IBM FlashSystems & SAN Volume Controller FAQ

February 2022

IBM Storage

IBM

Content

It’s all powered by **IBM Spectrum Virtualize**

The common, intelligent software platform that delivers advanced data services across the IBM FlashSystem family and SVC.

The industry-leading capabilities of IBM Spectrum Virtualize include automated data movement, synchronous and asynchronous copy services (either on-premises or to the public cloud), isolated and immutable copies with Safeguarded Copy and encryption, high-availability configurations, storage tiering, and data reduction technologies, among many others.

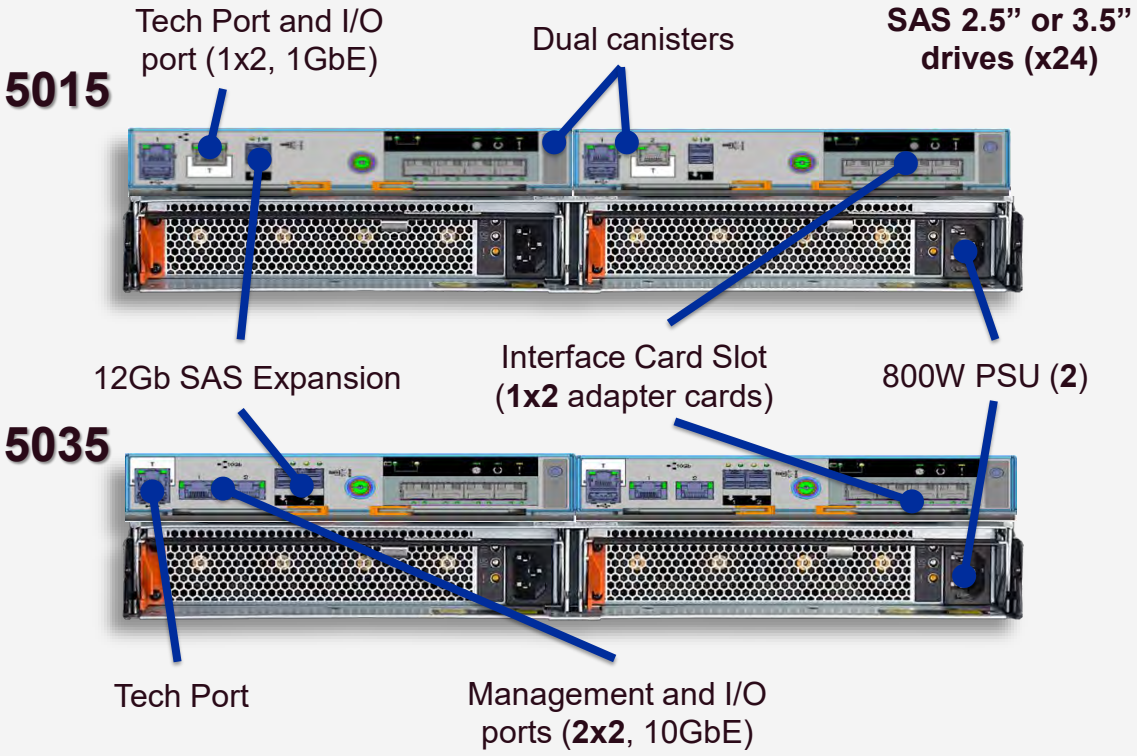
Product Summary

	FlashSystem 5015*	FlashSystem 5035*	FlashSystem 5200*	FlashSystem 7300*	FlashSystem 9500/R	SAN Volume Controller	
Machine Type	**2072**	**2072**	**4662**	**4657**	**4666**	**2145**	**2147**
Models	2N2 (12 drives) 2N4 (24 drives)	3N2 (12 drives) 3N4 (24 drives)	6H2 UH6**	924 U7D**	AH8 UH8**	SA2 (Low) SV3 (High)	
Technology	SAS	SAS	NVMe	NVMe	NVMe	NVMe	
Warranty	3 years 9x5 Next Business Day		1 year		1 year hardware 90 days software	*Separately licensed software*	
			Upgrade with IBM Storage Expert Care			1yr hardware 24x7	3yr hardware 24x7 ECS
License ***	Advanced features optional	Advanced features optional	All-inclusive	All-inclusive	All-inclusive	Capacity based	
Install	Customer	Customer	Customer, IBM install optional		IBM	IBM	
Service	Optional services	Optional services	**IBM Storage Expert Care**			Optional Services	ECS
SAS Expansions	12G 24G 92G	12G 24G 92G	12G 24G 92G	12G 24G 92G	AFF (24 drive) A9F (92 drive)	n/a	

* Offered as both AFA and Hybrid variants
** UH6, U7D and UH8 are Storage Utility models with cloud-like pricing
*** Excludes encryption and capacity based external virtualization, see product Sales Manuals for full license details

IBM FlashSystem 5015 and 5035

All-flash and hybrid flash arrays for entry enterprise



800GB, 1.92, 3.84, 7.68, 15.36, 30.72TB 12Gb SAS SSD,

1.2, 1.8, 2.4TB 10k HDD & **6, 8, 10, 12, 14, 16, 18TB** 7.2k HDD drives

32 or **64GB** cache

1GBe (5015) or **10GbE** (5035) iSCSI ports

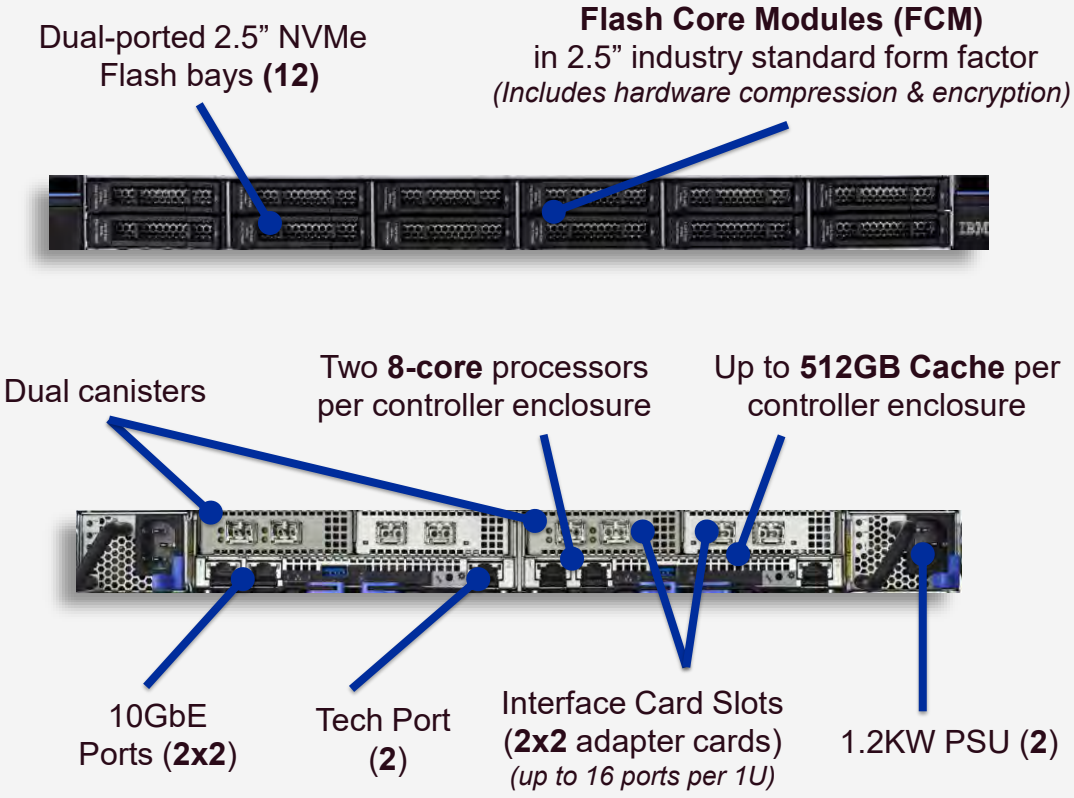
16Gb 4 port Fibre Channel (with NVMeoF), **10GbE** 4 port, **10/25GbE** iSCSI adapter cards

