



Introducing Graid Technology Inc.

PREPARED FOR: [CLIENT NAME]

Date

PRESENTED BY:

Name, Title

[GRAIDTECH.COM](https://graidtech.com)

Agenda

- The RAID Bottleneck Challenge
- Our Innovative Solution
- Future Proof Your Environment
- Competitive Comparison
- SupremeRAID™ Use Cases
- About Graid Technology Inc.
- Partners, Distributors, OEMs, & Resellers

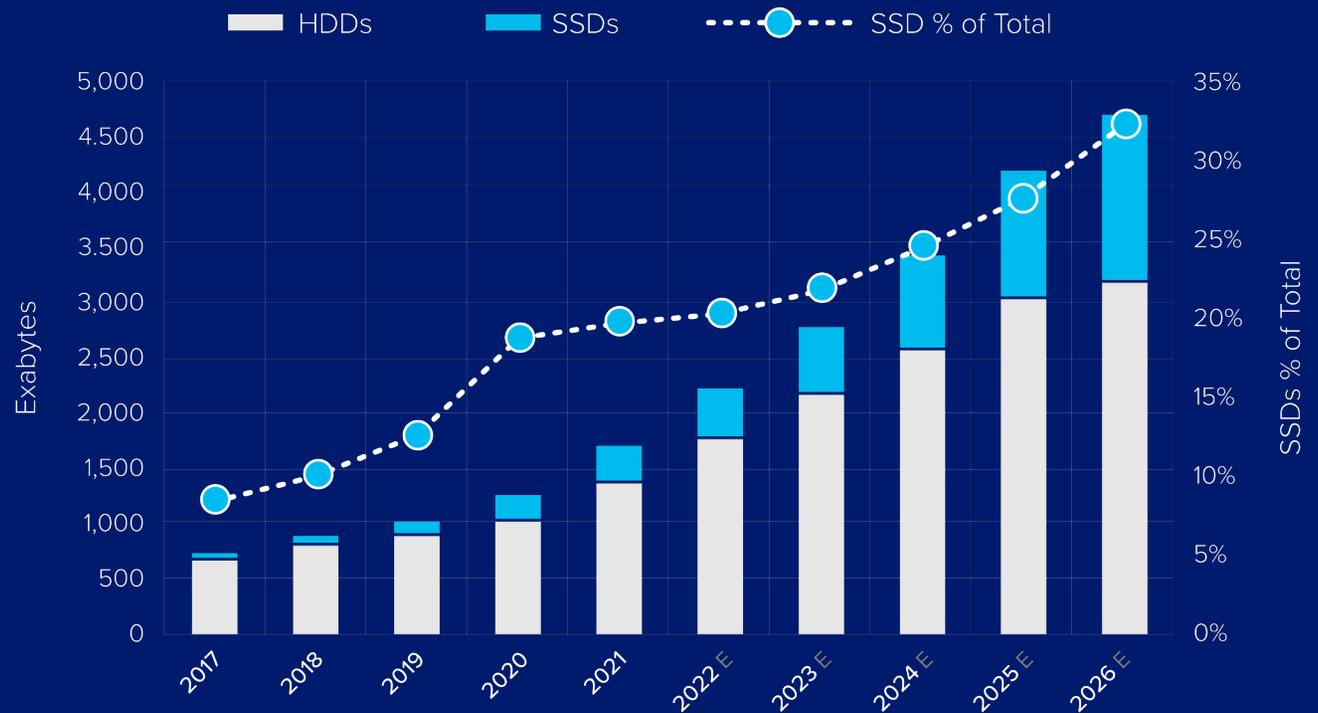


SupremeRAID™
The RAID Bottleneck
Challenge

A Decade of Change in the Storage Market

- Storage systems are becoming increasingly software-defined
- Commodity hardware prevents vendor lock-in
- SSDs are replacing HDD as the storage medium of choice for the enterprise as they deliver lower TCO with improved scalability and flexibility
- Gartner analysts predict enterprise SSDs will be 32% of overall HDD/SSD capacity shipped by 2026 (vs ~20% share in 2021)

