



DDN Update for 2019

第十八回PCクラスタシンポジウム

DataDirect Networks Japan, Inc.

2018/12/13

橋爪 信明 (nhashizume@ddn.com)

2018年主な出来事@DDN

- Declustered RAID(DCR)対応製品へラインナップ刷新
 - ▶ SFAOS11世代のHWへの切り替え元年
 - ▶ SFA200/400NV, SFA7990, SFA18K
- 6月 Intel社よりLustre部門を買収
 - ▶ DDNのWhamcloudディビジョンとして活動
 - ▶ Open Source Community Edition開発
 - ▶ Lustre L3サポート
- 9月 Tintri社を買収
 - ▶ DDN内の独立したTintriディビジョンとして活動
 - ▶ 仮想化・マルチクラウド自動最適化フラッシュストレージ



DDN SFA

ALL-FLASH AND HYBRID BLOCK STORAGE PLATFORMS

2019年より全グレードで新ラインナップを展開

| 200NV | 400NV | 7990 | 14KX | 18K |
|---|---|--|---|---|
|  |  |  |  |  |
| 23GB/s 1M IOP/s 24 NVME Slots | 46GB/s 2M IOP/s 24 NVME Slots | 23GB/s 1M IOP/s Up to 450 SSD/HDD | 60GB/s 4M IOP/s 48 NVMe Slots Up to 1872 SSD/HDD | 92GB/s 3.2M IOP/s 48 NVMe Slots Up to 1872 SSD/HDD |
| EDR IB (4), OPA (2) FC32 (8), FC (8) | EDR IB (8), OPA (4) | EDR IB (4), OPA (2) FC16 (8) | EDR IB (12 8) OPA (4), FC16 (24) | EDR IB (16), OPA (8) |
| NEW 2018 | COMING 2019 | NEW 2018 | To be EOS | COMING 2019 |

DDN SFA | 製品名と位置付け

| 位置付け | 用途 | 200NV | 400NV | 7990 | 18K |
|-------------------|-------------------------|-----------|-----------|----------|---------|
| 総称 | 全体をまとめて呼ぶ場合 | SFA200NV | SFA400NV | SFA7990 | SFA18K |
| ブロックストレージ | ファイルサーバに接続 | SFA200NV | SFA400NV | SFA7990 | SFA18K |
| エンベデッドアプライアンス | コントローラ上にファイルサーバを実装 | SFA200NVE | SFA400NVE | SFA7990E | SFA18KE |
| ExaScalerアプライアンス | ExaScaler(Lustre)エンベデッド | ES200NV | ES400NV | ES7990 | ES18K |
| GridScalerアプライアンス | GridScaler(GPFS)エンベデッド | GS200NV | GS400NV | GS7990 | GS18K |
| A3Iアプライアンス | AI向けエンベデッド | AI200 | AI400 | AI7990 | |



