PLiOPS
EXTREME DATA PROCESSOR

Building Highly Efficient and Reliable Shared Block Storage with QLC SSDs

The rapid development of cloud services is the cornerstone for many cloud organizations to satisfy insatiable customer data needs. Strong storage infrastructure capabilities are essential to providing agile, efficient, reliable, and diverse cloud services. The intersection of performance and profit is central to success; as such, lowering the cost per GB of storage leads to more users and greater profitability, while improved performance allows them to better support customers during peak workloads.

Challenge

A top 5 cloud service provider that offers a wide range of services was looking to reduce the cost per GB of its highly available shared block storage service. The company deploys disaggregated storage on large number of commodity servers with a mix of all-flash TLC SSDs, HDDs, and some hybrid configurations. As with all cloud operators, keeping cost low is a major objective.

For their all-flash TLC layer, they deploy a 10+2 node cluster configuration using an open-source distributed file system. That's 10 servers of user data and 2 with erasure coding per cluster. Each cluster has 1.5PB of usable storage capacity. While the primary objective was to lower the cost per TB, they also wanted to improve cluster reliability because they were experiencing more than 1,500 SSD-related cluster rebuilds per year. Degraded cluster performance during the rebuild process was impacting customers, and the overhead managing the failure events was taxing the maintenance teams.

The company considered whether it was possible to implement QLC to lower cost and increase density but was concerned about sacrificing reliability and performance. If successful, this would also help them simplify their storage deployments while also raising their SLAs.

Solution

The cloud provider looked to the Pliops Extreme Data Processor (XDP) to increase storage density with QLC SSDs while reducing cluster failure risk. Adding three XDPs per server enabled them to create protected SSD groups shifting the failure domain from the cluster level to server level. As a result, the performance impact on the cluster during a drive failure was eliminated.

To address QLC reliability and performance issues, XDP's hardware-accelerated architecture writes serially to SSDs, never random. Data is compressed and broken

Highlights

Pliops XDP enables higher storage density, with node level data protection to meet growing customer demands:

- 3x increase in capacity for the same footprint
- QLC at the speed of TLC
- 1.5x the endurance of TLC
- Highly reliable system with no downtime
- 40% TCO savings vs TLC
- Zero workload tuning

into variable-sized objects. XDP's key-value storage engine merges and packs the objects, creating long, optimized sequential writes aligned to flash boundaries.

All this is done in hardware at wire-speed, without needing CPU cores or firmware. Since XDP reduces data written to SSDs, it can efficiently add RAID parity to the data, making Pliops Drive Failure Protection up to 2.5x faster than RAID 0. XDP significantly reduces write amplification to the drive, allowing for substantially longer life and better performance. In addition, data was compressed by 1.5x at line rate and the QLC SSDs can be filled to 95% without affecting performance.

Results

With Pliops XDP, the cloud hosting company was able to increase storage density in the same cluster footprint by 3x using QLC SSDs. Instead of 1.5PB of TLC storage, the company now has 4.3PB per cluster with 1.5x higher endurance than the TLC solution. To get 4.3PB of usable capacity in the original TLC configuration it would take 28 servers, so XDP lets the cloud operator avoid 40% higher cost, while gaining higher reliability and efficiency.

The company chose Pliops XDP because it performs better than anything else they have seen. XDP provides decisive improvements in capacity, throughput, and latency across very diverse workloads, block I/O, SQL and NoSQL database. Deploying XDP's Drive Failure Protection at the server level enables ultrafast online rebuilds, which substantially reduce cluster rebalancing and management overhead. Pliops XDP is one solution that works for many different SLAs and lets them standardize storage across various innovative cloud services.

Current Software Based Solution

7.6TB x 24 SSDs
7.6TB x 24 SSDs
7.6TB x 24 SSDs
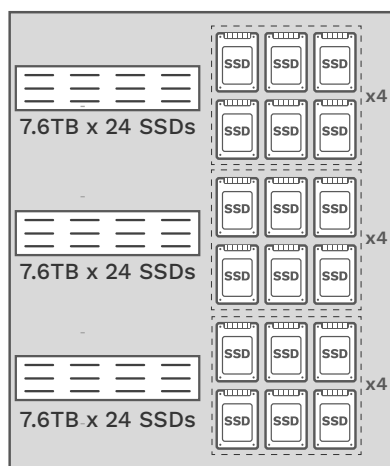
10+2 Servers with 2 Erasure Coding
1.5PB Usable
> 1500 Rebuilds /Year

Accelerated, High-Capacity Solution with Pliops

Server 1 | Server 2 | Server N
Multiple QLC SSD Groups
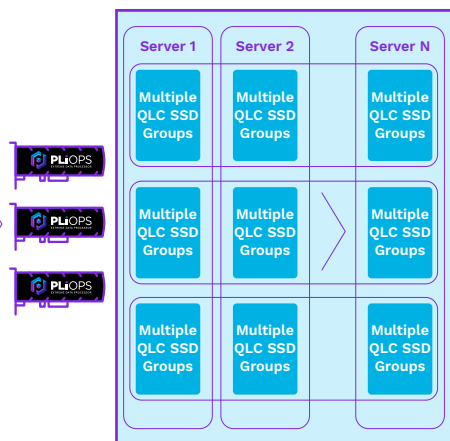
10+2 Servers with 2 Erasure Coding
4.3PB Usable
XDP Drive Fail Protection
0 SSD-Related Failures/Year

Figure 1: Reduction in Infrastructure Footprint

Pliops Customer Benefits

- Increase effective storage capacity by **3x**
- Isolate drive failures from cluster performance impact (FTT n+'1')
- Reduce TCO* $/TB by **161%**
- Improve QLC endurance by **1.5x** vs TLC with software
- Reduce carbon footprint considerably

About Pliops

Pliops multiplies the effectiveness of organizations' infrastructure investments by exponentially increasing datacenter performance, reliability, capacity, and efficiency. Founded in 2017 and named as one of the 10 hottest semiconductor startups by CRN in 2020 and 2021. Pliops global investors include NVIDIA, Intel Capital, SoftBank, Western Digital, KDT, and Xilinx. **Learn more at www.pliops.com**.