HDD and SSD Capacity Shipped (Exabytes); SSDs % of Total



Source: Gartner; Wells Fargo Securities, LLC; Blocks & Files

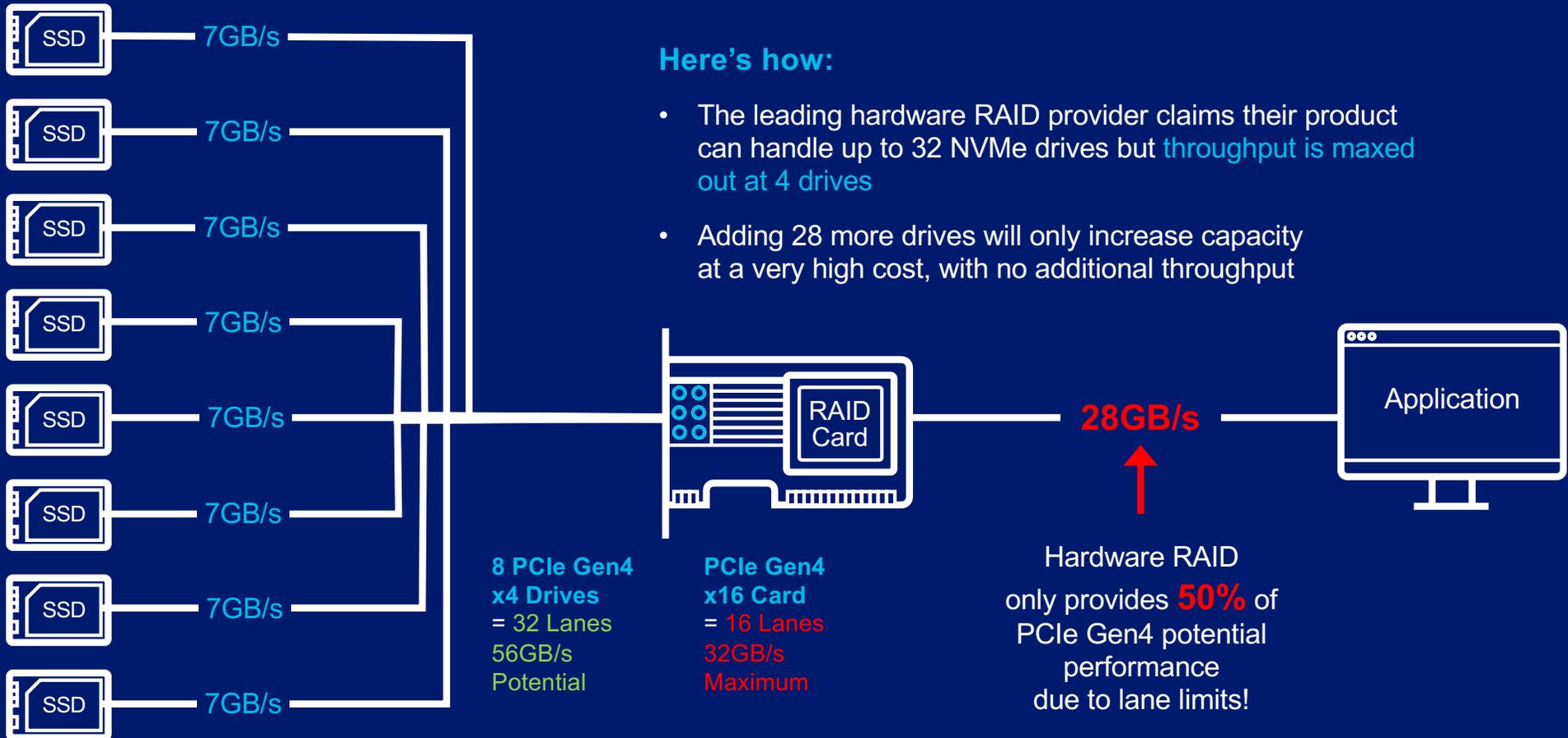
The Challenge

Traditional RAID is a bottleneck

- Flash storage performance is evolving too fast to be fully utilized by existing storage architectures
- Software-based RAID competes with other applications for CPU power, slowing the whole system down
- Advances in NVMe technology are moving so fast that ASIC-based RAID can't deliver the full performance capability of the SSDs
- **With these performance numbers, there is little to no ROI on investment in NVMe SSDs**



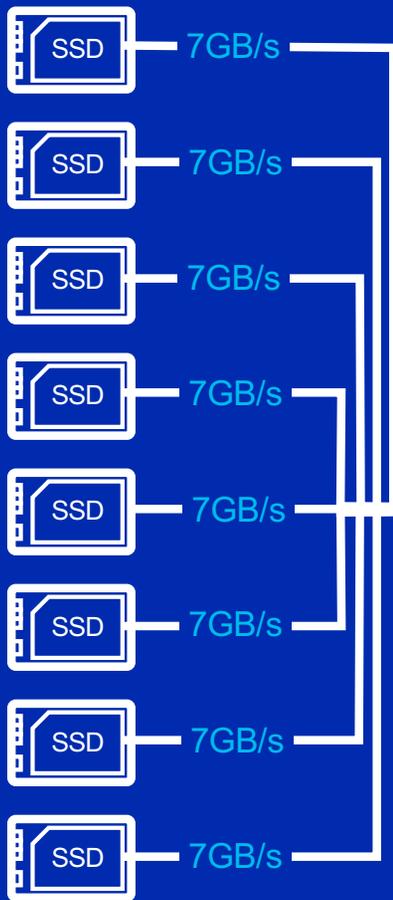
Hardware RAID Presents A Bottleneck



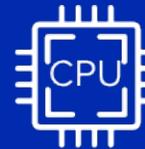
Here's how:

- The leading hardware RAID provider claims their product can handle up to 32 NVMe drives but **throughput is maxed out at 4 drives**
- Adding 28 more drives will only increase capacity at a very high cost, with no additional throughput

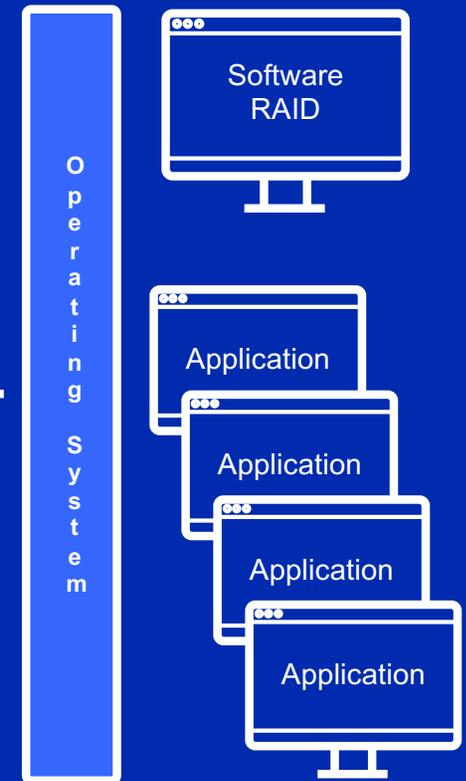
Software RAID Competes with Applications for CPU Cycles



- Software RAID runs alongside applications and the operating system, competing with them for CPU cycles
- **RAID5 and RAID6 are especially CPU intensive, so most admins use RAID10 to reduce CPU overhead at the cost of 50% of their useable capacity**
- As the number and speed of NVMe drives increase, more CPU cycles are required to keep up



Software RAID can consume **30% to 40%** of CPU depending on RAID level
During drive rebuilds, that can climb as high at **75%**!



The Solution: SupremeRAID™

Solve the IOPS Bottleneck

Process every IO with minimal CPU involvement

Solve the Throughput Bottleneck

RAID computation is out of the data path, resulting in up to **28M IOPS** and **260GB/s throughput**

Achieve Unprecedented Performance & Increased Scalability

SupremeRAID™ removes the traditional RAID bottleneck to deliver maximum SSD performance, comprehensive data protection, and unmatched flexibility

CHALLENGE THE STATUS QUO

for performance-demanding workloads with **SupremeRAID™**, the revolutionary next-generation NVMe RAID controller from Graid Technology Inc.



