONLINE 0 0 0
<1371d0 ONLINE 0 0 0
<1711d0 ONLINE 0 0 0
<1911d0 ONLINE 0 0 0

host omniosce_036
pool dc750-z1 (recsize=128K, sdb-, compr=off, readcache=all)
slog -
encryption aes-256-ccm
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
578 ops 4753 ops
115.596 ops/s 950.574 ops/s
388432us cpu/op 133516us cpu/op
8.6ms latency 1.6ms latency
115.4 MB/s 950.4 MB/s

```

I startet the write benchmark multiple times:  
sync was between 430 and 613 MB/s  
non-sync between 1112 and 1388 MB/s

sync was between 112 and 129 MB/s  
non-sync was between 950 and 954 MB/s

### 3.0 Disk pool, Epyc on OmniOS 151036

I had to switch mpio off in menu Disk > Details > SAS, test date was Dec 03, 2020

Disk Pool: without slog, enc off

```

napp-it pro omniosce_036 ZFS appliance v. 20.0dev 12.04.2020 [logout: admin | set | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
Home » Pools » Benchmarks Pro Monitor: 15.29 22s Pool Cap Disk Nec CPU Job
> filebench > lziozone-examples > lziozone lg > bonnie > dd bench
test done [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: hd-z1
NAME STATE READ WRITE CKSUM
hd-z1
raidz1-0 ONLINE 0 0 0
c27f5000cA08B8E3CE1C00 ONLINE 0 0 0
c29f5000cA08B8E3CE1C00 ONLINE 0 0 0
c31f5000cA08B8E3CE1C00 ONLINE 0 0 0
c28f5000cA08B8E3CE1C00 ONLINE 0 0 0
c30f5000cA08B8E3CE1C00 ONLINE 0 0 0
c25f5000cA2686911A00 ONLINE 0 0 0
c26f5000cA2686911A00 ONLINE 0 0 0

host omniosce_036
pool hd-z1 (recsize=128K, sdb=, compr=off, readcache=all)
slog -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
258 ops
31.500 ops/s
22281us cpu/op
0.8ms latency
51.4 MB/s
1199.365 ops/s
22451us cpu/op
0.8ms latency
51.2 MB/s

pri/sec cache=all randomread.f randomw.f singlestream
434.8 MB/s 572.2 MB/s 4.1 GB/s

```

without slog, enc on (aes-256ccm)

```

napp-it pro omniosce_036 ZFS appliance v. 20.0dev 12.04.2020 [logout: admin | set | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
Home » Pools » Benchmarks Pro Monitor: 15.34 55s Pool Cap Disk Nec CPU Job
> filebench > lziozone-examples > lziozone lg > bonnie > dd bench
test done [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: hd-z1
NAME STATE READ WRITE CKSUM
hd-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c27f5000cA08B8E3CE1C00 ONLINE 0 0 0
c29f5000cA08B8E3CE1C00 ONLINE 0 0 0
c31f5000cA08B8E3CE1C00 ONLINE 0 0 0
c28f5000cA08B8E3CE1C00 ONLINE 0 0 0
c30f5000cA08B8E3CE1C00 ONLINE 0 0 0
c25f5000cA2686911A00 ONLINE 0 0 0
c26f5000cA2686911A00 ONLINE 0 0 0

host omniosce_036
pool hd-z1 (recsize=128K, sdb=, compr=off, readcache=all)
slog -
encryption aes-256-ccm
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
185 ops
36.399 ops/s
209290us cpu/op
26.4ms latency
36.8 MB/s
1200.4 ops/s
133161us cpu/op
0.8ms latency
1200.4 MB/s

pri/sec cache=all randomread.f randomw.f singlestream
140.0 MB/s 268.4 MB/s 2.1 GB/s

```

I started the write benchmark multiple times:  
sync was between 51 and 55 MB/s  
non-sync between 1178 and 1197 MB/s

sync was between 36 and 40 MB/s  
non-sync was between 1203 and 1230 MB/s

Disk Pool: with Optane 900 slog, enc off

```

napp-it pro omniosce_036 ZFS appliance v. 20.0dev 12.04.2020 [logout: admin | set | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
Home » Pools » Benchmarks Pro Monitor: 15.43 40s Pool Cap Disk Nec CPU Job
> filebench > lziozone-examples > lziozone lg > bonnie > dd bench
test done [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: hd-z1
NAME STATE READ WRITE CKSUM
hd-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c27f5000cA08B8E3CE1C00 ONLINE 0 0 0
c29f5000cA08B8E3CE1C00 ONLINE 0 0 0
c31f5000cA08B8E3CE1C00 ONLINE 0 0 0
c28f5000cA08B8E3CE1C00 ONLINE 0 0 0
c30f5000cA08B8E3CE1C00 ONLINE 0 0 0
c25f5000cA2686911A00 ONLINE 0 0 0
c26f5000cA2686911A00 ONLINE 0 0 0
logs c18t1d0 ONLINE 0 0 0

host omniosce_036
pool hd-z1 (recsize=128K, sdb=, compr=off, readcache=all)
slog -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
404 ops
908.172 ops/s
39716us cpu/op
1.1ms latency
908.0 MB/s
1212.560 ops/s
26452us cpu/op
0.8ms latency
1212.4 MB/s

pri/sec cache=all randomread.f randomw.f singlestream
439.4 MB/s 586.6 MB/s 4.9 GB/s

```

with Optane 900 slog, enc on (aes-256ccm)