Up to **2-way** clustering (5035 only)

573TB in 2U before data reduction
32PB with SAS expansions or virtualization

IBM FlashSystem 5200

All-flash and hybrid flash arrays for entry enterprise



4.8, 9.6, 19.2, 38.4TB FlashCore Modules

375, 750, 800, 1600GB Storage Class Memory drives

800GB, 1.92, 3.84, 7.68, 15.36, 30.72TB Industry-Standard NVMe drives

800GB, 1.92, 3.84, 7.68, 15.36, 30.72TB 12Gb SAS SSD & **1.2, 1.8, 2.4TB** 10k HDD & **6, 8, 10, 12, 14, 16, 18TB** 7.2k HDD drives in expansion enclosure(s)

64 to **512GB** cache

10GbE iSCSI ports

4 port **16Gb,** 2 port **32Gb** Fibre Channel (with NVMeoF), **10GbE** iSCSI**, 10/25GbE** iSER (RoCE & iWARP) adapter cards

Up to **4-way** clustering

1TBe in 1U with FCM data reduction
32PB with SAS expansions or virtualization

IBM FlashSystem 7300

All-flash and hybrid flash arrays for midrange enterprise

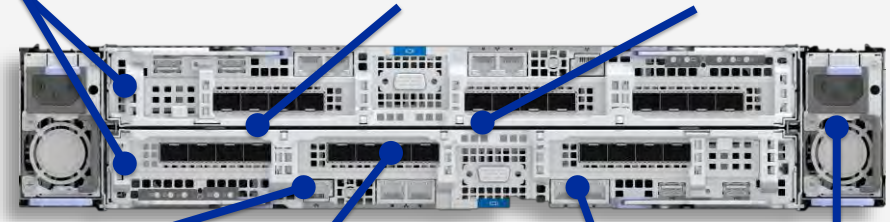
Dual-ported 2.5” NVMe Flash bays **(24)**

Flash Core Modules (FCM) in 2.5” industry standard form factor *(Includes hardware compression & encryption)*

Dual canisters

Four **10-core** processors per controller enclosure

Up to **1.5TB Cache** per controller enclosure



Tech Port (**2**)

Interface Card Slot (**3x2** adapter cards) *(up to 24 ports per 2U)*

10GbE Ports (**4x2**)

2KW PSU (**2**)

4.8, 9.6, 19.2, 38.4TB FlashCore Modules

1600GB Storage Class Memory drive

1.92, 3.84, 7.68, 15.36, 30.72TB Industry-Standard NVMe drives

800GB, 1.92, 3.84, 7.68, 15.36, 30.72TB 12Gb SAS SSD & **1.2, 1.8, 2.4TB** 10k HDD & **6, 8, 10, 12, 14, 16, 18TB** 7.2k HDD drives in expansion enclosure(s)

256GB, 768GB or **1.5TB** cache

10GbE iSCSI ports

32Gb 4 port Fibre Channel (with NVMeoF), **10/25GbE & 100GbE** iSCSI and NVMe adapter cards

Up to **4-way** clustering

2.3PBe in 2U with FCM data reduction
32PB with SAS expansions or virtualization

IBM FlashSystem 9500

All-flash array for high-end enterprise

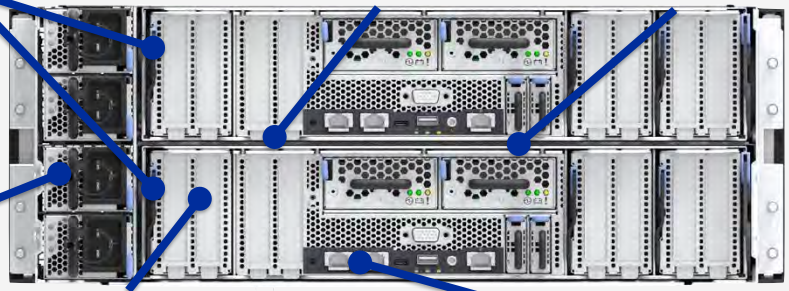
Dual-ported 2.5” NVMe Flash bays **(48)**

Flash Core Modules (FCM) in 2.5” industry standard form factor *(Includes hardware compression & encryption)*

Dual canisters

Four **24-core** processors per controller enclosure

Up to **3.5TB Cache** per controller enclosure



2KW PSU (**4**)

Interface Card Slot (**6x2** adapter cards) *(up to 24 ports per 2U)*

Tech Port (**4**)

4.8, 9.6, 19.2, 38.4TB FlashCore Modules

1600GB Storage Class Memory drives

1.92, 3.84, 7.68, 15.36, 30.72TB Industry-Standard NVMe drives

1.92, 3.84, 7.68, 15.36, 30.72TB 12Gb SAS SSD drives in expansion enclosure(s)

1TB, 2TB or **3TB** cache

32Gb 4 port Fibre Channel (with NVMeoF), **10/25GbE** and **100GbE** iSCSI and NVMe RDMA adapter cards

Up to **2-way** clustering

2.3PBe in 4U with FCM data reduction
(4.5PBe in future, Statement of Direction)
32PB with SAS expansions or virtualization

IBM FlashSystem 9500R

All-flash array for high-end enterprise

The FlashSystem 9500R is a bundle of products that will be assembled, delivered and configured for the customer

2 4666-AH8 **FlashSystem 9500s**, clustered together with a single point of control and packaged in a 7965-S42 rack and sold as a 9502R,

- *Twice the performance, capacity and connectivity of a single FlashSystem 9500*

Dedicated fibre channel backbone

- Isolated from host traffic
- Broadcom 8960-F24 switches

Can be expanded with expansion enclosures following installation

SAS Expansions

2U 3.5” x 12 SAS enclosure

HDD, not FlashSystem 9500

2U 2.5” x 24 SAS enclosure

SSD & HDD

5U 2.5” & 3.5” x 92 SAS enclosure

SSD & HDD

IBM SAN Volume Controller (SVC)

Storage Virtualization Appliance

Single node, 2U design
to be operated in node pairs

Up to **1.5TB** Cache per node
(**3TB** per pair)

SA2: Two **8-core**
processors per node

SV3: Two **24-core**
processors per node

2KW
PSU (2)

Interface Card Slots
(SV3 - **6** adapter cards)

Tech Port
(**2**)

SA2 provides solid performance at a lower price than SV3. Ideal for Enhanced High Availability configurations and small to medium virtualized environments

SV3 *(shown on the left)* represents the high end SVC for larger virtualized environments, and those seeking the highest performance possible. It comes with a greater potential port count over previous SVC nodes.