SupremeRAID™ SR-1010



SupremeRAID™ SR-1000

Our Innovative Technology

How SupremeRAID™ Works

- SupremeRAID™ is a software defined solution on GPU designed to deliver **maximum SSD performance without consuming CPU cycles**
- Out of path RAID protection technology means data travels directly from CPU to storage without passing through the SupremeRAID™ card

Unprecedented Performance Results

- SupremeRAID™ SR-1010 delivers **28M IOPS and 260 GB/s throughput**

Based on Linux RAID5 with AMD EPYC 9654 96-Core Processor x 2 and KIOXIA CM7 x 24

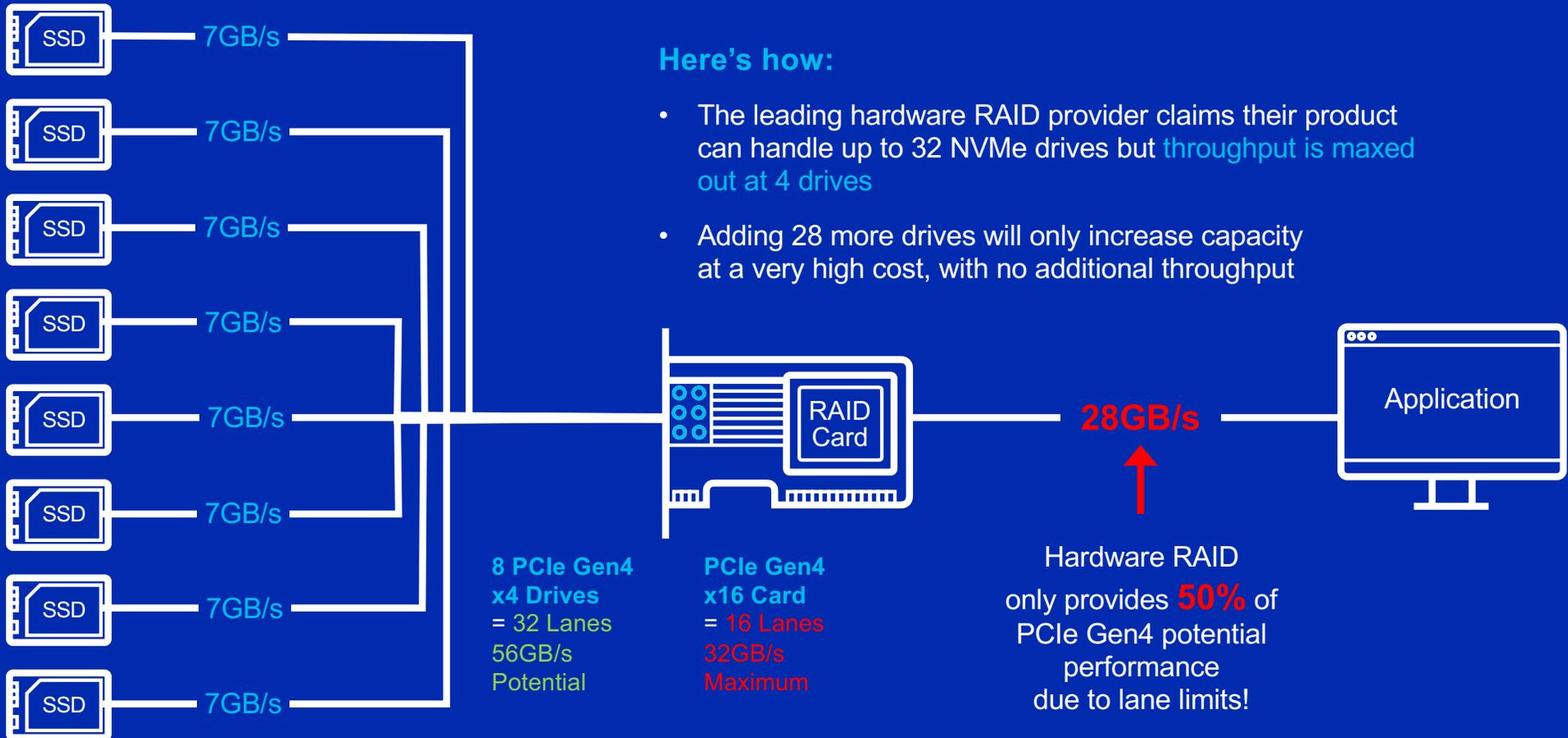
- SupremeRAID™ SR-1000 delivers **16M IOPS and 220 GB/s throughput**

Based on RAID5 with Intel® Xeon® Platinum 8468H CPU 48-Core with 2.1GHz x 2 and Samsung PM9A3 3.84TB x 32