```

napp-it pro omniosce_036 ZFS appliance v. 20.0dev 12.04.2020 [logout: admin | set | Edit | Mon | Acc]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
Home » Pools » Benchmarks Pro Monitor: 16.37 45s Pool Cap Disk Nec CPU Job
> filebench > lziozone-examples > lziozone lg > bonnie > dd bench
test done [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: hd-z1
NAME STATE READ WRITE CKSUM
hd-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c27f5000cA08B8E3CE1C00 ONLINE 0 0 0
c29f5000cA08B8E3CE1C00 ONLINE 0 0 0
c31f5000cA08B8E3CE1C00 ONLINE 0 0 0
c28f5000cA08B8E3CE1C00 ONLINE 0 0 0
c30f5000cA08B8E3CE1C00 ONLINE 0 0 0
c25f5000cA2686911A00 ONLINE 0 0 0
c26f5000cA2686911A00 ONLINE 0 0 0
logs c18t1d0 ONLINE 0 0 0

host omniosce_036
pool hd-z1 (recsize=128K, sdb=, compr=off, readcache=all)
slog -
encryption aes-256-ccm
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite.f sync=always sync=disabled
158 ops
31.599 ops/s
538092us cpu/op
31.4ms latency
31.4 MB/s
1166.963 ops/s
1166.963 ops/s
133142us cpu/op
0.8ms latency
1166.8 MB/s

pri/sec cache=all randomread.f randomw.f singlestream
153.2 MB/s 273.4 MB/s 2.2 GB/s

```

I started the write benchmark multiple times:  
sync was between 908 MB/s and 956 MB/s  
non-sync between 1151 MB/s and 1212 MB/s

sync was between 31 MB/s and 32 MB/s and  
non-sync was between 1166 MB/s and 1213 MB/s

### 3.1: Traditional Flash NVMe (Intel DC750) pool, Epyc on OmniOS 151036

DC 750 Pool: 151036, enc off

```

napp-it pro omniosce_036 ZFS appliance v. 20.dev.12.oct.2020 [logout: admin | set | Edit | Menu | Acc.]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 16:45:56 Pool: Cap: Disk: Net: CPU: Job:
> filebench » isozone examples » isozone lg » bonnie » dd bench

test done [input] [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: dc750-z1

NAME STATE READ WRITE CKSUM
dc750-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c22t100 ONLINE 0 0 0
c19t100 ONLINE 0 0 0
c21t100 ONLINE 0 0 0

host omniosce_036
pool dc750-z1 (reconfig=128K, ssw-, compr=off, readcache=all)
slog -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite,f sync=always sync=disabled
1134.772 ops/s 1879.324 ops/s
23984us cpu/op 23143us cpu/op
0.5ms latency 0.5ms latency
1134.6 MB/s 1879.1 MB/s

-----
pri/sec cache=all randomread,f randomw,f singlestream
336.4 MB/s 536.8 MB/s 2.3 GB/s
  
```

DC 750 Pool: 151036, enc on (aes-256ccm)

```

napp-it pro omniosce_036 ZFS appliance v. 20.dev.12.oct.2020 [logout: admin | set | Edit | Menu | Acc.]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 16:00:02 Pool: Cap: Disk: Net: CPU: Job:
> filebench » isozone examples » isozone lg » bonnie » dd bench

test done [input] [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: dc750-z1

NAME STATE READ WRITE CKSUM
dc750-z1 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c22t100 ONLINE 0 0 0
c19t100 ONLINE 0 0 0
c21t100 ONLINE 0 0 0

host omniosce_036
pool dc750-z1 (reconfig=128K, ssw-, compr=off, readcache=all)
slog -
encryption aes-256-ccm
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite,f sync=always sync=disabled
1032 ops/s 7794 ops/s
206.395 ops/s 1558.784 ops/s
205664us cpu/op 187133us cpu/op
4.6ms latency 0.6ms latency
206.2 MB/s 1558.5 MB/s

-----
pri/sec cache=all randomread,f randomw,f singlestream
104.8 MB/s 245.4 MB/s 1.5 GB/s
  
```

I started the write benchmark multiple times:  
 sync was between 943 and 1134 MB/s  
 non-sync between 1591 and 1877 MB/s

sync was between 201 and 206 MB/s  
 non-sync was between 1541 and 1592 MB/s

### 3.2: Optane 900 pool, Epyc on OmniOS 151036

Optane Pool: 151036, enc off