SFA18K

MAXIMUM SCALABILITY WITH NVMe + SAS

FOR CAPACITY & BANDWIDTH WITH DRIVE TYPE FLEXIBILITY

SFA18K



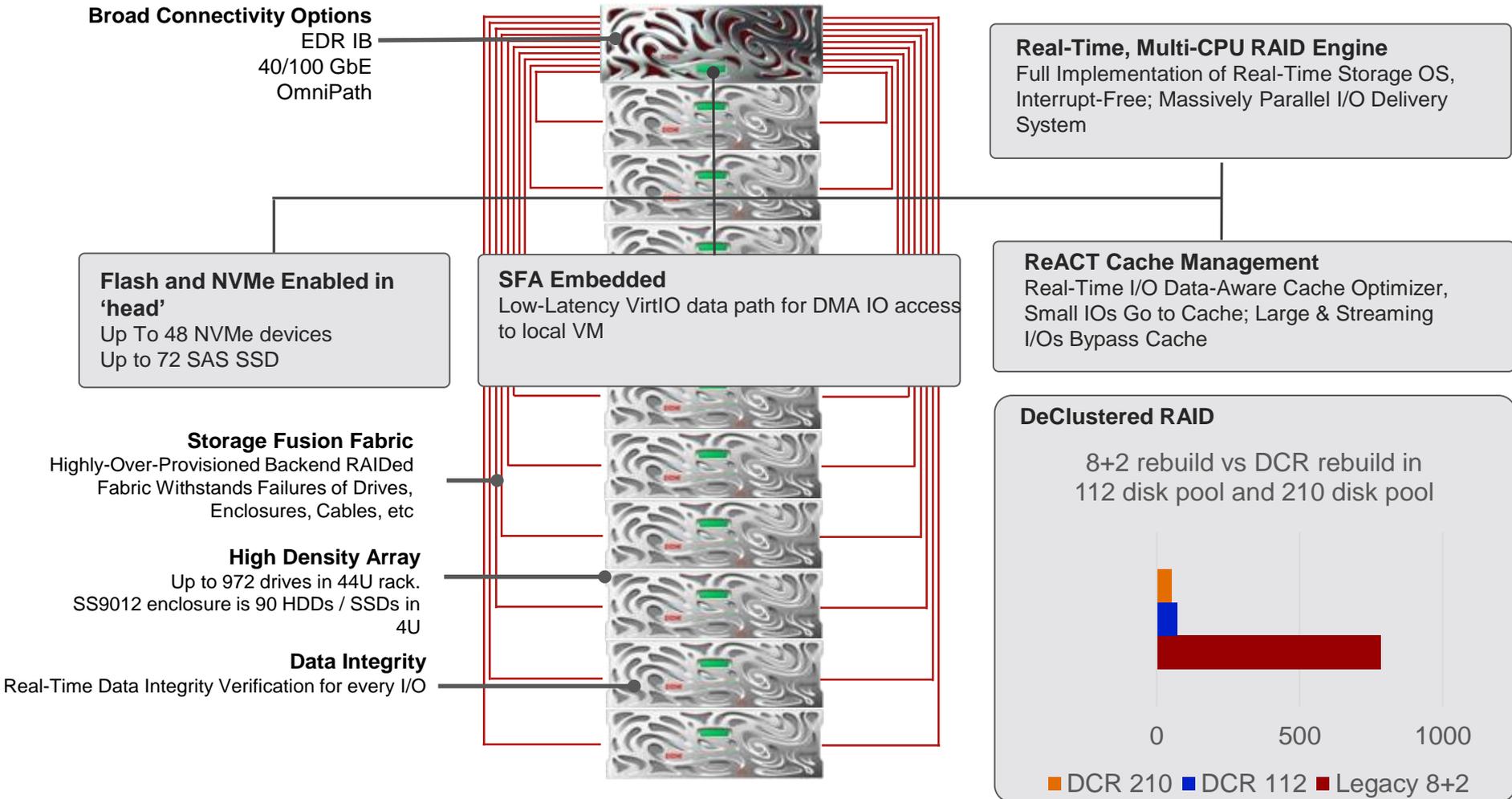
Block 92GB/s Embedded 78GB/s

- **Start in as little as 4U and Scale up & Scale out;**
 - Up to 1872 drives per system:
 - 72 Slots in “head”, 48 NVMe/SAS + 24 SAS
 - Add up to 20x SS9012 Enclosures (90 SAS slots)
- **Flexible Access for File: IB or Ethernet (16 ports), OPA (8 ports)**

Integrates high-performance, low-latency, RDMA capable networks. EDR InfiniBand and 100Gbps (or 40Gbps) Ethernet and OPA
- **Access for Block: IB (16 ports)**

Block systems attach via EDR IB to external servers

SFA18K Overview



SFA18K CONFIGURATIONS

| Config | SFA18K Only | + 1 SS9012 | +2 SS9012 | +4 SS9012 | +5 SS9012 | +6 SS9012 | +8 SS9012 | +10 SS9012 | +16 SS9012 | +20 SS9012 |
|----------------------------|--------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|----------------|----------------|
| SFA (BLOCK) | | | | | | | | | | |
| ES | | | | | | | | | | |
| GS | | | | | | | | | | |
| 2.5" NVMe or SAS SSD Slots | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) | 72 (NVMe:48) |
| 3.5" HDD or SAS SSD Slots | 0 | 90 | 180 | 360 | 450 | 540 | 720 | 900 | 1440 | 1800 |
| Enclosure Connection | NA | Direct | Direct | Direct | Direct | Direct | Direct | Direct | Daisy Chain | Daisy Chain |
| 最大物理容量 | NA | 1.26PB | 2.52PB | 5.04PB | 6.30PB | 7.56PB | 10.08PB | 12.6PB | 20.16PB | 25.20PB |

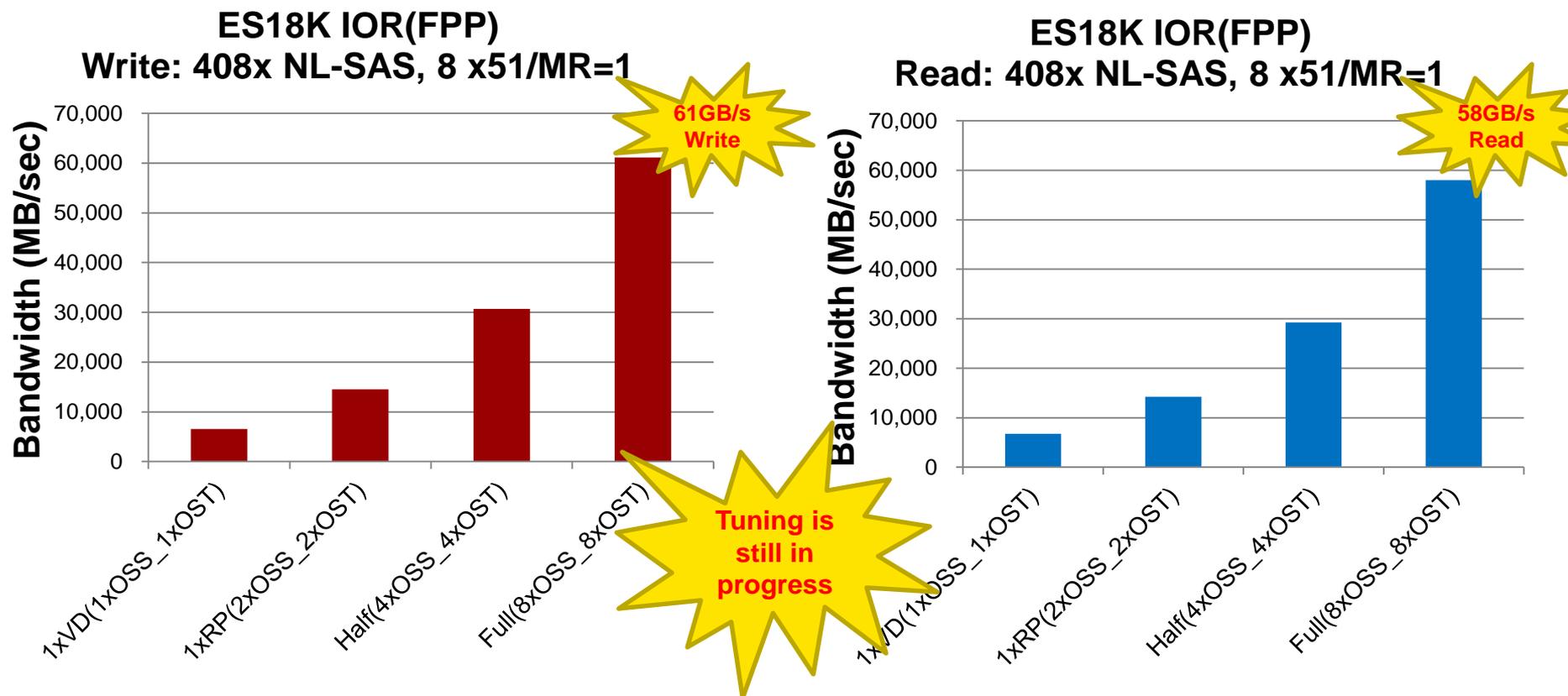
Expansion Options



※ 最大物理容量は14TB NL-SAS HDDをSS9012に実装した場合

EXAScaler ES18K Early Performance - IOR 1MB FPP

- EXAScaler IOR Client Benchmarking with an ES18K EDR with 408 NL-SAS Drives as 8 DeClustered RAID Pools of 51 drives.