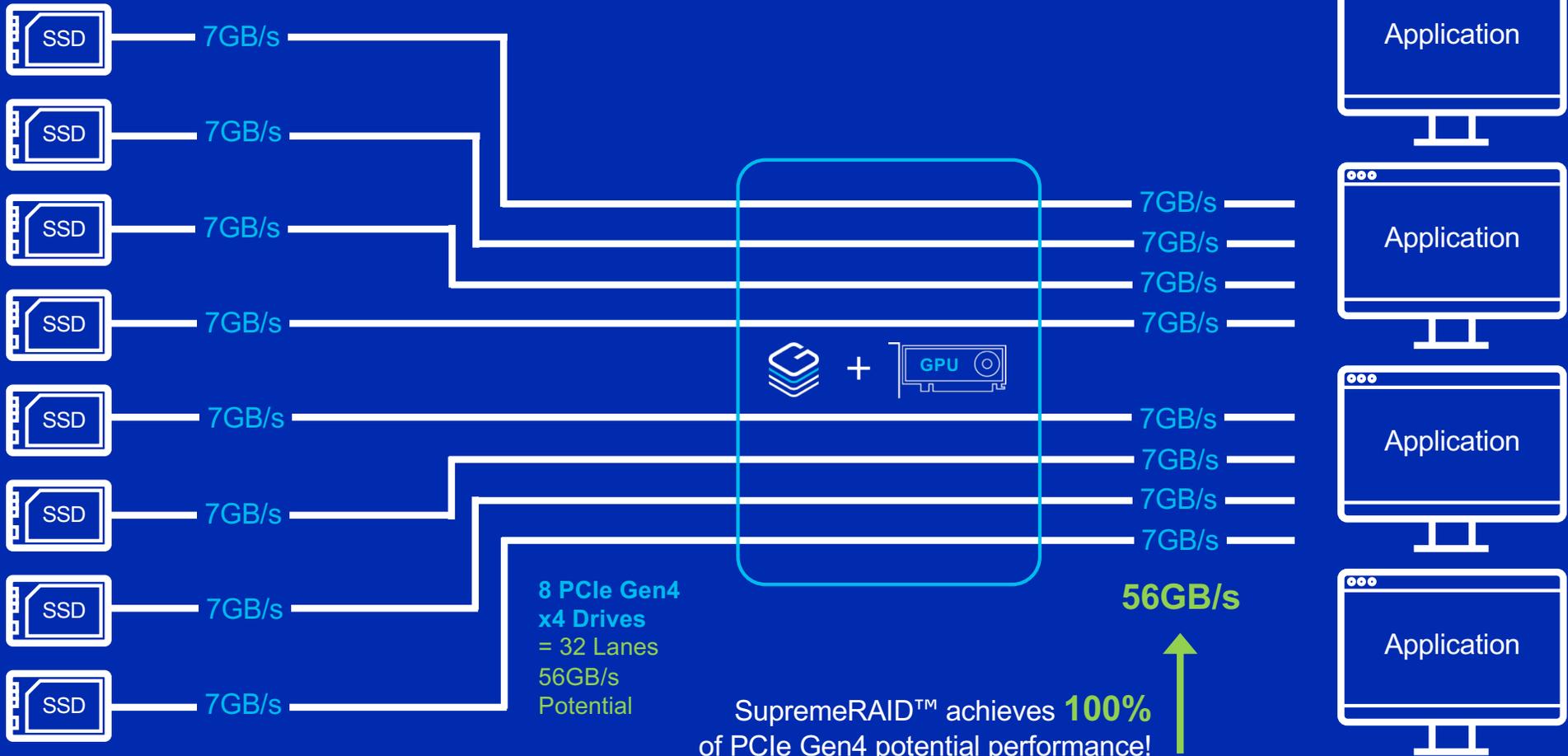


SupremeRAID™
Future Proof
Your Environment

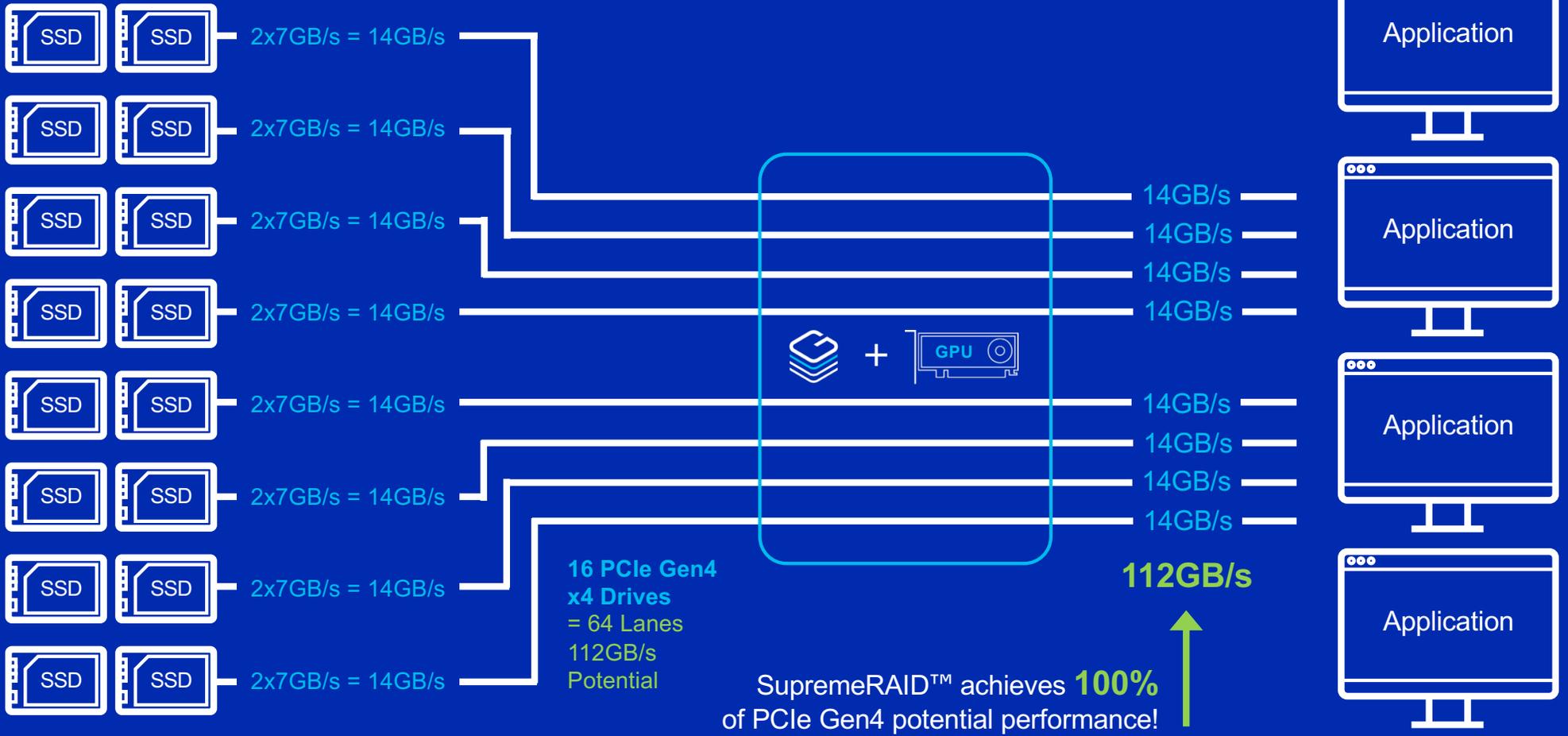
Hardware RAID for PCIe Gen4 Presents A Bottleneck