512, 1TB or **1.5TB** cache per node (up to **3TB** per node pair)

32Gb 4 port Fibre Channel (with NVMeoF), **10/25GbE** and **100GbE iSCSI and NVMe RDMA** adapter cards

Up to **4-way** clustering

Hardware FAQ

Which product do I want?
If you need native storage, see IBM FlashSystem Family.FAQ. If you don't need storage, then use the StorM tool to determine which SVC model meets your requirements

Why do you offer both hybrid and AFA variants of some products?
To ensure we can meet a range of different customer requirements.

What's the point of clustering?
To linearly scale performance, capacity (for FlashSystem products) and connectivity whilst maintaining a single point of control. Additionally it can be used to build high availability configurations using HyperSwap.

Why add expansion enclosures?
You'll be able to get more capacity at a lower price point than clustering. You won't scale the performance capability of the box with the capacity, but this maybe fine for some workloads which are generally not pushing the product to the maximum.

How do I get expansion enclosures?
They're offered under different model numbers for each product. See the Product Details page for more details on which models are available.

Does SAN Volume Controller support SAS or NVMe attached storage?
No, SVC SA2 and SV3 no longer supports drives in the nodes, or drives in an external SAS enclosure. SVC only supports externally virtualized storage.

Is the FlashSystem hardware fully redundant?
Yes, the canisters are active-active with both of them able to access all of the NVMe and SAS attached storage down redundant paths. If one canister fails, NPIV will move the port names to the working canister which will continue until the failing canister is fixed or replaced. Remaining power supply(s) can provide power for the entire system in the event of a power domain failure.

Is the SAN Volume Controller hardware fully redundant?
Yes, like with FlashSystem hardware, SVC runs as a pair of active-active nodes with redundant paths to the storage. It also supports dual power supplies.

What if power fails?
Batteries allow some tolerance of brown outs and supports a controlled shutdown to preserve the integrity of the data if required.

Can you mix and match host adapter cards?
Yes, but there are different rules for the products. Generally, you can mix and match different HBA types providing they're mirrored across canisters or node pairs. With FlashSystem products, if you're using expansion enclosures, then you'll need a SAS card in each canister, taking up one host adapter slot.

Can I upgrade cache and host adapter cards?
Yes, you can order additional components to upgrade your hardware.

End-to-end NVMe

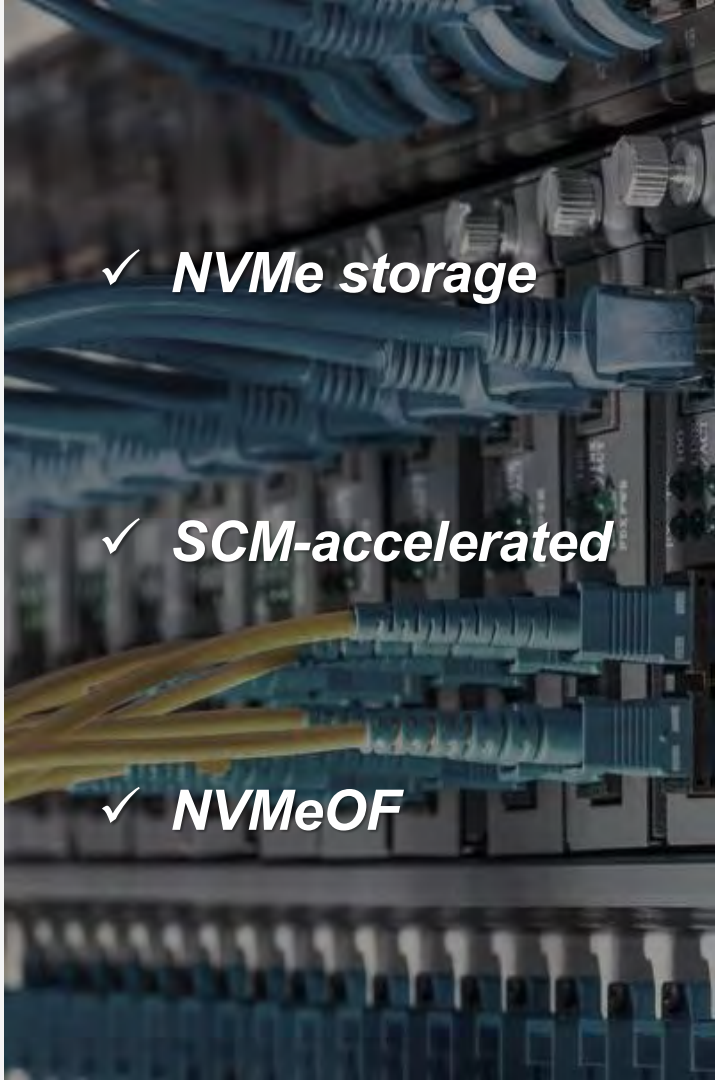
What is NVMe?
NVMe (Non-Volatile Memory Express) is a protocol designed for high-speed storage media. It's designed to remove some of the bottlenecks present in existing protocols as well as increase the number of data queues to increase the ability to process data in parallel.

What is NVMe storage?
NVMe storage is engineered to work over PCIe lanes, directly connecting the storage devices to the CPUs. This allows lower latencies and increased transfer rates. NVMe storage is supported in the FlashSystem 9500, 7300 and 5200.

What is SCM-accelerated?
Storage Class Memory (SCM) is a substantial step forward in memory technology, offering non-volatile, ultra low latency memory for a fraction of the cost of traditional memory chips. IBM FlashSystem products support SCM drives over NVMe to improve overall storage performance, or offer a higher performance storage pool.

What is NVMeOF?
NVMeOF is NVMe Over Fabric. This extends the advantages of the NVMe protocol to the host layer allowing lower latencies, increased transfer rates and reduced server IO workload demand.
NVMe RDMA is supported on Ethernet cards, with some limited support of NVMe FC on the Fibre Channel cards. Host drivers and workloads will also need to be ready for NVMeoF to take advantage of this function.

Do I have to use NVMeOF to take advantage of the NVMe storage?
No, you can still use the other host interfaces (Fibre Channel and iSCSI) to take advantage of the NMVe storage.



IBM NVMe FlashCore Modules

IBM FlashCore Modules (FCMs) are 2.5” form factor NVMe drives with *built-in hardware compression and encryption*

As data is written the drive, it’s compressed and encrypted *at line speed*

The drive attempts to compress data so that it uses less physical space. The potential capacity, *if supported by the workload compressibility*, is known as **effective capacity**

However, **FCMs** have a maximum **effective capacity**, beyond which they cannot be filled, even if the data can be compressed further. *This is shown on the right, by drive capacity*

FCMs deliver maximum performance with compression

Physical TB	Effective TB
4.8	21.99
9.6	28.8
19.2	57.6
38.4	115.2

How is my data stored?