SFA7990

SFA7990 WORLD'S MOST EFFICIENT HYBRID STORAGE

OPTIMIZED FOR SSD, HDD CAPACITY, MULTICORE & MULTI GPU

SFA7990

Block 23GB/s Embedded 20GB/s

DDN's ES7990 and GS7990, EXAScaler[®] and GRIDScaler[®] appliances, offer scalable, high performance parallel file systems in an integrated package. Designed, deployed and supported by the experts in data intensive workloads, these appliances are the gold standard for eliminating bottlenecks and maximizing application performance.

- **Start at 4U and Scale Up or Scale Out**

Mix Disk and Flash SSD for Hybrid Performance

- **Flexible Access for File: (IB, Ethernet, OPA)**

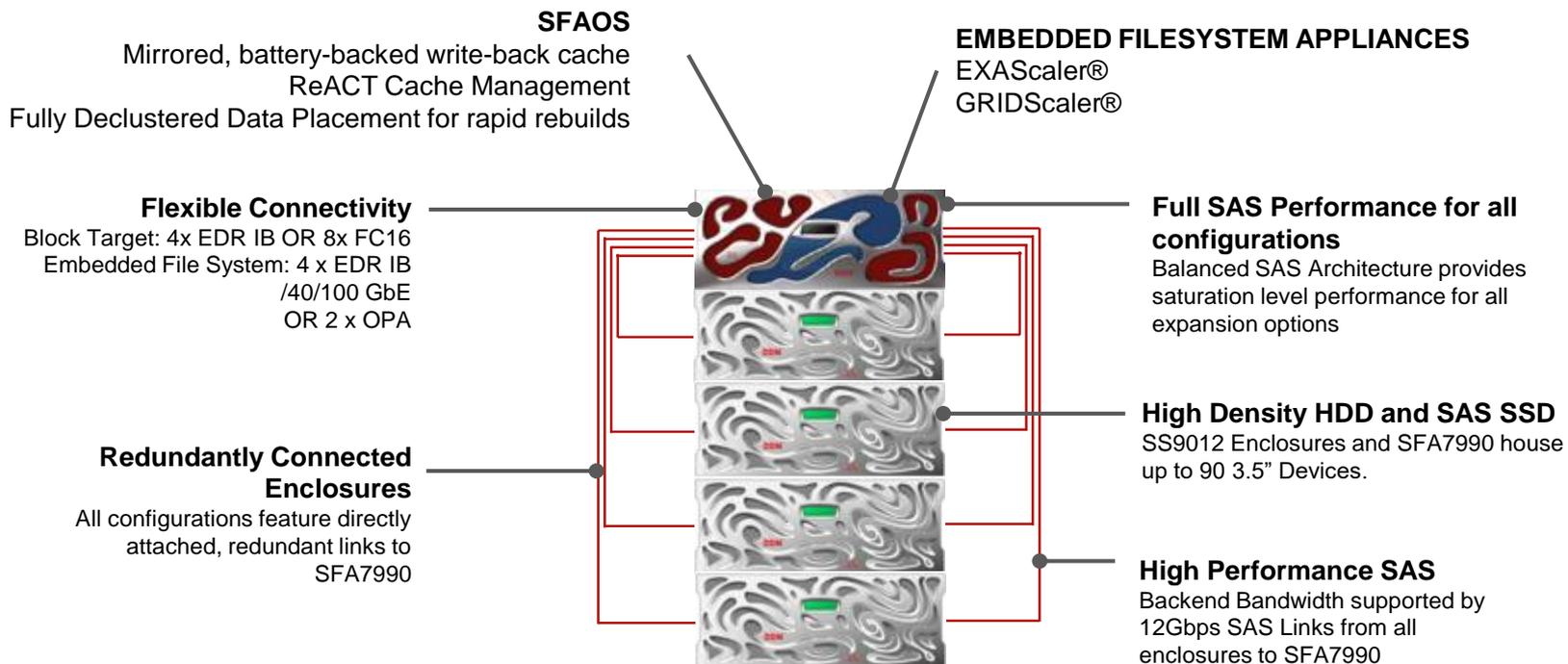
Integrates high-performance, low-latency, RDMA capable networks. Both EDR InfiniBand and 100Gbps (or 40Gbps) Ethernet plus OPA

- **Flexible Access for Block: (IB, FC)**

Block systems attach via FC or IB to external servers



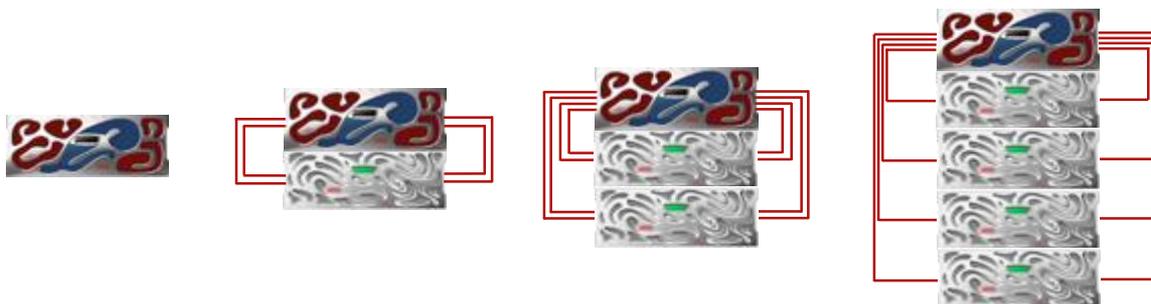
SFA7990 OVERVIEW



SFA7990 CONFIGURATIONS

| Configuration | SFA7990 Only | + 1 SS9012 | +2 SS9012 | +4 SS9012 |
|---------------------------|---------------------------------|------------|-----------|-----------|
| Supported Solutions | SFA (BLOCK) ES7990 GS7990 | | | |
| 3.5" HDD or SAS SSD Slots | 90 | 180 | 270 | 450 |
| 最大物理容量 | 1.26PB | 2.52PB | 3.78PB | 6.30PB |

