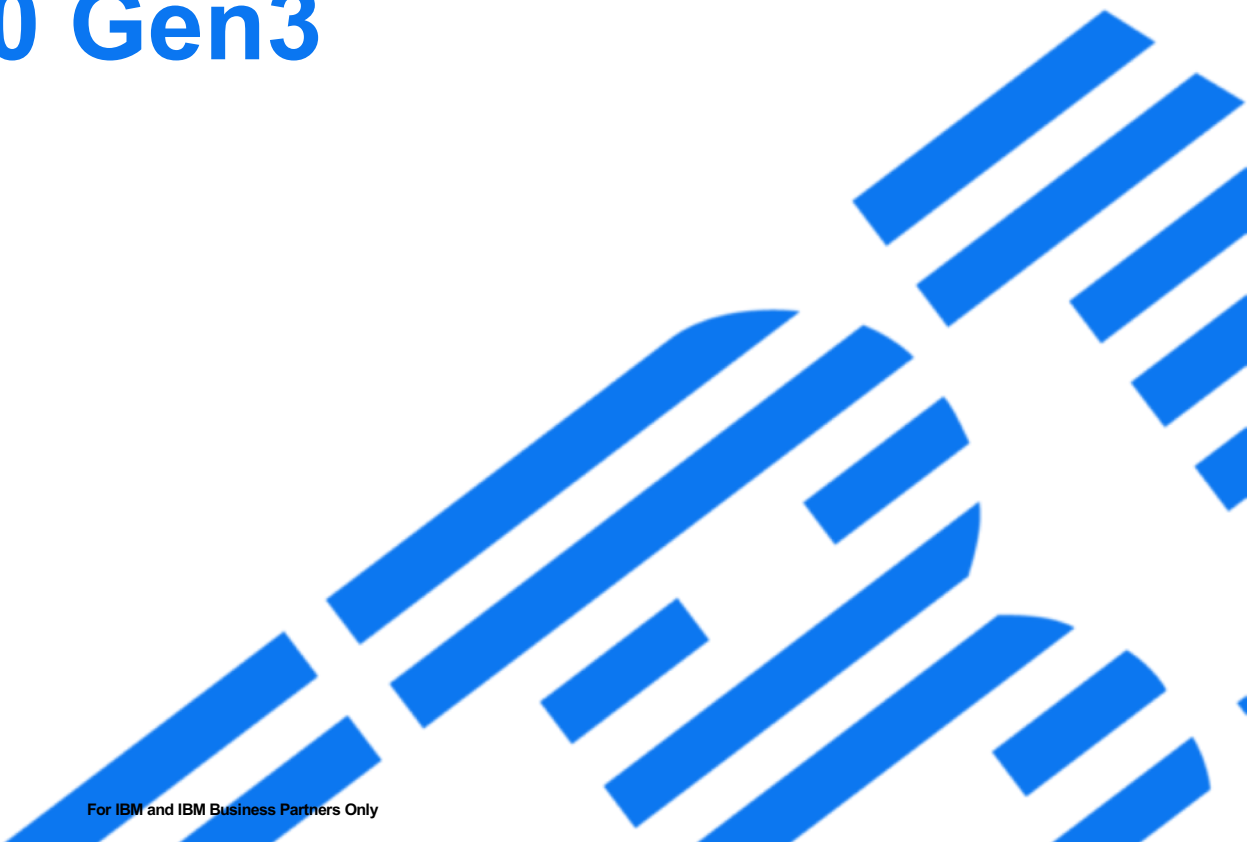**IBM Storage and SDI**

Storwize V7000 Gen3

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IBM Systems Flash/Hybrid Storage Offerings Portfolio

IBM Spectrum Virtualize — **IBM Spectrum Accelerate** — **IBM Spectrum Scale** — **IBM Power Systems**

