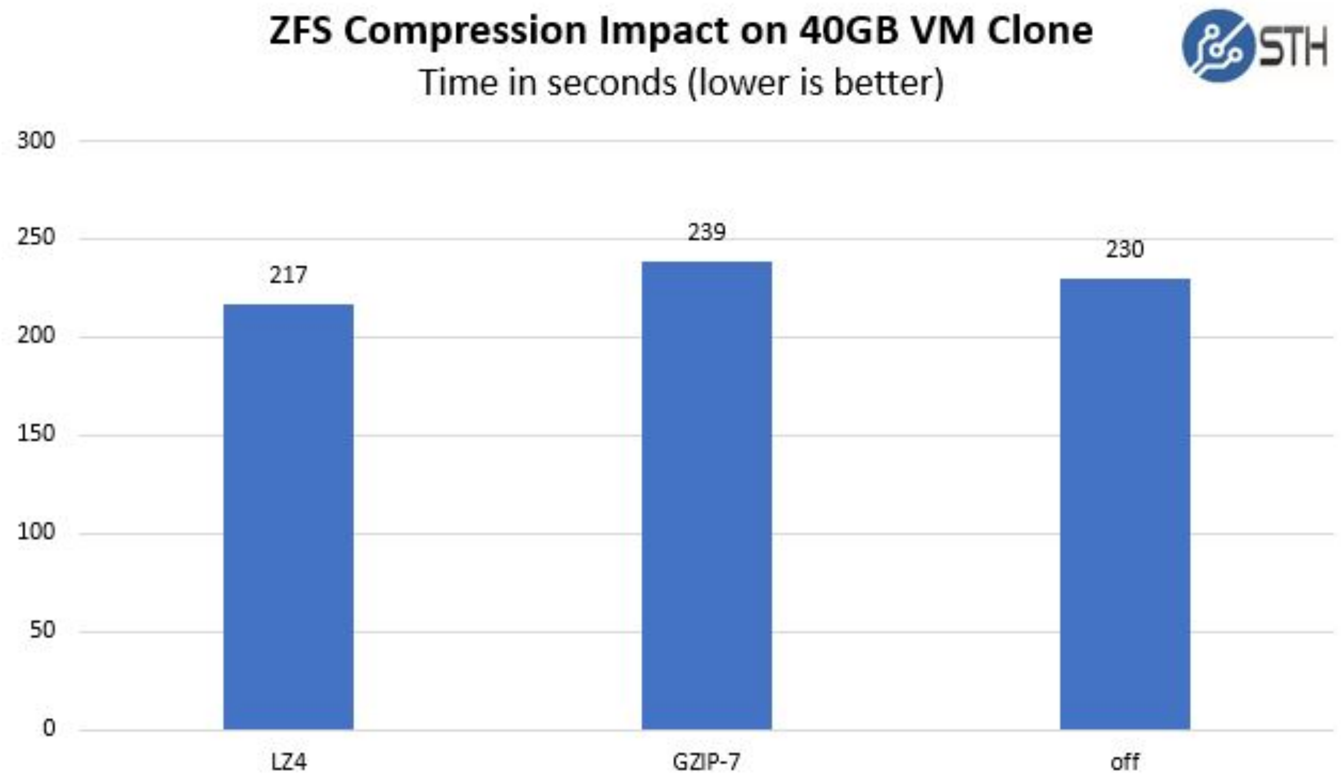
The Case For Using ZFS Compressio

By **Patrick Kennedy** - January 2, 2018



ZFS Compression Performance Lz4 Gzip 7 Off Time

An absolutely killer feature of ZFS is the ability to add compression with little hassle. As
resolution: use ZFS compression. Combined with sparse volumes (ZFS thin provisioning)
and better disk space utilization. Many workloads work really well with ZFS compression.
users overlook when it can be an enormous benefit.

How to find if you have ZFS compression enabled

For many ZFS environments, lz4 compression is the go-to solution. It is fast and gives a
tradeoff to get substantial gains. While there are some ZFS environments that default to
enabled by default. We looked back on questions we received in 2017, and a common on
enabled.