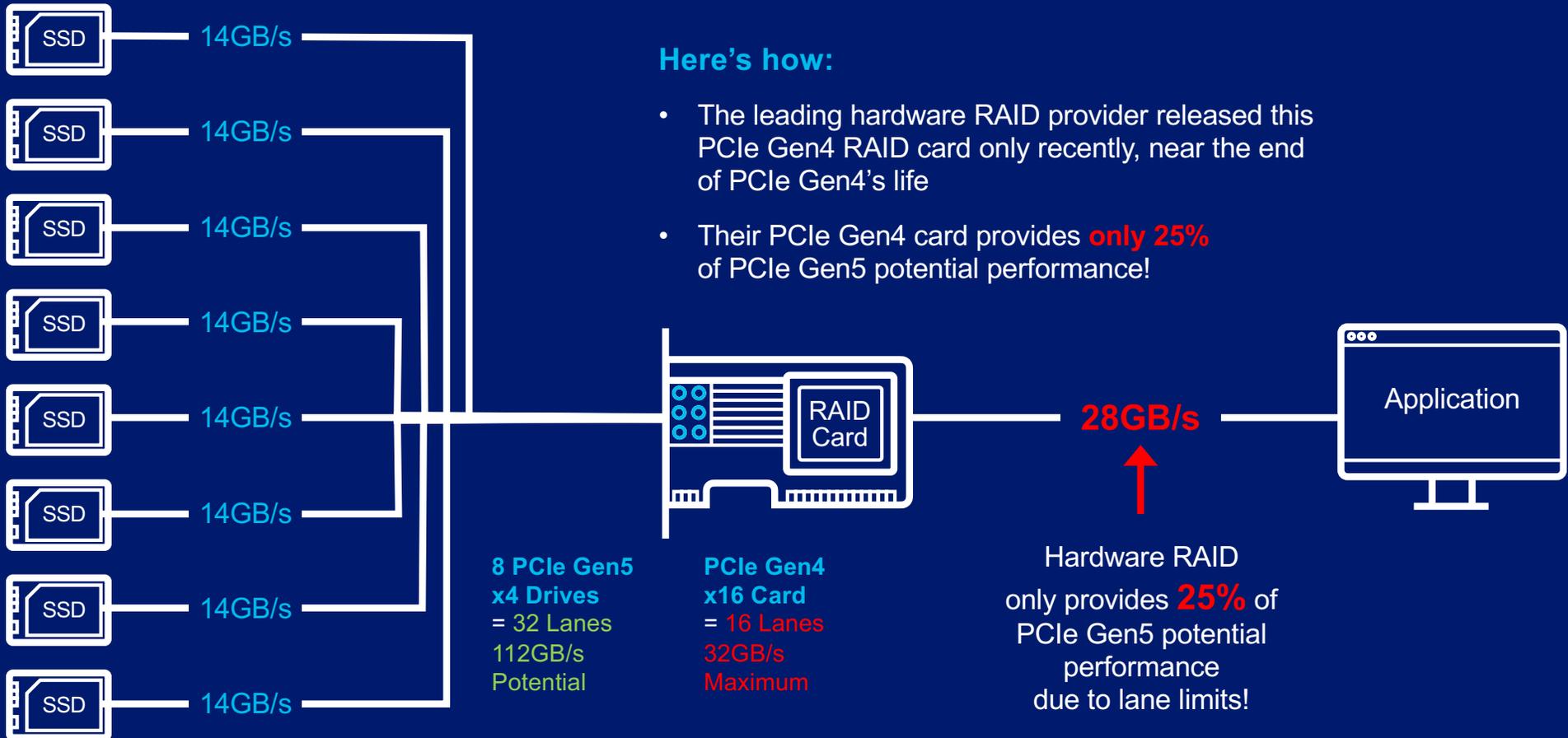
SupremeRAID™ Eliminates the Bottleneck!