Expansion Options



※ 最大物理容量は14TB NL-SAS HDDをSS9012に実装した場合

ES7990 WORLD'S MOST EFFICIENT HYBRID STORAGE

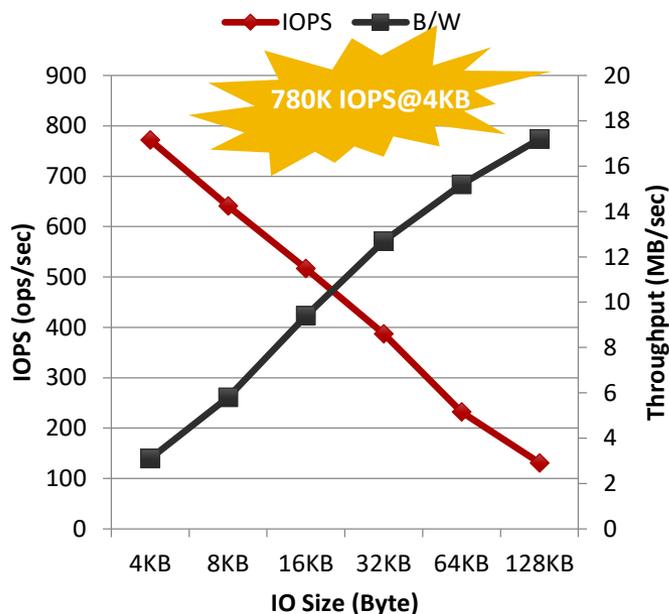
OPTIMIZED FOR SSD, HDD CAPACITY, MULTICORE & MULTI GPU

ES7990

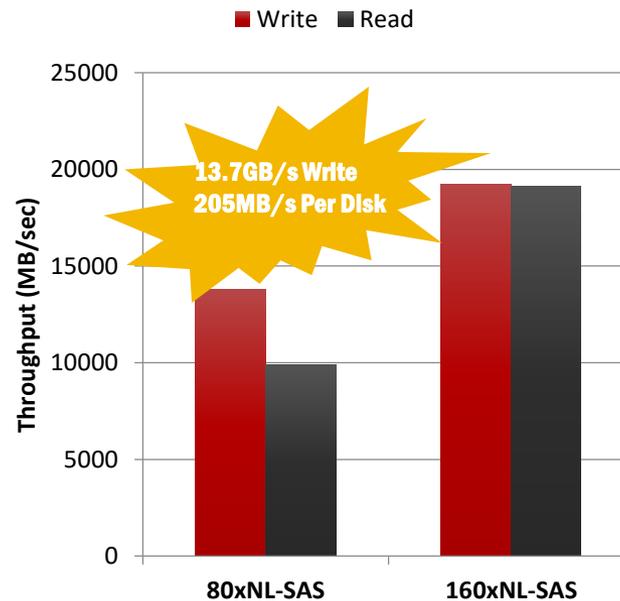
20GB/s



ES7990 Random IO Performance (10xSSD)



ES7990 Sequential IO Performance



GS7990 WORLD'S MOST EFFICIENT HYBRID STORAGE

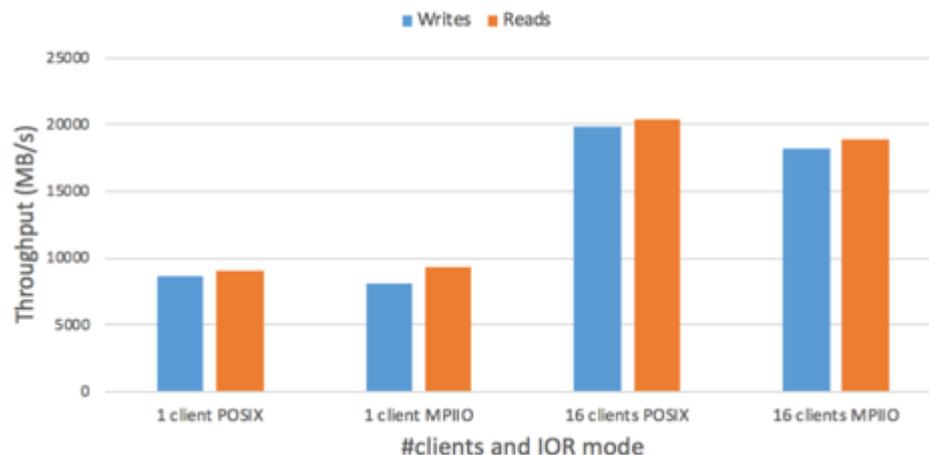
OPTIMIZED FOR SSD, HDD CAPACITY, MULTICORE & MULTI GPU

GS7990

20GB/s



IOR Sequential Throughput of GS7990



* Cached



SFA200/400NV

WORLD'S MOST EFFICIENT HPC FLASH

OPTIMIZED FOR NVMe IOPS, MULTICORE & MULTI GPU

SFA200NV

Block 23GB/s
Embedded 20GB/s



- **Start at 2U and Scale-out**

All NVMe Flash, high density, extreme performance

- **Flexible Access for File: (IB, Ethernet, OPA)**

Integrates high-performance, low-latency, RDMA capable networks. EDR InfiniBand and 100Gbps (or 40Gbps) Ethernet and OPA

- **Flexible Access for Block: (IB, FC)**

Block systems attach via FC or IB to external servers

WORLD'S MOST EFFICIENT HPC FLASH

OPTIMIZED FOR NVMe IOPS, MULTICORE & MULTI GPU

SFA400NV

Block 46GB/s
Embedded 40GB/s



- **Start at 2U and Scale-out**

All NVMe Flash, high density, extreme performance

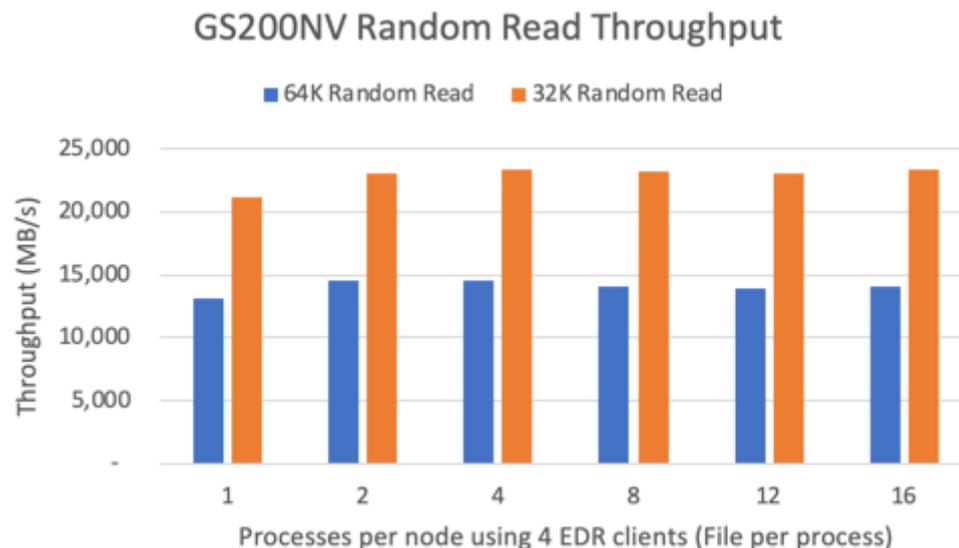
- **Flexible Access for File: (IB, Ethernet, OPA)**

