SOLUTION BRIEF

Pliops Zero Tradeoff Drive Failure Protection

Information and data are assets growing at exponential rates and must be protected against loss. At the same time, the majority of Enterprise data is stored on fast SSDs, which place unmanageable demands on existing data protection schemes, as illustrated in **Figure 1**.

	Customer 1 RAID 0	Customer 2 RAID 1/10	Customer 3 **Pliops Drive Fail Protection**
Database protection using storage redundancy	✗	✓	✓
Uncompromised database capacity for data protection	✓	✗	✓
Uncompromized database performance during storage drive failures & rebuild	✗	✗	✓
Improved RPO/RTO (Recovery Point and Time Objectives)	✗	✗	✓
Minimal downtime with lowest costs	✗	✗	✓

Figure 1: Traditional RAID vs. Pliops XDP

With business users and customers needing more rapid access to databases and applications, the ideal data protection solution needs to provide the benefits of RAID (redundant array of independent drives) without any of its inherent limitations. Just as GPUs overcome CPU inefficiencies to accelerate performance, the innovation of Pliops Extreme Data Processor (XDP) overcomes RAID and storage software stack inefficiencies to massively accelerate database and application performance and dramatically lower overall infrastructure costs.

Pliops XDP is delivered on an easy-to-deploy, low-profile PCIe card that radically simplifies the way data is processed. The integration of the Pliops XDP with direct-attached SSD storage exponentially increases performance, reliability, capacity, and efficiency resulting in greater effectiveness of infrastructure.

Key Highlights

Pliops XDP allows users to:

- **Flash Optimized Architecture:** Breakthrough data structures and algorithms ensures optimal protection without slowing performance to meet demanding service level agreements (SLAs)
- **Virtual Hot Capacity (VHC):** Unique dynamic capacity allocation eliminates the need to allocate any drives as spares
- **Drive Failure Protection:** Multiple drive failure protection to prevent data loss provides increased storage resiliency
- **Power Failure Protection:** Non-volatile memory (NVM) preserves meta and user data against loss
- **Automatic Rebuild:** Recovery immediately begins using available VHC capacity without reducing usable capacity

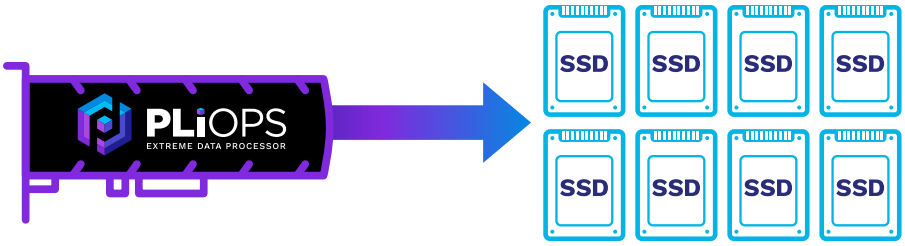

Figure 2: Each Pliops XDP supports up to 128TB of user data

Hardware Acceleration

Flash storage adoption creates a dilemma of maximizing storage capacity with no data protection or increasing data protection with significantly reduced storage capacity and performance.

Pliops XDP uses a revolutionary new architecture to deliver highly efficient performance, capacity, and recovery at levels not possible from traditional RAID. Otherwise, using RAID can protect data against loss due to a drive failure at the expense of intolerably slow performance, low capacity, and extended recovery times.

RAID 0 aggregates drive performance and capacity at high efficiency by avoiding data protection – making it a risky choice. RAID 1 and RAID 10 duplicate data across drives for data protection, which lowers capacity, and reduces performance. These options are most frequently used with traditional RAID because they create less overhead for drives and servers. RAID 5 and RAID 6 use data striping and parity protection to deliver more capacity at lower performance than RAID 1 or 10.

Write performance is especially affected by the need to use a process called read-modify-write (RMW) when writing to RAID 5 or 6 drives. RMW involves reading data and parity, locating existing data and updating it with changes, calculating new parity, and writing that parity data to disk. For these reasons and others, including extremely long recovery times, RAID 5 or 6 is rarely used with SSDs.