SupremeRAID™ Scales to 32 Drives for PCIe Gen4



Hardware RAID for PCIe Gen5 Is **Even Worse...**

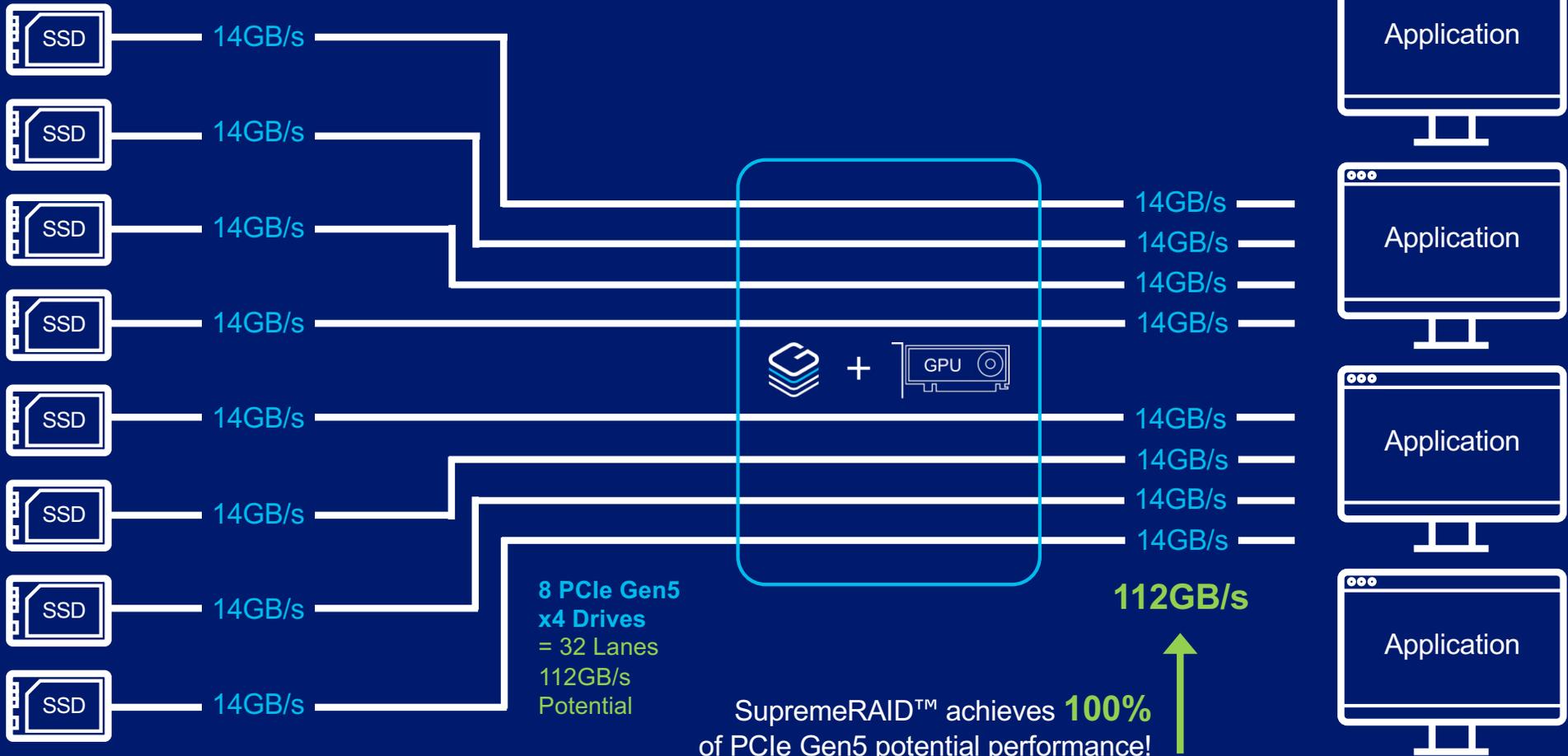


Here's how:

- The leading hardware RAID provider released this PCIe Gen4 RAID card only recently, near the end of PCIe Gen4's life
- Their PCIe Gen4 card provides **only 25%** of PCIe Gen5 potential performance!

Hardware RAID only provides **25%** of PCIe Gen5 potential performance due to lane limits!

SupremeRAID™ Shines with PCIe Gen5



Hardware RAID Doesn't Deliver

Broadcom MegaRAID 9670W-16i

- Designed for HDDs (based in ASICs)
- Delivers **only 600-800K IOPS** when used for NVMe SSDs
- Only supports 8 direct-wired NVMe SSDs per card
- Limited PCIe Uplink (x16 PCIe lanes) only 50% of the lanes needed for 8 drives
- Fixed amount of RAID processing
- SCSI-based RAID stack
- Claims to handle up to 32 NVMe drives yet throughput is maxed out at 4 drives
- Delivers **only 50%** of PCIe Gen4 potential performance and **only 25%** of PCIe Gen5 potential performance due to lane limits!



8 PCIe Gen4 x4 Drives	PCIe Gen4 x16 RAID Card
32 Lanes Potential	16 Lanes Maximum
56 GB/s Potential	32 GB/s Maximum

= only **50%** of PCIe Gen4 potential performance due to lane limits!

8 PCIe Gen5 x4 Drives	PCIe Gen5 x16 RAID Card
64 Lanes Potential	16 Lanes Maximum
112 GB/s Potential	32 GB/s Maximum

= only **25%** of PCIe Gen5 potential performance due to lane limits!

Comparison SupremeRAID™ SR-1010 PCIe Gen 3, 4 & 5

		SupremeRAID™ SR-1010	Software RAID	Hardware RAID
Performance (RAID 5)	4K Random Read	28 M IOPS	~2 M IOPS	6.9 M IOPS
	4K Random Write	2 M IOPS	200 K IOPS	651 K IOPS
	1M Sequential Read	260 GB/s Throughput	~9 GB/s Throughput	28.2 GB/s Throughput
	1M Sequential Write	100 GB/s Throughput	2 GB/s Throughput	10.4 GB/s Throughput
	4K Random Read in Rebuild	5.5 M IOPS	Unknown	1 M IOPS
	4K Random Write in Rebuild	1.1 M IOPS	Unknown	548 K IOPS
CPU Utilization		None	High	None
Data Protection		RAID 0, 1, 5, 6, 10 and EC	RAID 0, 1, 5, 10	RAID 0, 1, 5, 6
NVMeoF Support		Yes	Yes	No
Flexibility		High	Limited by CPU	None
Maximum Number of SSD Supported		32	32	8

Comparison SupremeRAID™ SR-1000 PCIe Gen 3, 4 & 5

		SupremeRAID™ SR-1000	Software RAID	Hardware RAID
Performance (RAID 5)	4K Random Read	16 M IOPS	~2 M IOPS	6.9 M IOPS
	4K Random Write	820 K IOPS	200 K IOPS	651 K IOPS
	1M Sequential Read	220 GB/s Throughput	~9 GB/s Throughput	28.2 GB/s Throughput
	1M Sequential Write	90 GB/s Throughput	2 GB/s Throughput	10.4 GB/s Throughput
	4K Random Read in Rebuild	3 M IOPS	Unknown	1 M IOPS
	4K Random Write in Rebuild	600 K IOPS	Unknown	548 K IOPS
CPU Utilization		None	High	None
Data Protection		RAID 0, 1, 5, 6, 10 and EC	RAID 0, 1, 5, 10	RAID 0, 1, 5, 6
NVMeoF Support		Yes	Yes	No
Flexibility		High	Limited by CPU	None
Maximum Number of SSD Supported		32	32	8

Maximum SSD Support Comparison

Broadcom

- Broadcom comes with 16 lanes directly connected to SSD
 - Each NVMe SSD occupies 4 lanes
 - Supports only 8 SSD direct connections to RAID card
- System design requires an extra PCIe switch in order to work around the number of SSDs supported
 - PCIe switch aggregates SSD lanes into 16 lanes to connect to RAID card
 - **32 SSD at 4 lanes requires 128 lanes, but bandwidth is limited to 16 lanes**

Graid Technology Inc.