New!	**New!**	**New!**	**Updated!**		**Updated!**	**New!**
Storwize V5030/F	**Storwize V7000 Gen3**	**FlashSystem 9100 Models 9110, 9150**	**FlashSystem A9000**	**FlashSystem A9000R**	**IBM Elastic Storage Server**	**DS888xF**
Entry / Midrange	Midrange Enterprise NVMe accelerated Hybrid Enabled	Enterprise Class, NVMe accelerated Multicloud Enabled	Cloud Service Providers	High End Enterprise	Big Data	Business Critical

Scale-out clustering
Simplified management
Flexible consumption model
Virtualized, enterprise-class, flash-optimized, modular storage
Enterprise class heterogeneous data services and selectable data reduction

Simplified management
Flexible consumption model
Large Grid scale
Full time data reduction

Consolidate file & object workloads
Faster data analysis
Global sharing

z/OS / AIX
Power HA
Power i HA

Business critical, deepest integration with z Systems
Superior performance and reliability
Three-site / Four-site replication
DS8882F, DS8884F, DS8886F, DS8888F

VersaStack™ Solution *by Cisco and IBM*

IBM FlashCore™ Technology Optimized

SVC
Enhanced data storage functions, economics and flexibility with sophisticated virtualization

NVMe FlashCore Module
Superior endurance & better performance
• FIPS 140-2
• Hardware Compression

FlashSystem 900
Application acceleration
• Extreme performance
• Hardware Compression
• Targeting database acceleration

IBM Spectrum Virtualize Flash/Hybrid Storage Offerings

IBM Storage and SDI

IBM Spectrum Virtualize

New! FlashCore at a low price

FlashCore at an Attractive price

All-Flash Array for customers with more cost optimized Flash requirements and smaller capacity needs.

Storwize V5030/F

Entry / Midrange

Hybrid array model
AFA model
Lowest AFA starting price
NEBS Compliant

Storwize V7000 Gen3

Midrange Enterprise

NVMe-oF Ready
Lowest end-to-end NVMe starting price
Hybrid configurations

FlashSystem 9100 9110 / 9150

Enterprise Class, NVMe accelerated Multicloud Enabled

Fairly low end-to-end NVMe starting price

Highest performance

Multicloud Enabled All-Flash offerings for customers who want highest performance, lowest latency, end-to-end NVMe capability, along with an Enterprise Class Support experience.

US Federal and other clients requiring FIPS 140-2

Scale-out clustering
Simplified management
Flexible consumption model
Virtualized, flash-optimized, modular storage
Enterprise heterogeneous data services and selectable data reduction

$ /IOP

Performance
IOPS & Throughput

The New IBM Storwize V7000 – Midrange NVMe Flash Array
NVMe-Accelerated, Hybrid Array Capable, Multicloud Ready

- IBM FCMs
- NVMe SSDs
- SAS SSDs
- SAS HDDs

Storwize V7000 Gen3
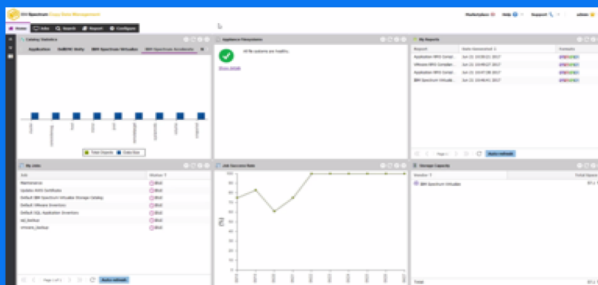
The New IBM Storwize V7000

- **100% end-to-end NVMe-Accelerated Midrange enterprise Flash Array**
  - Price, Performance and Scale - NVMe IBM FlashCore Modules and NVMe SSDs
  - Lowest starting price point for 100% NVMe solution
  - Agility, Availability and Security
  - Supports Physical, Virtual and Docker Environments
- **IBM Storage Insights**: AI-empowered predictive analytics, storage resource management, and support platform delivered over the cloud
- **IBM Spectrum Virtualize** for array management, migration, data efficiency, & much more. Additional capabilities through IBM Spectrum Software titles
  - IBM Spectrum Copy Data Management
  - IBM Spectrum Protect Plus
  - IBM Spectrum Virtualize for Public Cloud
  - IBM Spectrum Connect