Each individual FCM has :

Outstanding data reliability

Bit errors caused by electrical interference are continually scanned for and if any are found will be corrected by an enhanced ECC (Error Correcting Code) algorithm

If an error cannot be corrected, then the FlashSystem DRAID layer will be used to rebuild the data

Increased endurance, reduced maintenance

Data is stripped across more granular, sub-chip levels. This allows for failing areas of a chip to be identified and isolated without failing the entire chip

Asymmetric wear levelling understands the health of blocks within the chips and tries to place “hot” data within the most healthy blocks to prevent the weaker blocks from wearing out prematurely

FlashSystem Products have :

Distributed RAID 1 and 6 (DRAID)

Multiple FCMs (or other drive types) are used in a DRAID configuration. The data, parity and spare space is striped across all available devices, eliminating hot spots and reducing array rebuild times

With FCM drives, a tight coupling allows data to be rebuilt in the event of an unrecoverable error

DRAID5 is also supported on the FlashSystem 5000 products, trading off redundancy for capacity.

Volume Mirroring

Also available with SVC, you can optionally mirror a volume to create further redundancy

Combining *any drive type* with DRAID and mirroring will increase data resiliency

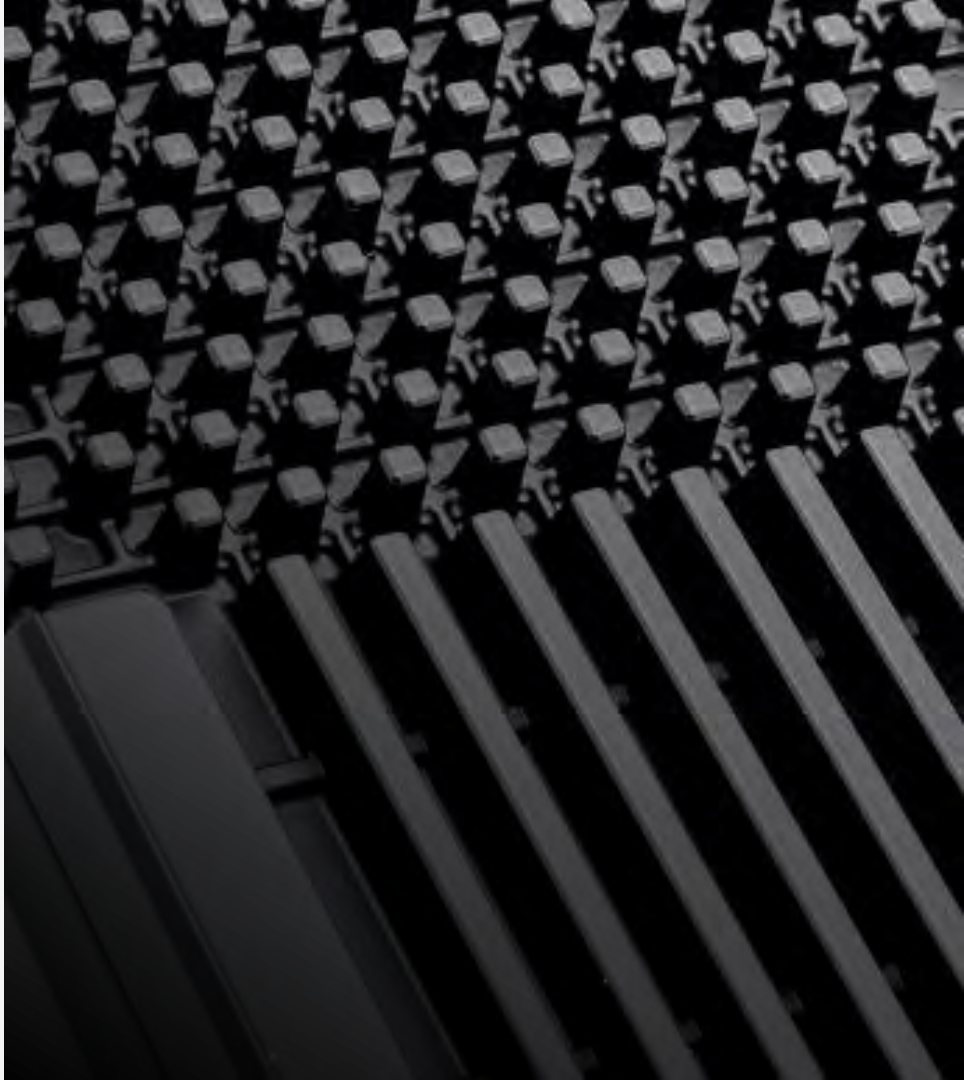
Storage Class Memory

Storage Class Memory (SCM) is a memory technology positioned somewhere between DRAM and other flash storage. It offers non-volatile, ultra low latency memory for a fraction of the cost of traditional memory chips

This technology is used in IBM FlashSystem products in the form of NVMe SCM drives

Up to 12 drives are supported per controller enclosure in a DRAID configuration

This means SCMs can be used for small workloads that need exceptional levels of performance at the lowest latencies, or they can be combined with other NVMe drives using Easy Tier to accelerate much larger workloads



NVMe Storage FAQ

Can I mix different NVMe drives in a controller enclosure?
Yes, you can mix SCM, FCM and industry-standard NVMe drives, but all drives in a RAID array must be the same type and capacity.

Why buy an FCM rather than an industry-standard NVMe drive?
Because you get inline hardware compression with no performance impact! The smaller industry-standard drives allow you to create smaller capacity systems.

With FCM drives, what exactly is the effective capacity?
The effective capacity is the maximum amount of data that can be written to the drive, regardless of how much that data can be compressed. Even to achieve any additional capacity beyond the physical capacity, you still need to write data that can be compressed. The less the data can be compressed, the less of a saving you'll see.

What happens if I write an uncompressible workload to an FCM?
It'll write the data and neither compress it further, or expand it. This will happen at line speed and not impact performance.

Should I run the system close to full?
If you're using data reduction, then regardless of the technology you choose, it's good practise to keep the system below ~85% to allow it to respond to sudden changes in the rate of data reduction (such as host encryption being enabled). Also as you run the system close to full, the garbage collection function will be working increasingly hard at the same time as new writes are being processed. This may start to slow the system down and increase latency to the host.

How can I tell how full my system is?
The GUI will tell you the amount of physical capacity remaining, as well as the amount of data written. You should be aware of both the data reduction ratios you're getting as well as the physical capacity in order to plan capacity upgrades.

Which SCM drives should I use?
Choose the capacity that suits your use case or workload. Where you're using Easy Tier, you should think about maximising the capacity to get most benefit (unless your working set is very small)

Should I use SCM with Easy Tier or as a separate pool?
SCM with Easy Tier has been measured to improve latency and in some cases, improve IOPS. If you want to get benefit of SCM across all of your capacity, then Easy Tier will continually automatically move the hottest data onto the SCM tier and leave the rest of the data on the lower tiers. This can also benefit Data Reduction Pools where the metadata is moved to the SCM drives.