- SSDs connect directly to PCIe bus
- SupremeRAID™ is a PCIe device connected to PCIe bus
 - Leverages our patent-pending technology for RAID protection off the data path
- No extra PCIe switch is needed, **SupremeRAID™ supports the maximum number of SSDs allowed by your system**
- SupremeRAID™ removes all throughput bottlenecks



SupremeRAID™ SR-1010

Performance Comparison At A Glance

	SupremeRAID™ SR-1010	Software RAID	Hardware RAID
4K Random Read	28 M IOPS	~2 M IOPS	6.9 M IOPS
4K Random Write	2 M IOPS	200 K IOPS	651 K IOPS
1M Sequential Read	260 GB/s	~9 GB/s	28.2 GB/s
1M Sequential Write	100 GB/s	2 GB/s	10.4 GB/s
4K Random Read In Rebuild	5.5 M IOPS	Unknown	1 M IOPS
4K Random Write In Rebuild	1.1 M IOPS	Unknown	548 K IOPS

Based on Linux RAID5 with AMD EPYC 9654 96-Core Processor x 2 and KIOXIA CM7 x 24



Performance Comparison At A Glance

SupremeRAID™ SR-1000

	SupremeRAID™ SR-1000	Software RAID	Hardware RAID
4K Random Read	16 M IOPS	~2 M IOPS	6.9 M IOPS
4K Random Write	820 K IOPS	200 K IOPS	651 K IOPS
1M Sequential Read	220 GB/s	~9 GB/s	28.2 GB/s
1M Sequential Write	90 GB/s	2 GB/s	10.4 GB/s
4K Random Read In Rebuild	3 M IOPS	Unknown	1 M IOPS
4K Random Write In Rebuild	600 K IOPS	Unknown	548 K IOPS

Based on RAID5 with Intel® Xeon® Platinum 8468H CPU 48-Core with 2.1GHz x 2 and Samsung PM9A3 3.84TB x 32



SupremeRAID™ Use Cases

AI Training & Machine Learning



“AI Training requires reading large amounts of data, a procedure that can take more than 12 hours with traditional solutions. **Combining SupremeRAID™ and NFS over RDMA reduced the procedure to 2 hours—a huge productivity improvement.**”

— AI Director of a well-known Health Research Department Institution

4K Video Surveillance



“To capture a car race with 4K video quality from different cameras requires more than 10GB/s write throughput.

SupremeRAID™ is the only RAID solution to deliver this kind of performance with RAID5 data protection.”

— IT Director, Global Media Company

Automotive, Aviation & Drone



“When recording large amounts of high-definition video in a limited environment, a RAID1 solution might be able to keep up with the speed but it’s not cost efficient. SupremeRAID™ delivers RAID5/6 that matches the performance of RAID1, expanding available space from 50% to 80+%. **Not only is it good for cost savings but also makes a lot of things possible in this limited environment.**”

— Solution Architect, North American-based Aviation Company

High Performance Computing



“Scale-out/parallel file systems such as Spectrum Scale, Lustre, and BeeGFS still rely on traditional hardware or software RAID for drive level protection within storage nodes.

SupremeRAID™ unlocks even more performance and maximize usable capacity for HPC workloads.”

— HPC Solution Architect, North America-based Tier-one Server Manufacturer

Emergency Healthcare



“In situations where fast access to data without bottlenecks is critical to life and death, **SupremeRAID™ consistently delivers crucial patient data** to the healthcare providers that need it the most.”

– Database Architect,
Nationally-recognized
Level 1 Trauma Medical Center

Healthcare Databases



“Healthcare organizations face multiple challenges in storing and maintaining increasingly large volumes of patient data.

SupremeRAID™ solved our need for flexible, scalable infrastructure capable of processing and protecting massive volumes of data on demand, **while also lowering our overall maintenance costs.”**

– IT Director, Globally-recognized
Medical Research Facility

Local Databases



“Current hardware RAID is obviously not the solution for local databases due to its latency and performance limitation for NVMe SSDs.

SupremeRAID™ provides unbeatable performance and latency for databases to realize the full benefits of NVMe SSDs.”

– Solution Architect,
Tier-one IT Company

SAN/NAS Storage Systems



“While most of the all-flash array vendors in the market only deliver up to 1.5M IOPS, Graid Technology Inc. makes **28M IOPS possible with a single SupremeRAID™ card.”**

– R&D Director,
SAN Storage Company

Microscopy Instruments



“Data transfer between a Windows client, which manages the operation of the microscopy system, and the Linux compute nodes presented a significant bottleneck. However, SupremeRAID™ delivered line saturating performance, improving the efficiency of the workflow and overall value of this new design approach. **The improved sustained write performance of 100GB/s, especially in RAID5, is especially important to us.**”

– Director of Core Analysis, Tier 1 Research Hospital

Triple the Lifespan of Servers



Server manufacturing represents 15–30% of each machine’s carbon impact. Reusing existing machines reduces e-waste—the fastest-growing waste category today—and lowers greenhouse gas emissions. The problem is older servers have the highest failure rates.

One of the main issues comes from older RAID controllers: they have batteries, which increase failure rates. **By retrofitting older servers with SupremeRAID™ and newer NVMe SSDs, the performance and reliability of these older machines can be massively improved, thus extending their use life as well as reducing cost, emissions, and e-waste.**

– Datacenter Decommissioning Expert



About
Graid Technology Inc.

Graid Technology Inc.

The New Standard in Enterprise Data Protection & Performance

We've developed the world's first NVMe and NVMeoF RAID card to unlock the full potential of your SSD performance.

Our extraordinary software plus hardware solution is the most powerful and flexible NVMe SSD RAID in the world.

HQ in Silicon Valley

R&D center in Taipei, Taiwan

Global Network of Partners, OEMs, Distributors & Resellers



Leadership

Our dedicated team of experts bring decades of experience in the SDS, ASIC and storage industries



Leander Yu

Co-Founder
& CEO

Santa Clara, CA



Dr. Henry Chang

CTO

Taipei, Taiwan



David Tseng

Chief Architect

Taipei, Taiwan



Tom Paquette

SVP & General
Manager, Americas
and EMEA

Bonita Springs, FL



Partners, OEMs & Distributors

AIC

 **ALTOS**
an Acer Group Company

 **SUPERMICRO**

 **ASRock**
Rack

 **ASUS**

 **GIGABYTE™**

 **KeyWin**
凱穩電腦

 **AMD**

 **LIQID**

 **msi®**

 **SEAGATE**

 **StarWind**
HYPERCONVERGENCE

 **KIOXIA**

 **TYAN**

 **Western Digital**

 **AFASTOR**

 **ANOW**

 **ASBIS®**

 **CLIMB®**
CHANNEL SOLUTIONS

 **EDOM**
TECHNOLOGY CO., LTD.

 **GLUESYS**

 **innotech**

 **Sunway**

 **TD SYNnex**

Resellers



SupremeRAID™ Competitive Advantages



Industry Leadership

Led by a dedicated team of experts with decades of experience in the SDS, ASIC and storage industries