The New IBM Storwize V7000 is Multicloud Ready

- Now SAP TDI certified Storage Solution for SAP Applications
- Ideal for mid-range blueprinted solutions for IBM Cloud Private

Transformation of performance and capacity density

Storwize V7000 Gen3

Designed for NVMe
- **FCMs**
- **NVMe SSDs**

Designed to support SAS
- **SAS SSDs**
- **SAS HDDs**

EasyTier™ & NVMe Make It Fast

Scale out for up to **4,800,000 IOPS, 78GB/sec** in 8U

Up to **8PB** of NVMe data storage in 8U
- Assumes 5:1 Data reduction
- 96 x 19.2TB NVMe FCM for 1.8PB Raw

Performance and density to Modernize and Transform business efficiency

600K IOPS, 9.75GB/s per rack unit

Up to 1PB data storage per rack unit

Up to 230TB raw per rack unit

IBM Storwize V7000 Gen3 Comparison

	Storwize V5030/F	Storwize V7000 Gen3	FlashSystem 9110
All-flash?	No (V5030F is all flash)	Yes, with option to add HDD	Yes
NVMe technology and IBM FlashCore Modules	No	Yes	Yes
NVMe-oF support	No	Yes	Yes
Perf: compressed data	Software	High-speed FCM compression	High-speed FCM compression
Max memory / control enclosure	64GB	1.1TB	1.5TB
Host adapter slots / control enc	2	4	6
Max capacity / control enclosure	368TB	461TB	461TB
Max capacity 4-way cluster	4PB	32PB	32PB
Cluster with Storwize V7000	No	Yes	Yes
Installation and support	Customer set-up ECS optional	Customer set-up ECS optional	IBM install, technical advisor and enterprise-class support
Upgrade to FlashSystem 9150	No	No	Yes (SoD)
Starter software included	No	No	Yes
Multicloud solutions	No	Ready	Yes

The Changes From V7000 G1 to G2 to V7000 G3

	Storwize V7000 Gen 1	Storwize V7000 Gen 2	Storwize V7000 Gen 3
User Interface	Web-based GUI	Web-based GUI	Web-based GUI
Comnnectivity Interfaces	8GB FC	16GB FC	16GB FC (FC-NVMe)
	1Gb iSCSI	25Gb iSCSI	25Gb iSCSI (NVMe-oF ready)
	10Gb iSCSI / FCoE	10Gb iSCSI / FCoE	10Gb iSCSI
	- -	- -	25GbE iWARP or RoCE
Cache	8GB or 16GB	64GB, 128GB or 256GB	128GB up to 1,152GB
CPU (Model, GHz, Cores)	Intel Xeon (Jasper Forest) 2.1GHz, 2 x 4 core	Intel Haswell 1.9GHz, 2 x 10 core	Intel Skylake 1.7GHz, 4 x 8 core
Max Number of Drives	240 per control enclosure; 960 w/ four way clustering	760 per control enclosure; 3,040 w/ four way clustering	760 per control enclosure; 3,040 w/ four way clustering
Drive Types	SAS SSDs, SAS HDDs	SAS SSDs, SAS HDDs	FCM NVMe, NVMe SSDs, SAS SSDs, SAS HDDs
Max IOPS	850K / 3.4M Clustered	1.2M / 4.8M Clustered	1.2M / 4.8M Clustered
Max Bandwidth	6GB/s	12GB/s / 48GB/s Clustered	19.6GB/s / 78GB/s Clustered
RAID Levels	Traditional RAID 0, 1, 5, 6, 10	DRAID 0, 1, 5, 6, 10	TRAID 10, DRAID 5, 6