Integrates high-performance, low-latency, RDMA capable networks. EDR InfiniBand and 100Gbps (or 40Gbps) Ethernet and OPA

GS200NV : SCALABLE FILE PLATFORMS

OVER 23GB/s THROUGHPUT EVEN FOR RANDOM READ WORKLOADS

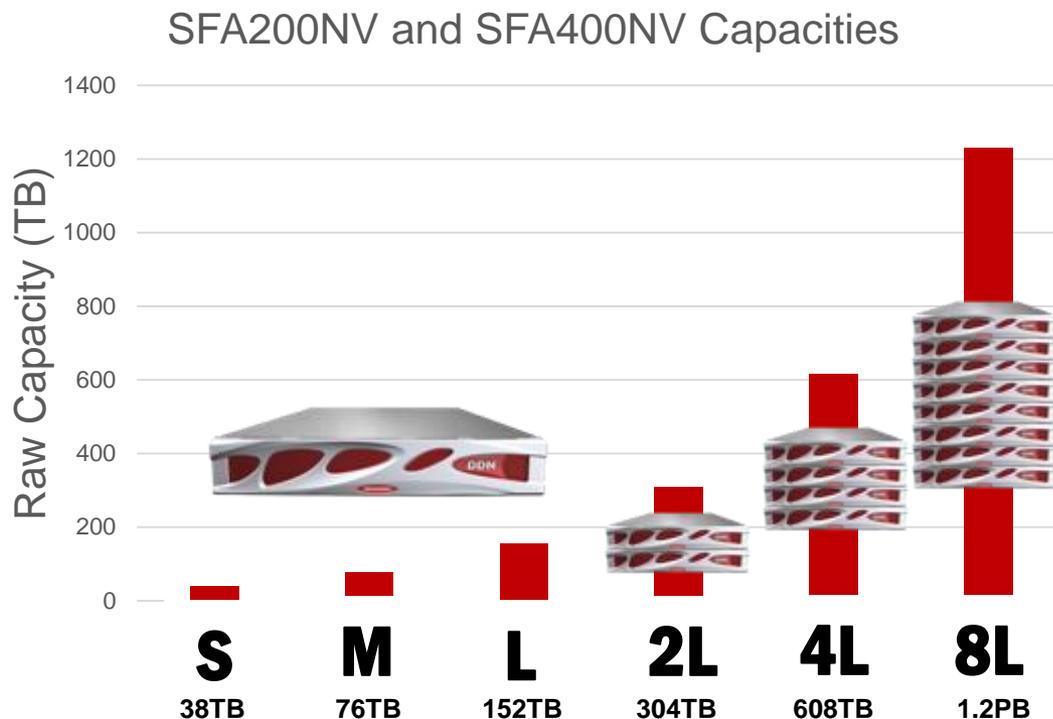
- Saturation level random read performance with small I/O transfers
- Ideal for Analytics platforms requiring Enterprise Features



SFA200NV AND SFA400NV | SCALABLE FILE PLATFORMS

Start with a complete All NVMe Flash, Parallel File System from DDN in just 2RU

- Choose your starting option from as small as 38TB or up to 152TB in just 2 RU
- Scale-out with NVMe to Petabytes of Flash and TB/s of performance



Coming soon
15.36TB NVMe



A3I

Accelerated, Any-scale AI Solutions From DDN

DDN PARALLEL FILE STORAGE APPLIANCES FOR AI AND DL



AI200

All NVME parallel file storage appliance
Optimized for the most intensive workloads
30TB, 60TB, 120TB in 2RU



AI7990

Hybrid parallel file storage appliance
Optimized for capacity, intermix with flash
1PB in 4RU

23GB/s, 395K IOPS • 100Gb Ethernet or EDR InfiniBand • Start with 1, Scale out and mix

DDN[®] A3I[®]

POWERED BY  NVIDIA



DDN[®] A3I[®]

with  **Hewlett Packard
Enterprise**



DDN A³I WITH DGX-1 SCALABLE REFERENCE ARCHITECTURES

A³I with single DGX-1



A³I with quad DGX-1



A³I with DGX-1 POD

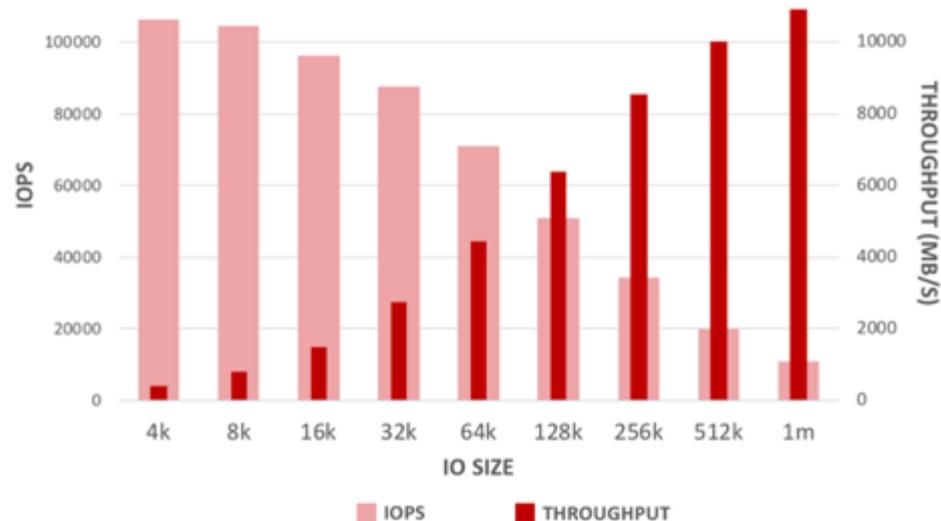


DDN A³I Solutions: Performance to a single container

Over 100K IOPs and 10GB/s to 1 Container

EXAScaler client demonstrates over 10GB per second to a *single* container and over 100K IOPs.