Disruptive Innovation

Award-winning NVMe / NVMeoF performance via RAID without compromising data security or business continuity



Strategic Partnerships

Strong strategic partnerships with well known OEMs, distributors, resellers, and technology providers across the globe



Global Footprint

Immediate distribution to the greater global market (NA / EMEA / APAC); delivering well ahead of our competitors



Proven Performance

Extensive testing with documented record-breaking performance stats for both SupremeRAID™ SR-1000 and SR-1010

SupremeRAID™

Innovation, Performance, & Value

Flexible & Future Ready



Unmatched flexibility with features like new O/S support, compression, encryption, thin provisioning, or boot drive protection easily added with software releases

Plug & Play



Out of the box, into the future: effortless installation, no cabling or motherboard re-layout required

Highly Scalable



Easily manage 32 direct attached NVMe SSDs; extend data protection without sacrificing performance with Software Composable Infrastructure

World Record Performance



Unprecedented NVMe/NVMeoF performance up to 28M IOPS and 260GB/s throughput with a single SupremeRAID™ card delivers the full value of your server investment

Liberate CPU Resources



Offload your entire RAID computation to SupremeRAID™ to free-up precious CPU computing resources for 5G, AI and AIoT applications

Easy to Use



SupremeRAID™ doesn't rely on memory caching technology to improve performance, eliminating the need for battery backup modules

Unbeatable Performance

Take a quick look at the SupremeRAID™ SR-1010 and SR-1000:

RAID 5	SupremeRAID™ SR-1010	SupremeRAID™ SR-1000
4K Random Read	28 M IOPS	16 M IOPS
4K Random Write	2 M IOPS	820 K IOPS
1M Sequential Read	260 GB/s	220 GB/s
1M Sequential Write	100 GB/s	90 GB/s
4K Random Read In Rebuild	5.5 M IOPS	3 M IOPS
4K Random Write In Rebuild	1.1 M IOPS	600 K IOPS

[Download the Spec Sheet](#)

[Download the Spec Sheet](#)

Our Partner White Papers

READ THE
WHITE PAPERS



KIOXIA
GRAID Technology & Kioxia
Partner to Revolutionize Enterprise
Data Protection Architecture
MAY 2021

GIGABYTE
GRAID SupremeRAID™
A Data Protection Solution for NVMe SSDs
NOVEMBER 2020

SEAGATE
Seagate Exos® 2X14
Plus GRAID SupremeRAID™
Provides Complete Data Protection
At Twice the Performance
AUGUST 2021

StarWind
HYPERCONVERGENCE
White Paper
**StarWind
Backup Appliance**
StarWind Backup Appliance (B/A) reimagines the approach to and the technology behind backup overall. We've taken the components traditionally associated with performance enhancement and top-level enterprise backup solutions, StarWind Backup Appliance is a revolutionary backup solution that redefines backup speed and efficiency.

GIGABYTE
GIGABYTE Servers and
GRAID SupremeRAID™
Solutions that deliver 100% NVMe SSD performance
without sacrificing data security or business continuity
MAY 2021

SOLIDIGM
Case Study: SupremeRAID™
and Solidigm D5-P5316 QLC
NVMe
WHITEPAPER
jeonickel@hnsd.com
VP Storage, Chu Network
July 2021

Western Digital
White Paper
**SupremeRAID™ with OpenFlex™
Data24**
Abstract
This white paper explores the performance benchmarks of SupremeRAID SR-1000 NVMe-oF™ RAID card in conjunction with the Western Digital OpenFlex Data24 NVMe-oF Storage Platform.
July 2021

KIOXIA
NVMe SSDs: How virtualized platforms can
benefit from innovative setup of high
performance and large capacity NVMe storage
arrays
Industry trends
Over recent years, the IT industry has continued its long-term shift from mechanical hard disk drives (HDDs) to solid state drives (SSDs), taking advantage of the speed and performance that the latter offers. According to IDC, worldwide SSD industry revenues will continue to increase strongly between now and 2026, representing a compound annual growth rate (CAGR) of around 9.6% during this period.
The speed and performance requirements of today's applications continue to rise, whether it's a new game, a new application or a more demanding business service. Many customers are looking for faster storage and others are focused on lower power consumption, while others simply want to get smaller, and there is a continual struggle for hardware to keep up with software developments.
To meet increasing demands, data centres and enterprise operations are now also looking to move away from SSDs based on older SATA and SAS technologies, which were originally developed for HDDs. Instead, they want to take advantage of the newer NVMe (Non-Volatile Memory Express) technology, which is specifically optimised for SSDs usage and delivers lower latency than other legacy storage technologies.
While NVMe SSDs provide substantial operational advantages, there are many companies that have not yet made the transition from AIOCs. This is partly due to a perception that changing from SATA based servers and storage to NVMe involves substantial extra costs in changing out adapting backplanes, cables and other peripherals. However, recent price drops for NVMe SSDs mean that they are now competitively positioned against their SATA SSD requirements – and this is encouraging migration to the newer technology.
Copyright © 2023 KIOXIA Europe GmbH. All Rights Reserved.



Questions?
Thank You



PRESENTED BY:

Name, Title

(xxx) xxx-xxxx

first.last@graidtech.com

[GRAIDTECH.COM](https://www.graidtech.com)

Copyright © 2021–2023 Graid Technology Inc. All Rights Reserved. SupremeRAID™ is trademarked by Graid Technology Inc. and/or its affiliates in the United States, certain other countries, and/or the EU. The term GraidTech refers to Graid Technology Inc. and/or its subsidiaries. For more information, please visit www.Graidtech.com. Graid Technology Inc. reserves the right to make changes without further notice to any products or data described herein. Information provided by Graid Technology Inc. is believed to be accurate. However, Graid Technology Inc. does not assume any liability arising from the use of any application or product described herein, neither does it convey any license under its patent rights nor the rights of others.