IBM Storwize V7000 Gen3
The first Storwize system with NVMe

Storwize V7000
Dual 8-core processors per controller. Four 8-core total (HA)

Up to 1.1TB Cache per controller enclosure

Up to 2 host adapters per controller

Dual Active-Active Array Controllers w/NVMe to Flash Media
Dual-ported 2.5" NVMe Flash bays (24)

Flash Core Modules redesigned to 2.5" industry standard form factor
(Includes: HW Compression, HW Encryption and 64 Layer 3DTLC)

Interface Card Slot (2)   Tech Port   10GbE Ports (4)   USB Ports (2)   2KW PSU (2)

SAS Expansion ports (2)

8
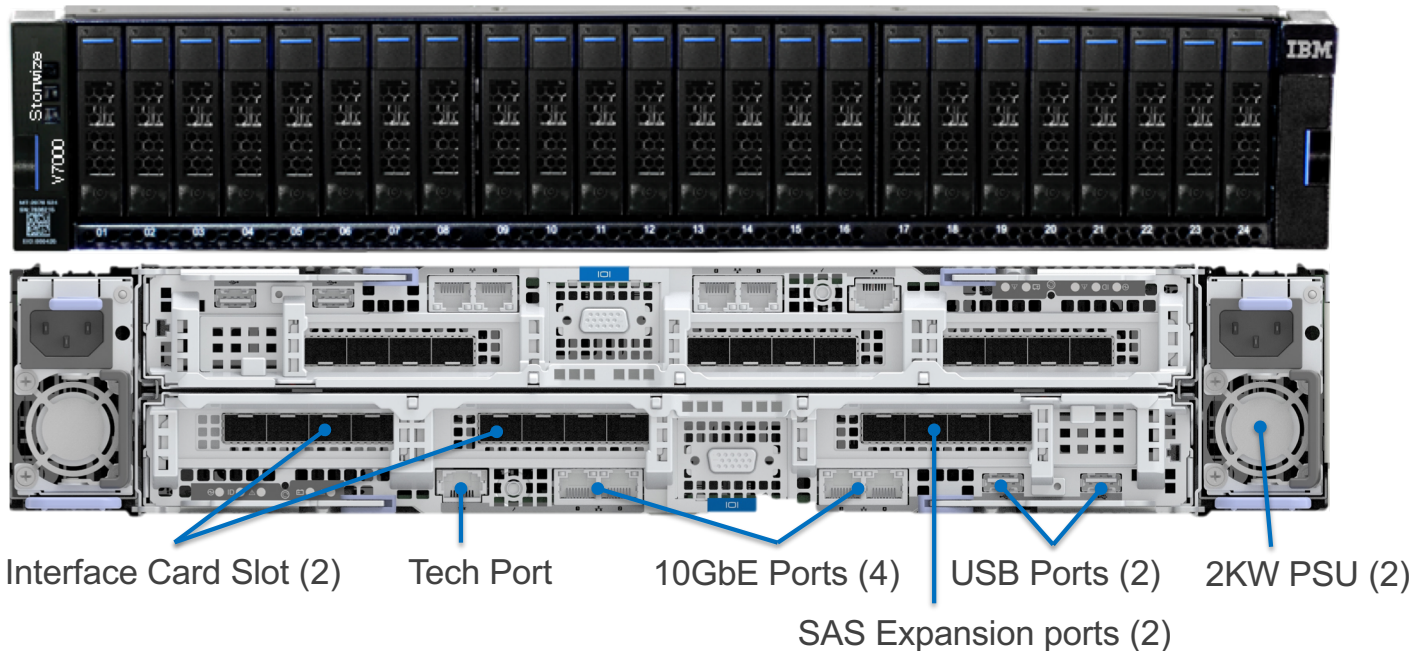
New Storwize V7000 Features/Capabilities