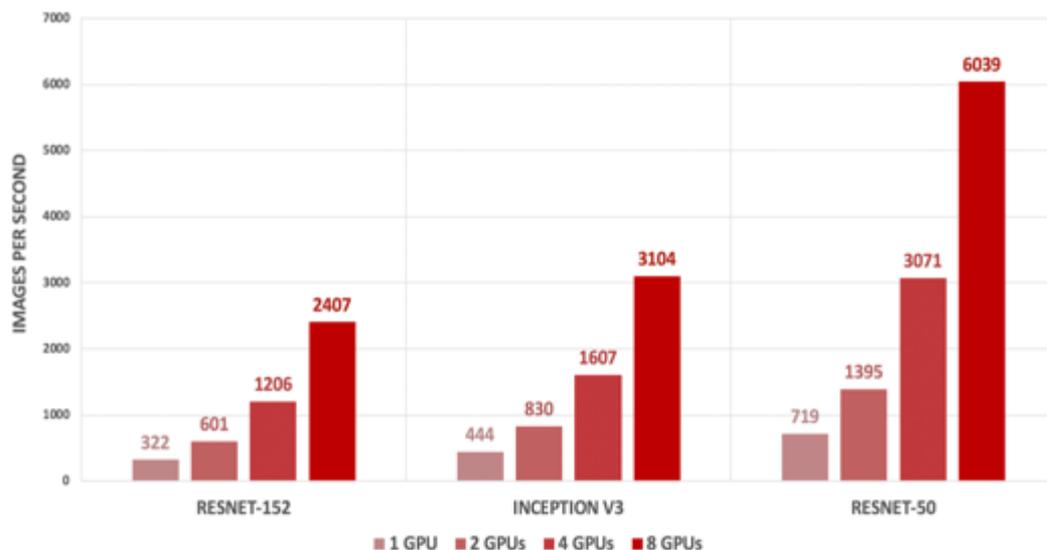
Typical Deep Learning Codes will perform IOs around 128K IOs – and see around 6GB/s with this pattern.



DDN A³I Solutions: Fully-optimized with widely-used DL frameworks

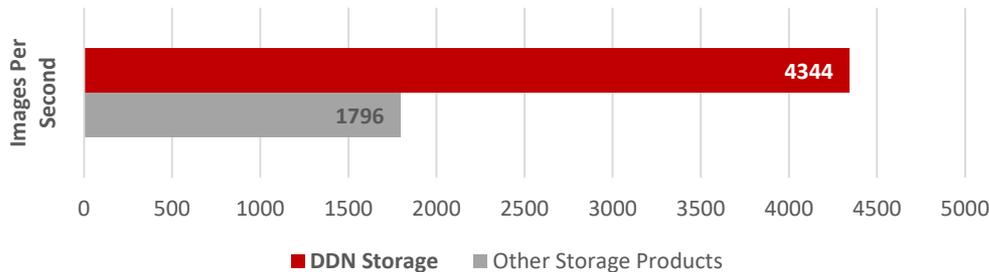
60% Faster - Consistent, Linear AI Performance

AI benchmarking of AI Frameworks with popular test sets demonstrates images per second rates 60% higher than competing systems

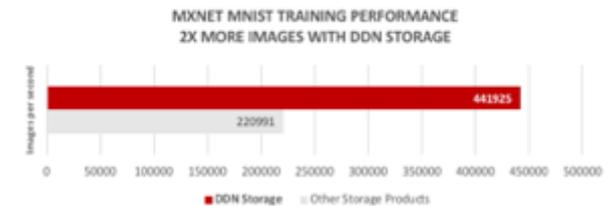
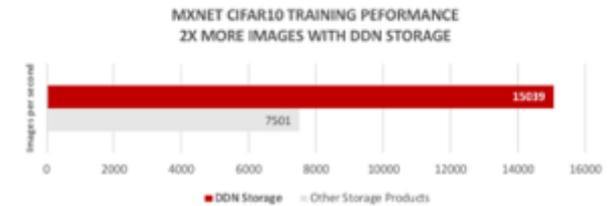
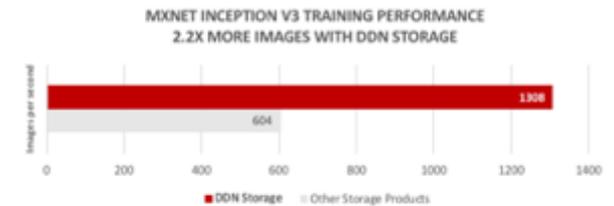
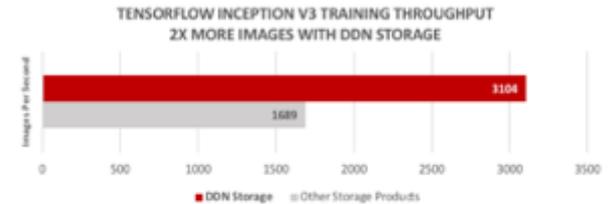
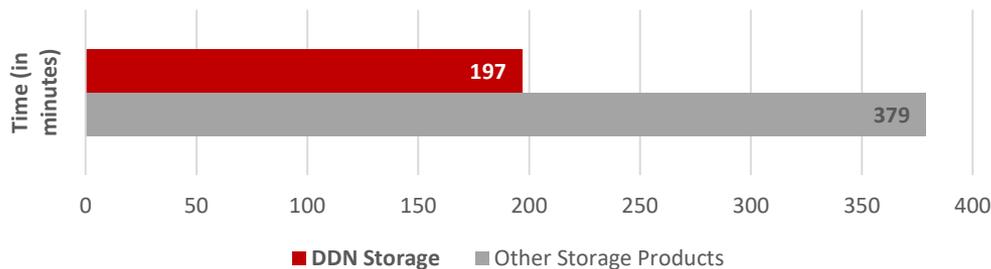