If you have a particular workload that requires the best performance and lowest latency, and it fits in the limited SCM capacity available then use SCM as a separate pool and pick which workloads use that pool.

What effect does the cache have on SCM performance?
SCM drives when used in an Easy Tier relationship work a little like a secondary cache. If your working set fits in cache, then the effect of Easy Tier will be reduced. If you have a large working set that exceeds the cache size then the advantages of the acceleration will be much greater as more of that data will be either in cache or a high performance, low latency SCM tier.

How should I configure my drives?
The GUI will suggest the correct geometry for your drives.

Can I add more drives later?
Yes, you can create a new pool, or you can add more drives to an existing pool using DRAID expansion.

Data Reduction Pools

What are Data Reduction Pools (DRP)?
DRP is an alternative data reduction technology to the hardware compression built into FlashCore Modules. It offers deduplication (storing fewer copies of duplicated data) as well as compression to achieve greater data savings.

What data reduction savings can I achieve with DRP?
Unlike FlashCore modules there's no maximum effective TB limit. Higher levels of compression can be achieved if the workload supports it. Additionally, if there is a lot of duplicate data across the volumes in a data reduction pool, then this will further increase the data reduction ratio.

Which should I use, FCM or DRP?
FCM offers compression with the highest performance and can be used for the most demanding workloads. DRP trades some of the maximum performance potential for a higher data reduction ratio. If you have a mixture of performance and capacity requirements, FCM and DRP can be combined in the same pool and used on a volume by volume basis.

Where can I use DRP?
On all Spectrum Virtualize products except the FlashSystem 5015. It will take advantage of compression hardware assistance where available (SVC, FlashSystem 5200, 7300, 9500)

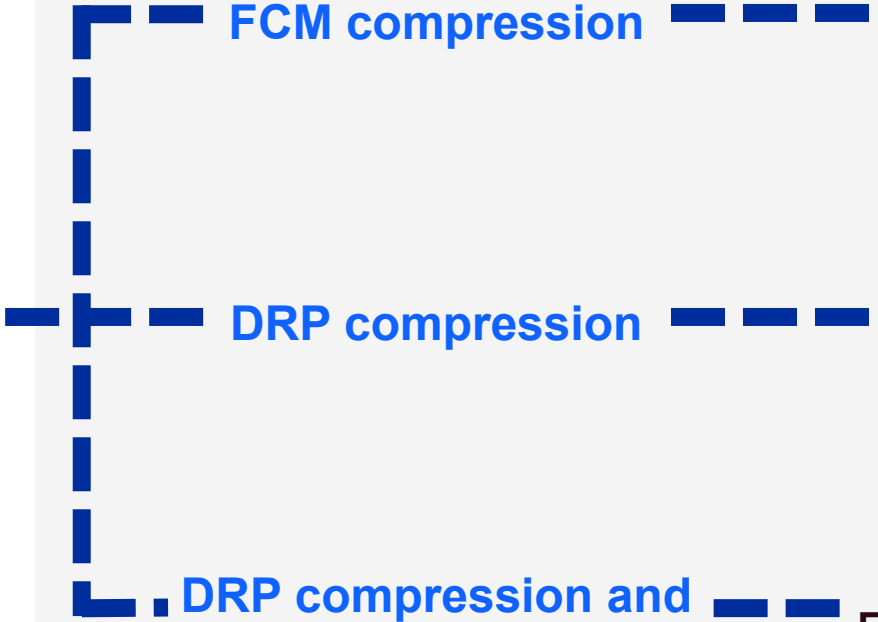
How can I make the most of DRP?
DRP uses a log structured array to keep track of the data, generating both data and metadata IO. By maximizing the cache and considering the use of SCM drives in an Easy Tier configuration, you'll get the best performance by reducing the latency when accessing the metadata.

Are there any DRP best practices?
Yes, see the FlashSystem Best Practices Redbook

DRP maximises data reduction to make the most of available capacity

Data Reduction Tooling

Choose your **Data Reduction** approach and use the tooling to estimate the amount of **effective** storage required



Use the host based
Comprestimator
Use "FCM" option
Or "Estimate Compression Saving" option in the GUI but consider the maximum effective compression with FCMs
(IBM | BP)

Use the host based
Comprestimator
Use "DRP" option
Or "Estimate Compression Saving" option in the GUI if your workload is already on a Spectrum Virtualize product
(IBM | BP)

Use the host based
Data Reduction Estimation Tool (DRET)
This will show you the savings for thin provisioning, compression and deduplication
(IBM | BP)

Data Reduction FAQ

Can I turn off FCM compression?
No, FCM data compression is hardware-based and always on. It is designed to not impact performance even with data that is not compressible.

Are there any disadvantages to using Data Reduction volumes with compressing FCMs?
No! The data will be compressed within the Data Reduction Pool and then written to the FCM which will either compress the data further, or write the data as-is. In either case, because the FCM compression is done in hardware there will be no performance impact.

Can I use just deduplication with FCM compression?
The GUI will force the selection of compression with deduplication. Further compression with FCM will yield minimal additional savings but will not impact performance.

How does deduplication work?
As blocks of data are written they are compared to data that has been written previously (using an in-memory dictionary) and any matches are turned into references to the existing data. Common patterns are also detected and replaced with a simple reference.

How do I understand how much data has been written?
The GUI shows the amount of data written by the hosts, the amount of physical space used and an overview of where any data reduction is occurring.

Will I receive warnings before running out of space?
Warnings will be generated by the system as the physical space is getting close to being used up. If an out-of-space condition does occur, the system will allow you to recover the volumes by allowing data to be deleted or migrated to free space.

Can I really use Fully Allocated volumes and Data Reduction volumes in the same Data Reduction Pool without limiting the performance?
Yes, the high-performance workloads on the Fully Allocated volumes will not be affected by the workloads on the Data Reduction volumes.

Should I ever use a traditional storage pool (rather than a DRP)?
If you're really-really focused on performance, and want to ensure that any copy services are using just thin provisioning then this is a slightly better performing solution than DRP. However, it lacks the functionality and flexibility of DRP.

What if I just want to use thin provisioning?
Traditional storage pools still offer the ability to use thin provisioning. If the pool is backed by FCM, then you'll still get FCM compression (see first question)

High Availability (HA) & Disaster Recovery (DR)

What is HyperSwap?
HyperSwap is an HA solution where a pair of SVC nodes, or a FlashSystem controller are located at different sites and run as a cluster. Each volume is accessable from both sites, with IO being mirrored across synchronously.

If the physical storage at site A fails, the controller at site A can forward requests to site B, with no interruption to the host. If site A fails completely, then the host can fail over to site B. When site A recovers, HyperSwap will take a consistent copy and resynchronize across the two sites so that full HA is restored. With host clustering, this gives full HA capability.