There are many ways you can do this, but the easiest is with "zfs get compression." Here

ZFS Get Compressratio And Compression

Along with “zfs get compression” another useful command is “zfs get compressratio” whi
“compress” not “compression” ratio here. These are two attributes that you will see on zp
zvol’s (p3600R1/vm-203-disk-1) compression inherited from the zpool (p3600R1.) We su
general purpose storage and then alter explicitly from there.

ZFS has a lot of attribute information that you can use “zfs get all” to lookup. Here is an

ZFS Get All

If you have zfs compression showing as “on”, and want to see if you are using lz4 alread
feature@lz4_compress which should be active if you are using lz4 as the default:

Zpool Get All

Either way, our resolution is to turn on zfs compression if at all possible.

How To Set ZFS Compression

We are going to suggest simply setting ZFS compression at the zpool level. That allows s
it easy to maintain. To set the compression to lz4, we can use “zfs set compression=lz4”.

ZFS Set Compression

In the first zfs get compression command we see that compression is off by default. We u
zpool (bulksata2) to turn compression on. We then verify that the compression is now se

You will notice that the compression ratio is 1.00x which is essentially nothing. That is sir
new volume.

You can also use different algorithms such as gzip (e.g. gzip-7 that we are using in our n
incremental backups on a dedicated backup server, going the gzip route can make a lot c
deduplication.

ZFS Compression Impact

We took a 40GB Ubuntu 16.04.3 LTS VM volume (about 32GB of 40GB in-use) used for ir
storage". For us, that means the source was on two Intel Optane 900p 280GB NVMe driv
960GB SSDs. These SSDs were configured as ZFS mirrors. Given the size of the VM, we v
while ensuring the source was many times faster than the destination.

First off, we wanted to see compression ratios. We know that compression=off gives us 1
is what we saw with the lz4 compressed pool:

ZFS Get Compressratio Results LZ4

We got a 1.93x compression ratio with lz4 compression. That is good for near transparen
used gzip-7 just to show the compression ratio difference:

ZFS Get Compressratio Results Gzip 7

As you can see, we got a 2.27x compression ratio which is significantly better. We used g
ratios versus lower levels offered by gzip that are faster.

There was a cost, however.

With lz4 compression, the entire snapshot clone operation (NVMe to SATA) took about 10
which was already running at 52% utilization. Using gzip-7 we saw utilization spike over
point, this copy with compression=off pushed utilization up 8-9%. Here are the incremen
operations:

ZFS Compression Performance Lz4 Gzip 7 Off Average CPU Utilization

In terms of the actual clone performance, the timings were close but there was a noticea

ZFS Compression Performance Lz4 Gzip 7 Off Time

Not only did lz4 use less CPU, but it did so over a shorter period of time.

We also were logging iowait while we were doing these operations. Since we were using a
more akin to a running virtualization server, we wanted to see what the impact was on io
be minimized.

ZFS Compression Performance Lz4 Gzip 7 Off Max Iowait

If you remember, we are doing this transfer from mirrored Intel Optane SSDs to mirrore
you were cloning development VMs to lower-cost storage. We were debugging the impac
is why we were watching the iowait number. Through the ten runs we did, each time we
was near 0% on the system otherwise.

To some compression=off may seem like the obvious choice for the highest performance,
better compression, lz4 provides “good enough” compression ratios at relatively lower pe
recommendation.

Final Words

If you are starting the year and looking for a project, ensure that your ZFS storage is usi
compromise between compression ratio and performance is well-known at this point. Usi
saving benefit during some operations which makes it a great choice.

Even though lz4 ZFS compression is a well-known solution, over the 2017 holiday seaso
from other folks who were not using it on their zpools. Set compression=lz4 at the zpool
compression. You will be happy for this new year’s resolution that takes a few seconds a

Test Configuration Notes

Here is a quick overview of the test configuration for the above. We are becoming ZFS or

- System: Supermicro 2U Ultra
- CPUs: 2x Intel Xeon E5-2698 V4
- RAM: 256GB (8x 32GB) DDR4-2400 RDIMMS
- OS SSDs: ZFS Mirror Intel DC S3610 480GB
- Source SSD: ZFS Mirror Intel Optane 900p 280GB
- Destination SSDs: ZFS Mirror Samsung PM963 960GB
- Proxmox VE 5.1
  - Based on Debian Stretch 9.2
  - Kernel 4.13.3
  - QEMU 2.9.1
  - ZFS 0.7.2

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