- Storage Virtualization
- Virtual Disk Mirroring
- HyperSwap
- Metro Mirror - synchronous remote replication
- Global Mirror - asynchronous remote replication
- Global Mirror over IP - remote replication over the Internet
- Importing and exporting existing LUNs via Image Mode
- Unmap
- Vvols
- Public Cloud offerings
- IBM Cloud Private
- Container support

- Thin Provisioning
- Fast-write cache
- Auto tiering (Easy Tier)
- Distributed RAID 5 & 6
- Transparent Cloud Tiering
- Cloud Snapshot
- Compression
- Deduplication
- FlashCopy (Snapshot)
- FlashCopy rollback
- Encryption of data at rest
- Data migration and pooling

Introducing FlashCore Module Design

- Optimized 3DTLC Flash Card design first designed for IBM FlashSystem and now being utilized in Storwize V7000 Gen3

- Highly parallelized design

- 3D TLC 8DP (3Tb) Design

- Added read ahead cache enabling improved read latency on highly compressed pages

- Four-plane programming to lower the overall power during write operations

- Flash Controller provides IBM patented Variable Stripe RAID (VSR). Now being used for the first time in a Storwize product when employing FCMs.

FlashCore: Hardware Accelerated I/O
NEW *Inline Hardware Compression*

FlashCore data compression/decompression algorithm is a Modified Dynamic GZIP algorithm

- Implemented completely in hardware, no processor intervention

- This technology originated with Z and has been adapted to work in an IBM FlashCore™ flash controller

- Improved economics with no performance impact

  - Compression is performed as the first step in the inbound data path, and decompression is the last step in the outbound data path. This minimizes the amount of data written to flash

  - Data protection (ECC) is implemented on top of compressed data

  - Compression and decompression are completely transparent above the FlashCore module except for management of space

Who has it?

IBM is the **only** vendor to deliver these purpose-built TLC flash modules with inline high-performance compression!

Unprecedented Storage Capacity In 2U Of Rack Space

NVMe-FCMs	Capacity per Drive with Inline Compression (max ratio varies 2:1 – max)	Max System Capacity in 2U with Inline Compression (max ratio varies 2:1 – max)	Capacity per Drive with Data Reduction Pools (2:1 – 5:1)	Max System Capacity in 2U with Data Reduction Pools (2:1 – 5:1)
FCM 4.8TB	9.6TB – 22TB	230.4TB – 528TB	9.6TB – 24TB	230.4TB – 576TB
FCM 9.6TB	19.2TB – 22TB	460.8TB – 528TB	19.2TB – 48TB	460.8TB – 1.1PB
FCM 19.2TB	38.4TB – 44TB	921.6TB – 1PB	38.4TB – 96TB	921.6TB – 2.3PB

NVMe SSDs	Capacity per Drive with Data Reduction Pools (2:1 – 5:1)	Max Capacity in just 2U with Data Reduction Pools (2:1 – 5:1)
NVMe 1.92TB	3.84TB – 9.6TB	92.6TB – 230.4TB
NVMe 3.84TB	7.68TB – 19.2TB	184.32TB – 460TB
NVMe 7.68TB	15.36TB – 38.4TB	368.64TB – 921.6TB
NVMe 15.36TB	30.72TB – 76.8TB	737.28TB – 1.8PB

Two Models Of Storwize V7000 Gen3

MTM[2]	2076-724	2076 – U7B
Mktg Name	Storwize V7000 Gen3	Storwize V7000 Gen3
CPUs per controller enclosure	Intel Skylake 4 x 8 core 1.7GHz	Intel Skylake 4 x 8 core 1.7GHz
Min System Cache	128 GB	128 GB
Max System Cache	1152 GB	1152 GB
Warranty	3 Year; 9x5 NBD	3 Year; 9x5 NBD
Install	Client Install/Maintain	Client Install/Maintain
Miscellaneous	Supports NVMe FCMs, NVMe SSDs, SAS SSDs and SAS HDDs	
Clustering	524 / 624 / AF6 / 724	U7A / U7B
Multicloud	Ready	Ready
Storage Utility Offering	No	Yes