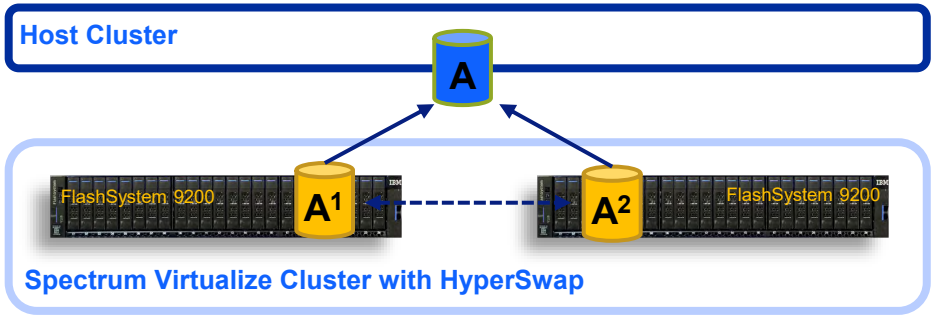
What is enhanced stretch cluster?
Similar to HyperSwap is enhanced stretch cluster, where a pair of SVC nodes are split across sites. Following a failed site being restored data is resynchronized.

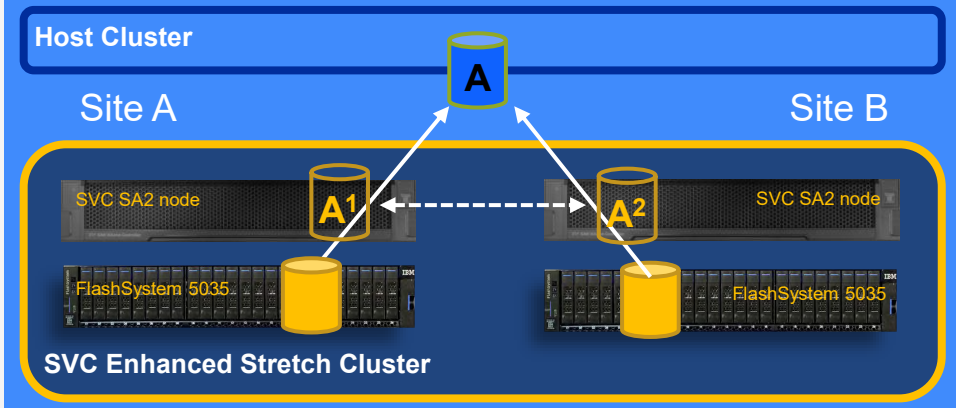
This has the potential to be a lower cost solution over HyperSwap.

How do you do Disaster Recovery (and 3-site)?
IBM Spectrum Virtualize can do both synchronous and asynchronous copy of a volume between different FlashSystem controllers, or SVC clusters. This gives the user the ability to maintain two (or three copies) of a volume across different sites and tune the RPO to meet their cost and business goals.

Alternatively, Enhanced Stretch Cluster can be used with a third site, giving the choice of sync or async to the third site.

Where can I get more information?
There are pretty big topics and much more information on these and other Copy Services topics can be found in the FlashSystem and Spectrum Virtualize Redbooks





Safeguarded Copy

What is Safeguarded Copy?
Safeguarded Copy prevents point in time copies of data from being modified or deleted due to user errors, malicious destruction or ransomware attacks

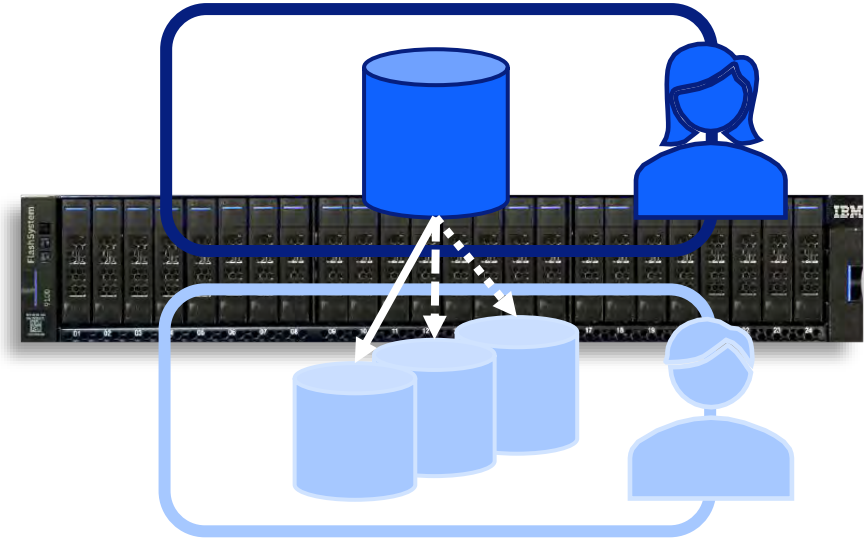
How does it work?
An **administrator role** can create immutable point in time copies of data. The administrator cannot remove or delete these Safeguarded copies, and they cannot remove or compromise the pools the copies are stored in.

A separate **security administrator role** can manage security and users, as well as the Safeguarded copies and location of the copies.

How is data restored from the copies in the event of an attack?
The Safeguarded copies are not directly mountable to a host. In order to restore from a copy, a copy is made to a new volume which can then be mapped to a host for access. It's good practice to test these copies occasionally to establish known good points-in-time.

Is FlashCopy required for Safeguarded Copy?
Yes, Safeguarded Copy makes use of FlashCopy technology.

Does Safeguarded Copy require other software?
Yes, Safeguarded Copy requires IBM Copy Services Manager software for the copy scheduling and recovery capabilities. If you're already using Copy Service Manager, then you can use it with Safeguarded Copy. Alternatively, an IBM Copy Manager for IBM Spectrum Virtualize software bundle is available.



Encryption

Is encryption supported?
Yes! NVMe and SAS drives in FlashSystem products support hardware encryption. For virtualized controllers without encryption, Spectrum Virtualize offers software encryption. Encryption can be enabled per storage pool or per storage array.

What is FIPS 140-3?
The Federal Information Processing Standard (FIPS) issued by the National Institute of Standards and Technology (NIST) is a U.S. government computer security standard used to approve cryptographic modules. This means it is a standard to maintain the confidentiality and integrity of information with four increasing, qualitative levels of security which cover a wide range of applications and environments. Federal agencies and other regulated industries often require FIPS compliance.

Do you have FIPS 140-3 compliance?
We have apply for FIPS 140-3 certification for the FCM drives we're using in the 5200, 7300 and 9500 with a view to gaining the certification post GA.

Will all drives be FIPS 140-3 compliant?
No, just FCMs. Industry standard NVMe drives and SAS drives are not FIPS 140-3 compliant.

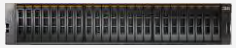
What happens when I order the encryption feature code?
You will be provided with an activation key to permit you to use encryption. This feature is not available in all countries.

How are encryption keys managed?
Keys can be managed either using USB sticks or by using a key manager such as IBM Security Guardium Key Lifecycle Manager. If you want to use USB sticks, you can order these with the product.