	PERFORMANCE	CAPACITY	PROTECTION
Pliops Drive Fail Protection	>200%	>200%	Yes
RAID 6	<15% W / >50% R	75%	Yes
RAID 5	<25% W / >75% R	75%	Yes
RAID 10	50%	50%	Yes
RAID 1	50%	50%	Yes
RAID 0	100%	100%	No

Figure 3: RAID performance, capacity, and protection compared

Drive Failure Protection

Pliops XDP protects data from loss during drive failures while significantly outperforming RAID 0 – even while rebuilding a failed drive. Also, XDP offers Drive Failure Protection (DFP) that enables recovery point objective (RPO) and recovery time objective (RTO) of zero seconds.

Pliops data protection technology preserves non-disruptive access to data during a drive failure for zero RPO and automatic rebuild and recovery for zero RTO. All of this occurs with Pliops hardware-based DFP that outperforms RAID 10, as seen in **Figure 4**.

Figure 4: RAID 10 vs. Pliops XDP DFP

RAID 10 is both too slow and too expensive, causing many organizations to deploy unprotected RAID 0 as a necessary compromise. The use of RAID 0 results in RTO measured in days because the failed drive must be replaced, a new RAID configuration must be created, and data must be restored from backups. The RPO of RAID 0 is also measured in days because all data created and changed after the previous backups are permanently lost during a drive failure.

	Recovery Time Objective (RTO)	Recovery Point Objective (RPO)
Pliops Drive Fail Protection	Zero	Zero
Software RAID 10	Hours	Zero
Software RAID 0	Days	Days

Figure 5: RTO and RPO comparison

Power Failure Protection

RAID data protection is a highly dynamic process that involves temporarily caching data to optimize performance. When using traditional RAID, cached data is lost during unexpected power loss, but this does not occur with Pliops XDP.

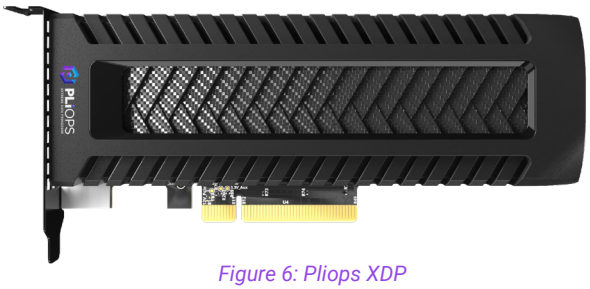

Figure 6: Pliops XDP

Pliops XDP includes dedicated power failure protection that protects data from loss using onboard hardware. This includes a system that detects server interruptions and commands a bank of supercapacitors to provide backup power to cache memory until all data is safely stored to non-volatile memory. Software RAID lacks power failure protection, so the cached data is permanently lost, and RAID configurations unavoidably fail during unexpected power loss.

Virtual Hot Capacity

Traditional RAID options offering data protection reserve space to store mirrored data or parity codes. This reduces usable capacity for storing data by up to 50% depending on the RAID option and the number of drives in use. Usable capacity declines even more when drives are used as spares, which is a RAID best practice. RAID 5 using six 15TB drives (90TB total capacity) results in 60TB usable capacity with 15TB lost to parity and 15TB lost to a spare drive, as illustrated below.

Pliops XDP includes virtual hot capacity (VHC) technology that minimizes reserved space requirements and eliminates the need to allocate any drives as spares. Utilizing Pliops XDP DFP using the same six 15TB drives as the prior example results in 78TB usable capacity – a 30% increase versus RAID 5. With XDP compression at level three, capacity expands to 138TB, 2.3x more than RAID 5.

Also, notice Pliops XDP increases usable drive capacity from 15TB to 19TB (13TB usable + 3TB VHC + 3TB parity), so reserving space for VHC does not lower usable capacity compared to software RAID 5. And Pliops XDP provides this improved space efficiency while delivering 19x higher performance than RAID 5.