Storwize V7000 Gen3 Cache Configurations

Canister	Control Enclosure	DDR4 DIMM Use/Canister
64GB	128GB	4 x 16GB
128GB	256GB	8 x 16GB
192GB	384GB	12 x 16GB
576GB	1152GB	12 x 16GB 12 x 32GB

Supported Adapter Cards

Number of Cards	Ports	Protocol	Possible Slots
0 – 2	4	16Gb Fibre Channel	1, 2
0 – 2	2	25Gb Ethernet (iWarp)	1, 2
0 – 2	2	25Gb Ethernet (ROCE)	1, 2

On Board Ethernet Ports

Port	Speed	Function
1	10 GbE	Management IP, Service IP, Host IO
2	10 GbE	Secondary Management IP, Host IO
3	10 GbE	Host IO
4	10 GbE	Host IO
Technician	1 GbE	Technician Port – DHCP/DNS for direct attach service management

Competitors NVMe & Virtualization Strategy

	Dell-EMC PowerMax	HPE Nimble AF	Pure FA //X	NettApp AFF A-Series	Storwize V7000 Gen3
Declared Latency	350µs	500+µs	250µs	250µs	~ 200-230µs
FlashCore Enhanced NVMe, or faster, drives					✓
Standard NVMe drives	✓	Unknown Timeframe	✓	✓	✓
NVMe-oF Support	2019	Timeline Unknown	SoD	✓ - FC	✓ - FC-NVMe NVMe-oF Ready
SCM Support	2019	Timeline Unknown	SoD	SoD	SCM capable
Predictive Maintenance Software		Infosight	Pure1	ActiveIQ	Storage Insights
Using AI Analytics	PowerMax OS				EasyTier
Ext Storage Virtualization				✓	✓
Solutions	Traditional Workloads/ Cloud	Traditional Workloads/ Cloud/ Multicloud	Traditional Workloads/ Cloud	Traditional Workloads/ Cloud/ Multicloud	Traditional Workloads/ Cloud/ Multicloud

- IBM is the performance leader
- IBM delivers greater flexibility, capacity, and choice to clients
- IBM delivers dual-ported NVMe drives like the rest of the industry
- As of July 2018, NetApp's FC-NVMe is single-path and lacks HA for enterprise. IBM will deliver full OS support with HA
- Storwize V7000 Gen3 is capable of handling SCM when it is available
- IBM provides Storage Insights for most storage across the entire portfolio
- Easy Tier delivers AI cognitive tiering requiring no intervention by the client
- IBM delivers the "gold standard" in storage virtualization with support for > 440 different storage systems
- IBM leads the competition by enabling clients to quickly obtain our multicloud environments, data protection, & optimize data reuse.

At A Glance Competitive Product Alignment

	Entry	Midrange	Enterprise	HCI
DellEMC	Compellent - SC	Unity GS Series	XtremIO VMax PowerMax	Ready Nodes
HPE	Store Virtual Series MSA Series	Nimble CS / AF Series StorServe 9450	StorServe 20000 Series	Simplivity
NetApp	EF/F Series FAS 2600 Series	FAS Series AFF Series	AFF NVMe A800	Solidfire Series
PURE	Low end //M series	High end //M Series Low end //X Series	High end //X Series	FlashBlade
HDS	VSP G350	VSP G370/G700/G900	VSP F AFA F350/F370/F700/F900 HDS VSP G1500/F1500	
IBM	Storwize V5010 Storwize V5020 Storwize V5030/F	Storwize V7000/F G2+ Storwize V7000 Gen3	FlashSystem 9100 FlashSystem A9000/ A9000R DS8000 for Block & Mainframe	VersaStack

THANK YOU

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