Is secure erase supported?
Yes, please see this Redpaper on Cryptographic Erase

FlashSystem Family Capabilities

Powered by IBM Spectrum Virtualize

Storage Insights (AI Predictive Analytics and Proactive Monitoring)				
				
FlashSystem 5015	FlashSystem 5035	FlashSystem 5200	FlashSystem 7300	FlashSystem 9500/R
VMware & Container Integration				
Multi-tenancy				
3-Site Data Copies				
Metro/Global Mirror (remote copy)				
FlashCopy (local and cloud copy snapshots)				
Easy Tier (Automated Hot/Cold Extent Movement)				
Data Migration (from >500 Supported Arrays)				
Distributed RAID 1 & 6 (and 5 on 5000 products)				
DRP (Software Only)	Data Reduction Pools (Hardware Assist Compression)			
Clustering (Multiple I/O Groups)				
HyperSwap (Active / Active Access)				
Encryption (Local and Server Based Keys)				
Safeguarded Copy				
NVMe Flash and NVMeOF Host Connections				
FCMs (Highest performance NVMe with compression & encryption)				
External Storage Virtualization (>500 Supported Arrays)				
Storage Class Memory (ultra low latency drives)				

Spectrum Virtualize FAQ

Is Spectrum Virtualize built into FlashSystem and SAN Volume Controller products or do I need additional hardware?
It's built in. Spectrum Virtualize runs on each canister in a FlashSystem product, and on each node in a SVC node pair.

What hosts are supported?
The host interoperability is similar across all Spectrum Virtualize products. Check SSIC for details..

Can I virtualize FlashSystem products behind SAN Volume Controller?
Sure. See the interoperability matrix on SSIC for details.

Can I virtualize other storage controllers?
Yes, whilst this is core function for SAN Volume Controller, FlashSystem products can also do this either for migration purposes or to extend the capacity of your system more permanently.

What controllers are supports with external virtualization?
Over 500 different controllers are supported. Check SSIC for details..

Does Spectrum Virtualize function extend to virtualized controllers?
Yes, all of the Spectrum Virtualize function can be applied to all storage in the storage pool, whether it's local storage (in the case of FlashSystem products), or virtualized. This includes using Easy Tier to accelerate older storage with newer Flash technology.

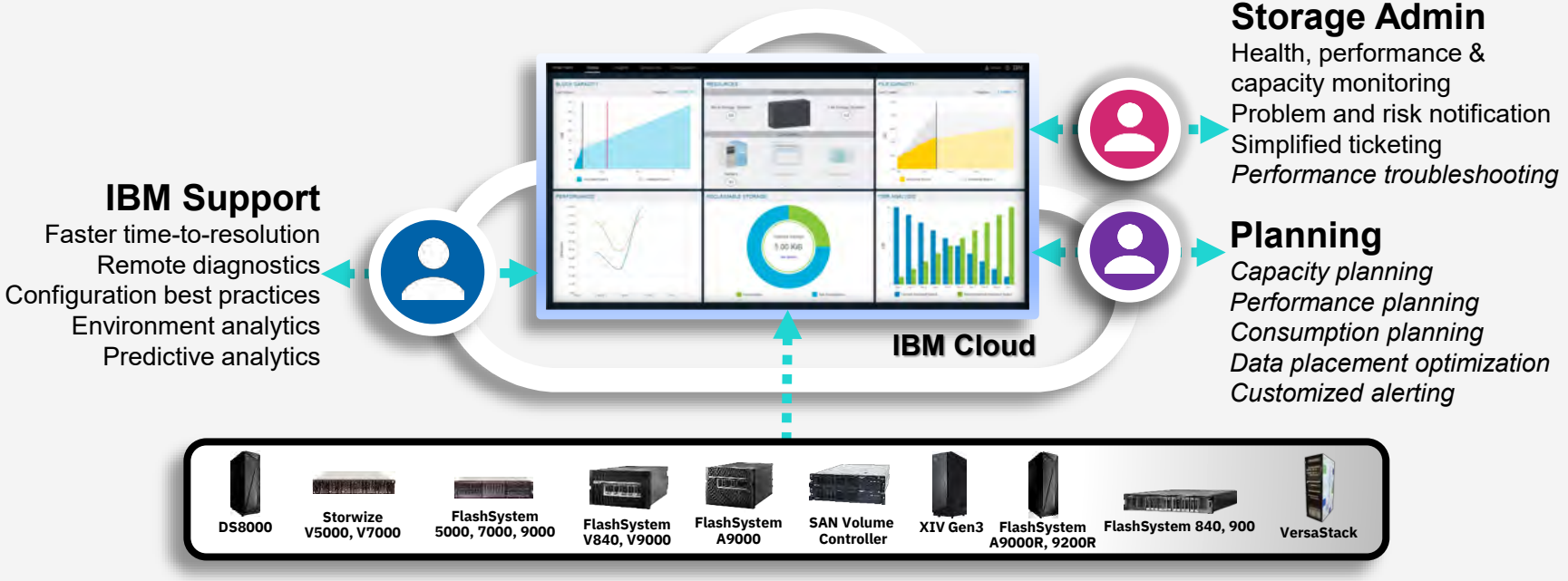
If I'm virtualizing storage controllers, where should I do data reduction?
Best practise is to do data reduction in the controller, and to manage and track the physical storage there. A more detailed answer can be found in the FlashSystem Best Practices Redbook

What user interfaces does Spectrum Virtualize offer?
A easy-to-use GUI, a command line over SSH, and REST API for integration into other workflows.

How can I find out more about Spectrum Virtualize functionality?
There are multiple IBM Redbooks that both provide an overview and go into detail on specific functions.

What is Storage Insights?

Storage Insights (SI) provides a single pane of glass for you to monitor your storage estate
It's available with IBM FlashSystem and SAN Volume Controller products with a valid support contract



Storage Insights Pro paid-for-features shown in italics, also included with Spectrum Control license and Expert Care Premium

Storage Insights FAQ

How much does Storage Insights cost?
Storage Insights available for no charge on all FlashSystem and SAN Volume Controller products with IBM Storage Expert Care.

What can I see on the Storage Insights Dashboard?
You can see the performance, capacity and health for all of your supported systems on a single pane of glass. Systems that require immediate attention are highlighted so that you can take action to avoid interruptions in service. The expanded view for each system allows you to see a more detailed system health report, along with events and open service tickets for that system.

How does Storage Insights improve the support experience?
Your IBM support representatives, including your Technical Advocate will have the same view of your infrastructure. IBM support representatives also have access to historical data to aid them in any problem determination needed. Storage Insights also gives IBM the ability to remotely gather diagnostic data if required (with the customer's permission of course).

What insights does Storage Insights actually provide?
Storage Insights proactively works to identify best practice violations. These capabilities will be continually expanded as we gain more insights into our user base.

What's the difference between Storage Insights and Storage Insights Pro?
The Pro version is licensed based on the amount of storage that's being monitored. It enables a longer history, better granularity, additional functionality as well consumption reporting.

How do I install Storage Insights?
Each customer will have their own instance of Storage Insights running in the IBM cloud – you just register with IBM here. Your welcome letter will include instructions for installing a lightweight data collector that runs in the data center to stream performance, capacity, asset and configuration data to your cloud instance.