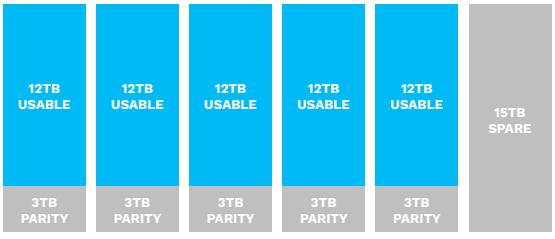

Figure 7: RAID 5 example with six 15TB drives

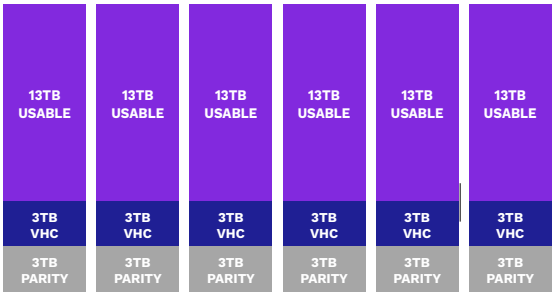

Figure 8: Pliops XDP DFP example with six 15TB drives

Automatic Rebuilds

Pliops XDP automatically rebuilds failed drives without reducing usable capacity. The first failed drive will automatically cause XDP to reconfigure the RAID layout by allocating the reserved VHC space to usable capacity. The examples in **Figures 8** and **9**, show the usable capacity remains similar as XDP changes from a 6 x 13TB to 5 x 16TB configuration (any apparent difference is due to rounding in the examples).

Once the first RAID configuration process is completed, Pliops XDP Drive Fail Protection supports the ability to protect against a subsequent drive failure with a second RAID reconfiguration, as shown in **Figure 10**. This occurs by allocating the reserved parity space to usable capacity. The usable capacity remains similar as XDP changes from a 5 x 16TB to 4 x 19TB configuration (any apparent difference is due to rounding in the examples).

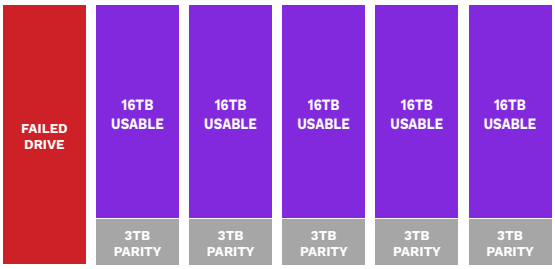

Figure 9: Pliops XDP DFP with first failed drive

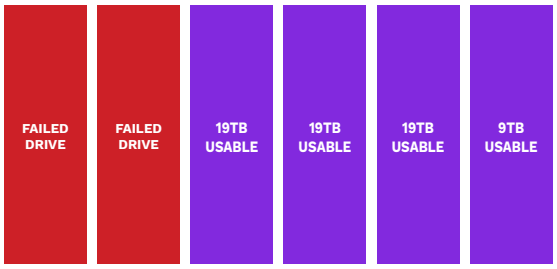

Figure 10: Pliops XDP DFP with second failed drive

Rapid Recovery

Since data protection occurs as a hardware-accelerated process with Pliops XDP, the performance impact of rebuilds is very low over a relatively short period. As shown in **Figure 11**, testing demonstrates that throughput is temporarily reduced by 20% using default settings but can be changed to lessen the impact even more by extending rebuild times. Even so, this same testing shows Pliops XDP offers at least twice the performance of software RAID 0 – even during rebuilds.

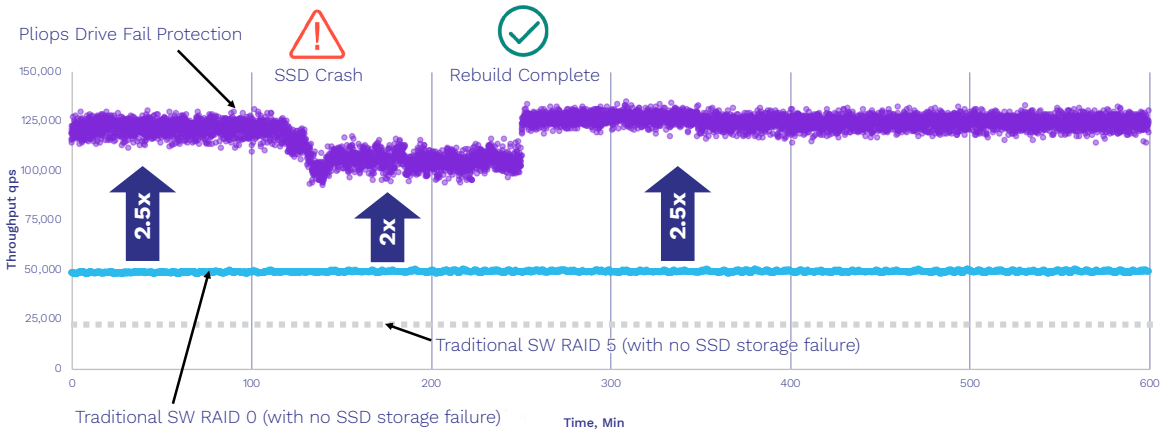

Figure 11: Pliops XDP performance during a DFP rebuild

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**.