```

napp-it pro omniosce_036 ZFS appliance v. 20.dev.12.oct.2020 [logout: admin | set | Edit | Menu | Acc.]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 17:13:23 Pool: Cap: Disk: Net: CPU: Job:
> filebench » isozone examples » isozone lg » bonnie » dd bench

test done [input] [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: optane-900

NAME STATE READ WRITE CKSUM
optane-900 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c18t100 ONLINE 0 0 0
c32t100 ONLINE 0 0 0
c33t100 ONLINE 0 0 0

host omniosce_036
pool optane-900 (reconfig=128K, ssw-, compr=off, readcache=all)
slog -
encryption -
remark -

fb3 sync=always sync=disabled
fb4 singlestreamwrite,f sync=always sync=disabled
7366 ops/s 18350 ops/s
1441.151 ops/s 3271.514 ops/s
33228us cpu/op 33248us cpu/op
0.7ms latency 0.3ms latency
1441.0 MB/s 3271.0 MB/s

-----
pri/sec cache=all randomread,f randomw,f singlestream
379.8 MB/s 494.6 MB/s 2.0 GB/s
  
```

Optane Pool: 151036, enc on (aes-256ccm)

```

napp-it pro omniosce_036 ZFS appliance v. 20.dev.12.oct.2020 [logout: admin | set | Edit | Menu | Acc.]
About Help Services System User Disks Pools ZFS Filesystems Snapshots Comstar
home » Pools » Benchmarks Pro Monitor 17:16:52 Pool: Cap: Disk: Net: CPU: Job:
> filebench » isozone examples » isozone lg » bonnie » dd bench

test done [input] [cmd]

Benchmark: Write: filebench_sequential, Read: filebench, date: 08.19.2020
pool: optane-900

NAME STATE READ WRITE CKSUM
optane-900 ONLINE 0 0 0
raidz1-0 ONLINE 0 0 0
c18t100 ONLINE 0 0 0
c32t100 ONLINE 0 0 0
c33t100 ONLINE 0 0 0

host omniosce_036
pool optane-900 (reconfig=128K, ssw-, compr=off, readcache=all)
slog -
encryption aes-256-ccm
remark -

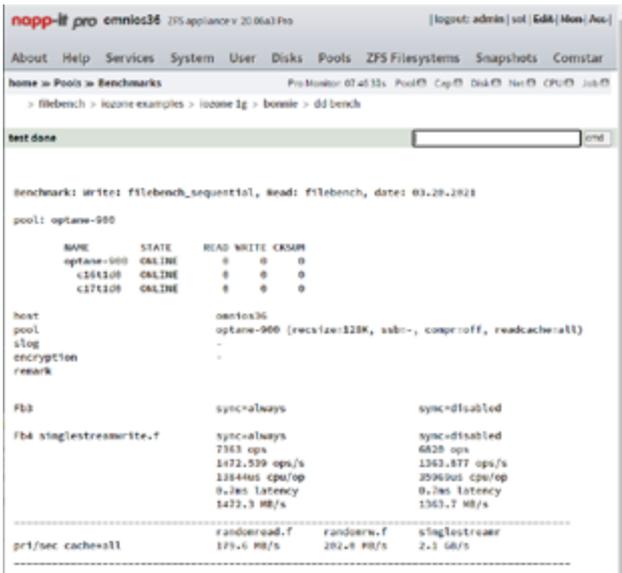
fb3 sync=always sync=disabled
fb4 singlestreamwrite,f sync=always sync=disabled
1055 ops/s 8611 ops/s
203.154 ops/s 1721.848 ops/s
215550us cpu/op 14333us cpu/op
4.6ms latency 0.6ms latency
203.0 MB/s 1721.9 MB/s

-----
pri/sec cache=all randomread,f randomw,f singlestream
56.6 MB/s 123.4 MB/s 203.0 MB/s
  
```

I started the write benchmark multiple times:  
 sync was between 1445 and 1471 MB/s  
 non-sync between 3339 and 3707 MB/s

sync was between 202 and 207 MB/s  
 non-sync was between 1720 -1730 MB/s





## Needed steps for Optane 900 or DC750 and Passthrough/ ESXi

- ssh to ESXi
- edit /etc/vmware/passthru.map
- add following lines at the end of the file:
 

```
# Intel Optane 900P pci-e device
8086 2700 d3d0 false
# Intel DC750 pci-e device
8086 370D d3d0 false
```
- restart hypervisor and add the pci device to OmniOS

check device id ex 2700 in ESXi > Management > PCI devices  
 Either try id ex 2700 or sub id ex 3900 (Optane 900)  
 on problems with passthrough

more device id ex Optane 900 2,5", Intel DC 750 etc, see  
<https://pci-ids.ucw.cz/read/PC/8086>

more

For some NVMe there is another hint on problems:  
 add the following to the .vmx file of a VM:  
 pciPassthru0.msiEnabled = „FALSE“

<https://tinkertry.com/search?s=passsthrough#gsc.tab=0&gsc.q=passsthrough&gsc.sort=>  
<https://kb.vmware.com/s/article/2142307>