AI Benchmarking: **DDN enables and accelerates**

CAFFE GOOGLNET TRAINING THROUGHPUT
2.4X MORE IMAGES WITH DDN STORAGE



CAFFE GOOGLNET TRAINING TIME
2X FASTER WITH DDN STORAGE



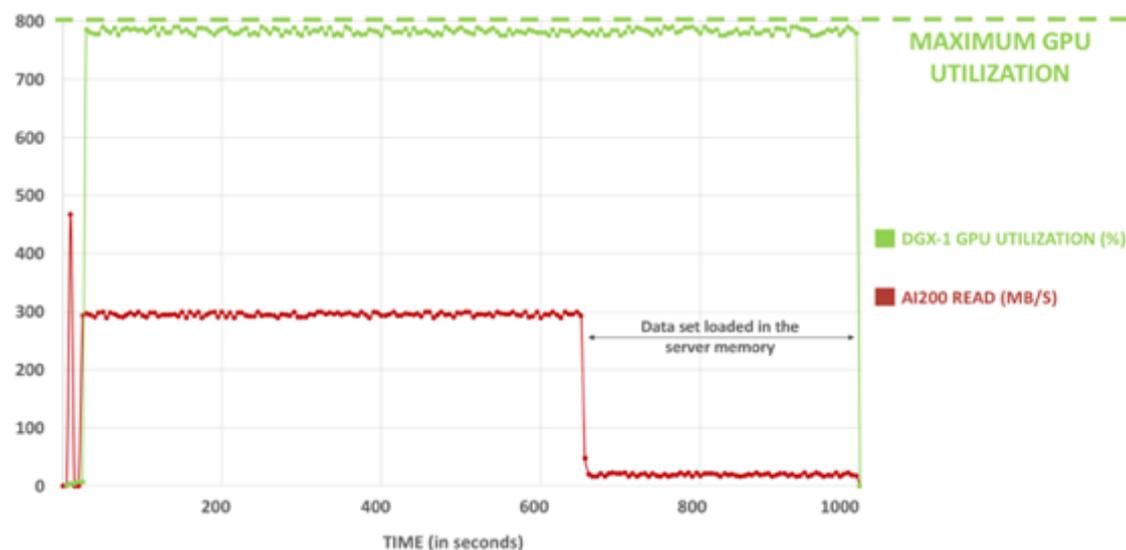
AI Benchmarking: IO during TensorFlow training

Full GPU Saturation, Maximum Productivity

DDN AI200 delivers a steady high-throughput, low-latency stream of data to the DL training application

Achieving full GPU saturation ensures every compute cycle is put to productive use

DDN true end-to-end parallelism enables acceleration at scale for distributed computing with multiple multi-GPU nodes



AI Benchmarking: **Optimized TensorFlow Data Sets**

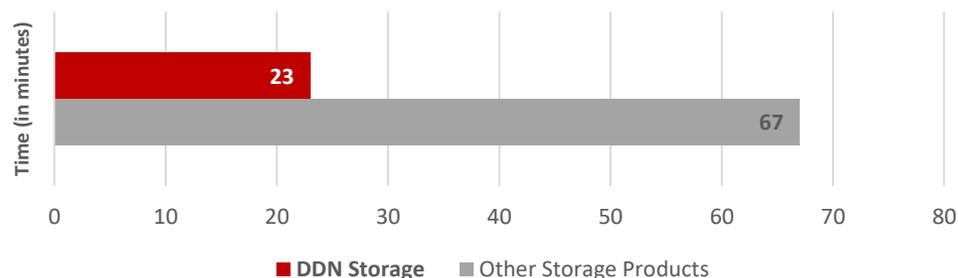
Optimized Data Sets, Accelerated Training

Convert discrete data and metadata asset collections into series of streamlined binary files for TensorFlow

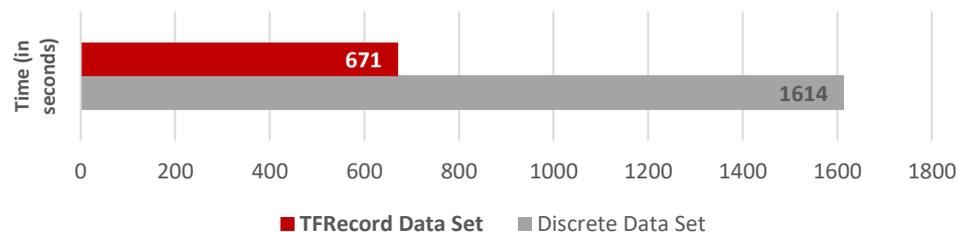
Maximize DL training and validation efficiency while minimizing data management and preparation overhead