What data is collected?
Metadata about the configuration and operations of storage resources. At no time is any customer data stored on any of the storage collected as this cannot be accessed by the data collector.

How is data collected?
Metadata flows in one direction, from the data collector in your data center to the ISO 27001 certified IBM cloud over a secure https connection.

Who can access my instance of Storage Insights?
Access is restricted to the customer who owns the Storage Insights dashboard; administrators who are authorized to access the dashboard; the IBM Cloud team who are responsible for maintaining cloud instances; and IBM support personnel for the investigating and closing of service tickets.

Where can I find out more information about Storage Insights, including more detail on many of the questions covered here?
Share a high level solution overview
Watch a product demo
Learn how secure data collection works
More info can be found here

Choosing A FlashSystem
for Business Partners and Sellers

Choosing a FlashSystem should start with understanding the **workload characteristics** for the workloads the customer plans to run on the system. For example, what are the likely read and write IOPs? What is the typical block size? And how much capacity do you need?

Consider both the **port bandwidth** and **port count** when thinking about **I/O cards**. The bandwidth should be enough to cope with any workloads, but if the customer is planning on clustering or using HA/DR configurations, plan on having dedicated ports to keep that traffic separate from host traffic.

As the **working set** (ie most accessed workloads) and **total capacity** increases, consider increasing the **cache**. If consolidating from multiple controllers, consider at least matching the amount of cache across those controllers

Finally, consider the future needs and whether the chosen product can expand to meet those needs.

The pre-sales tools on the left may help you.

Performance & Capacity

IBM BP

Storage Modeller (StorM)

StorM allows you to determine the right product and configuration, understand the capacity and then model the performance

Cost

IBM BP

TCOnow!

To determine the Total Cost of Ownership, including power, cooling, warranty, etc use **TCOnow!** You can also compare your configuration with other solutions

What is IBM FlashWatch?

A comprehensive suite of flash storage guarantee programs that gives you the confidence to purchase, own, and upgrade your IBM Storage

Acquisition

High Availability Guarantee
Proven 99.9999% availability
Optional 100% commitment when using HyperSwap

Data Reduction Guarantee *
2:1 self-certified
Up to 5:1 with workload profiling

All-inclusive Licensing
All storage function included in licensing cost for internal storage

Operation

IBM Storage Expert Care
Choose the duration and level of support needed, independently of the FlashSystem product purchased

Cloud Analytics
Storage Insights to proactively manage your environment

Flash Endurance Guarantee
Flash media is covered for all workloads whilst under warranty or maintenance

Migration

IBM Flash Momentum
Storage Upgrade Program
Replace your controller *and* storage every 3 years with full flexibility

Cloud-like Pricing
Optionally available consumption pricing models: IBM Storage as a Service or Storage Utility

No Cost Migration
90 days no-cost data migration from over 500 storage controllers, IBM and non-IBM

*Replaces all previous "Controller Upgrade", "Peace of Mind" and "FlashWatch" Programs commencing with purchases made on or after **February 11th 2020***
*Program applicability varies by product. Check "FlashWatch Product Matrix". * Requires signed contract.*

IBM Storage Expert Care

** Next business day, parts only for FS5200, FS7200*
*** Same day, IBM on-site for FS9200*
**** On-site available as additional paid service*

What's different about Expert Care from other IBM Storage service offerings?
It allows you to independently choose your product, support level and duration to align with your business needs.

What products is IBM Storage Expert Care available with?
FlashSystem 5200 (MT 4662), 7300 (MT 4657), 9500 (MT 4666)

Do I have to purchase Expert Care?
No, but base warranty is limited to just one. By separating out Expert Care from the base warranty we're allowing you to define the level of support you'll receive as a fixed percentage of the hardware price for the duration you choose.

Are there alternative warranty upgrades or maintenance services?
No, services either as a standalone TSS offering or as ServicePacs are not available. The only way to extend and improve your warranty is through an Expert Care offering.

Are other service upgrades available with Expert Care?
Yes, complementary services to the Expert Care offerings such as media retention, machine setup support (IBM Installation) and others are available separately.

Can I renew Expert Care at the end of the initial duration?
Yes, you can renew your existing coverage at the end of the contract or choose to renew or upgrade to a higher offering at any point.

	Warranty	Basic 5200, 7300	Advanced 5200,7300,9500	Premium 7300, 9500
IBM Spectrum Virtualize fixes, updates and new releases	1 year	Yes	Yes	Yes
Guidance on installation, usage and configuration		Yes	Yes	Yes
Automated ticket management and alerting		Yes	Yes	Yes
Use of Storage Insights for collaborative problem resolution		Yes	Yes	Yes
Predictive issue alerting			Yes	Yes
Storage Insights Pro entitlement				Yes
IBM Installation	Standard with 9500	Additional paid service	Additional paid service	Additional paid service for 7300
Remote code upgrades (2x year) ***				Yes
Dedicated Technical Account Manager (TAM)				Yes
30 minutes Severity 1/2 response				Yes
Hardware service / parts replacement	9x5 NBD* or 24x7 Same day**	9x5 NBD, IBM on-site	24x7 Same day, IBM on-site	24x7 Same day, IBM on-site

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Financing with IBM Storage Expert Care

How does IBM Storage Expert Care change the way a product is financed?
Previously a fixed level of maintenance was included with 3-year warranty products, and the pricing of that product was adjusted to accommodate this. In order to allow customers to choose the level of Expert Care that's right for them, Hardware and Maintenance are now being sold separately.

What are the implications of selling these two components separately?
If you're financing a product, then both hardware and maintenance can still be financed. However, in some countries Hardware and Maintenance are subject to different financing and tax rules and will be treated separately. An example of a common transaction is shown on the right.

What does this mean for Business Partners and Sellers?
Nothing, you should continue to prepare your configuration business as usual, and pass it to your IBM Financing sellers who will manage the transaction correctly.

	Generic Financing Example	
Component	**FlashSystem Hardware**	**IBM Storage Expert Care**
Cost	$66,000	$34,000
Financing type	Fair Market Value Lease Financing	Loan Financing
Client Financing Rate per Thousand Financed	$24.8974 per $1000	$29.9610 per $1000
Customer monthly payment	$1,643.23	$1,018.67
Total paid over 36 month	$59,156.22	$36,672.26
End of lease options	Buy out, return or renew	None (customer owns)
Client Accounting	Fixed asset	Loan
Client VAT	Paid over time	Paid upfront

Other Resources

IBM FlashSystem & SAN Volume Controller FAQ

Details on the IBM Spectrum Virtualize products, covering IBM FlashSystem family and SAN Volume Controller

IBM FlashWatch FAQ

Guidance on the IBM FlashWatch programs

IBM Redbooks

Detailed information on both IBM FlashSystem products and IBM Spectrum Virtualize function

FlashSystem Product Tour

Interactive product tour showing GUI usage and performance

Thank you

Matt Smith
IBM FlashSystem Product Manager
—
msmith@uk.ibm.com
ibm.com

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