Achieve more accurate results by eliminating manual data shuffle bias

TFRECORD CONVERSION BENCHMARK
3X FASTER WITH DDN STORAGE

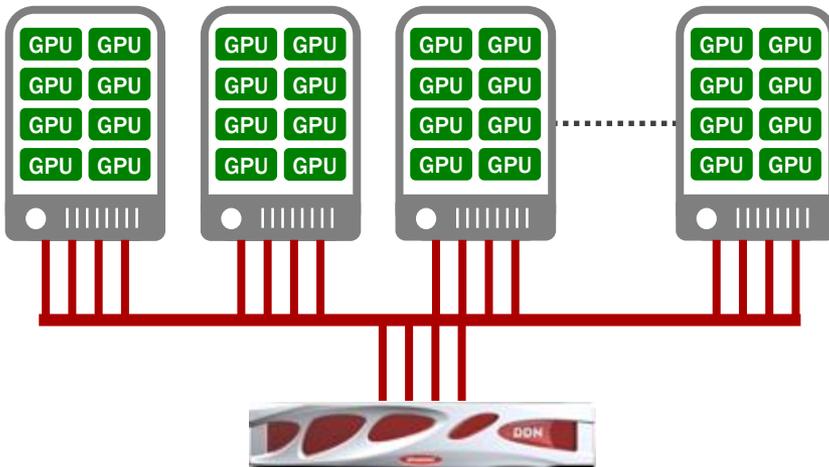


TENSORFLOW RESNET-50 TRAINING
PERFORMANCE
2.5X FASTER WITH TFRECORDS

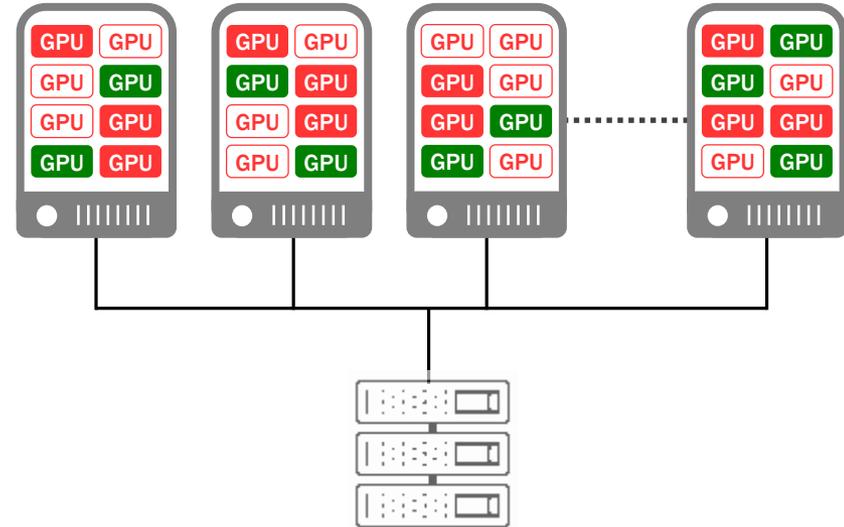


DDN PARALLEL ARCHITECTURE AND PROTOCOL vs NFS

FULL GPU SATURATION
MAXIMUM AI PRODUCTIVITY



GPU STARVATION
CRIPPLED AI PERFORMANCE



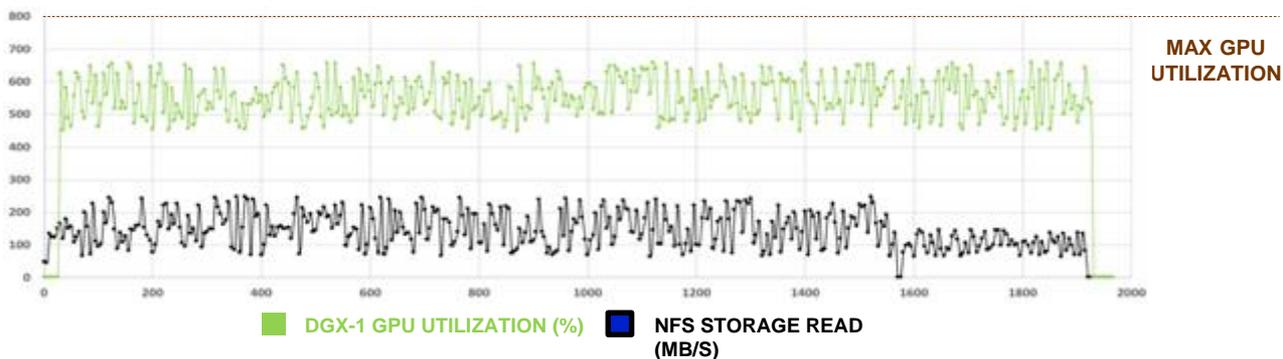
DDN PARALLEL ARCHITECTURE AND PROTOCOL vs NFS

DDN FULL GPU SATURATION



2X FASTER
Consistent DL performance
Achieves full GPU utilization
Efficient loading of data set

NFS GPU STARVATION

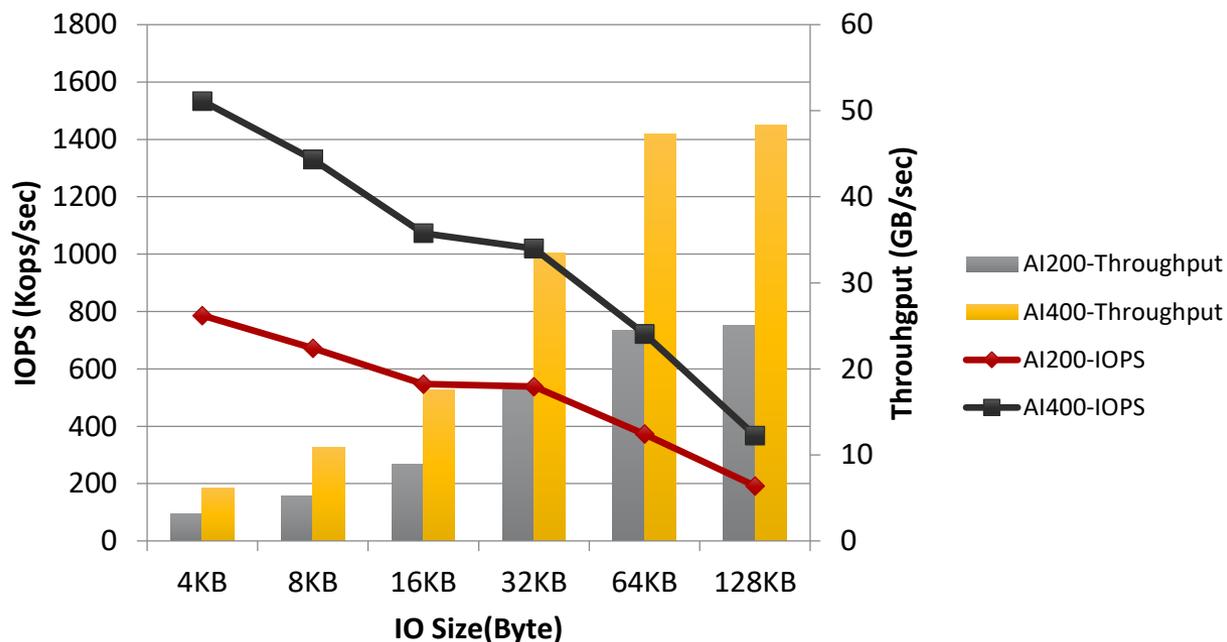


DDN A³I SOLUTIONS PERFORMANCE ENHANCEMENTS

AI200 and AI400 Optimizations for AI

Performance improvements for Random Read up delivers up to around 750K IOPs per RU for AI400 and over 22GB/s per RU

AI200 and AI400 (Random Read IOPS and Throughput)



Thank You!

Keep in touch with us



Team-JPSales@ddn.com



Tokyu Bancho Bldg. 8F
6-2 Yonbancho Chiyoda-ku,
Tokyo 102-0081



[@ddn_limitless](https://twitter.com/ddn_limitless)



+81-3-3261-9101
+81-3-3261-9140



[company/datadirect-networks](https://www.linkedin.com/company/datadirect-networks)