

**IBM Storage and SDI**

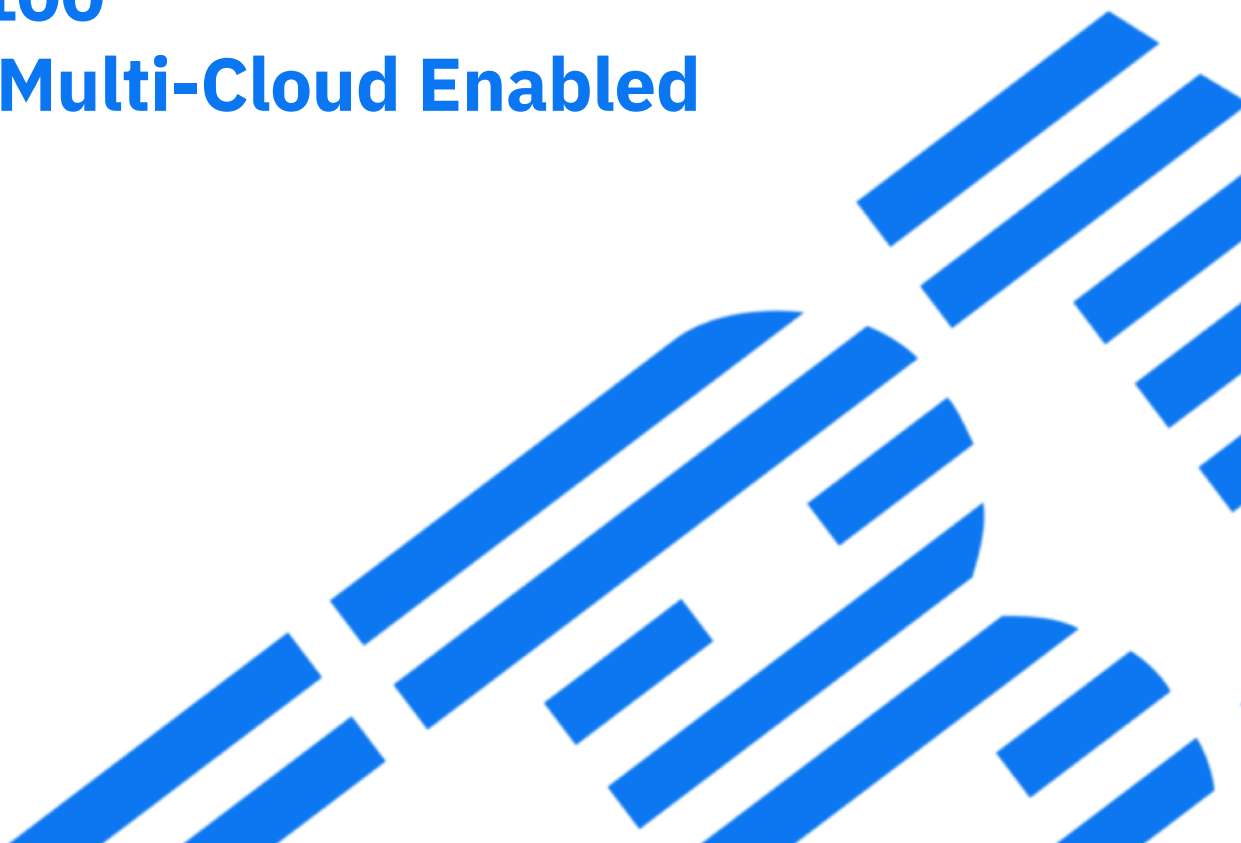
# **IBM FlashSystem 9100**

## **NVMe-Accelerated, Multi-Cloud Enabled**

**Peter Lončarević**  
Storage CTS

September, 2018

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*“The world’s most valuable resource is no longer oil, but **data.**”*

**The Economist**

May, 2017



## Today’s architecture starts with multi-cloud in mind

- Extend data across infrastructures
- Looking for choice, control and consistency
- Easy and agile data access

# Broadest Storage and Software Defined Portfolio in the Industry



IBM Storage and SDI

## Storage Systems

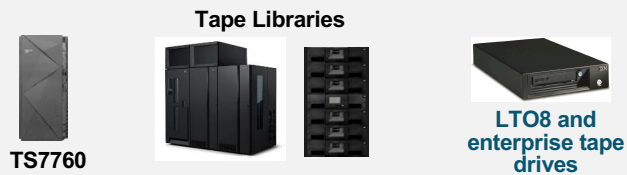
*Lowest Latency  
Application  
Acceleration*



*All Flash and Hybrid Storage Systems*



*Tape and Virtual Tape Systems*



## Software Defined Storage

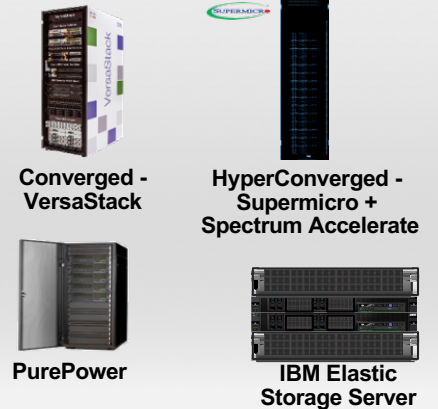
### IBM Spectrum Storage

#### IBM Spectrum Storage Suite

- IBM Spectrum Virtualize
- IBM Spectrum Protect
- IBM Spectrum Control
- IBM Spectrum Accelerate
- IBM Spectrum Scale
- IBM Spectrum Archive
- IBM Spectrum Copy Data Management
- IBM Cloud Object Storage



## Integrated Infrastructure Solutions

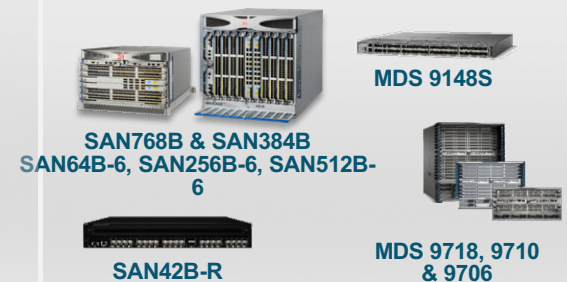


## Software Defined Computing

### IBM Spectrum Computing

- IBM Spectrum Symphony
- IBM Spectrum LSF
- IBM Spectrum Conductor
- IBM Spectrum Cluster Foundation
- IBM Spectrum MPI

## Storage Networking



# IBM Systems Flash Storage Offerings Portfolio

IBM Storage and SDI



**New!**

**NVMe end-to-end  
FlashSystem 9100  
Models 9110, 9150**

**Storwize  
V5030F / V7000F**



**Entry / Mid-Range**



**Enterprise Class,  
NVMe accelerated  
Multi-Cloud Enabled**

**FlashSystem  
A9000**



**Cloud Service  
Providers**

**FlashSystem  
A9000R**



**High End  
Enterprise**

**IBM Elastic  
Storage Server**



**Big Data**

Consolidate file &  
object workloads  
Faster data analysis  
Global sharing

**DS888xF**



**Business Critical**

z/OS / AIX  
Power HA  
Power i HA

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

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

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



**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



## Modern Infrastructure Support

### Flexible

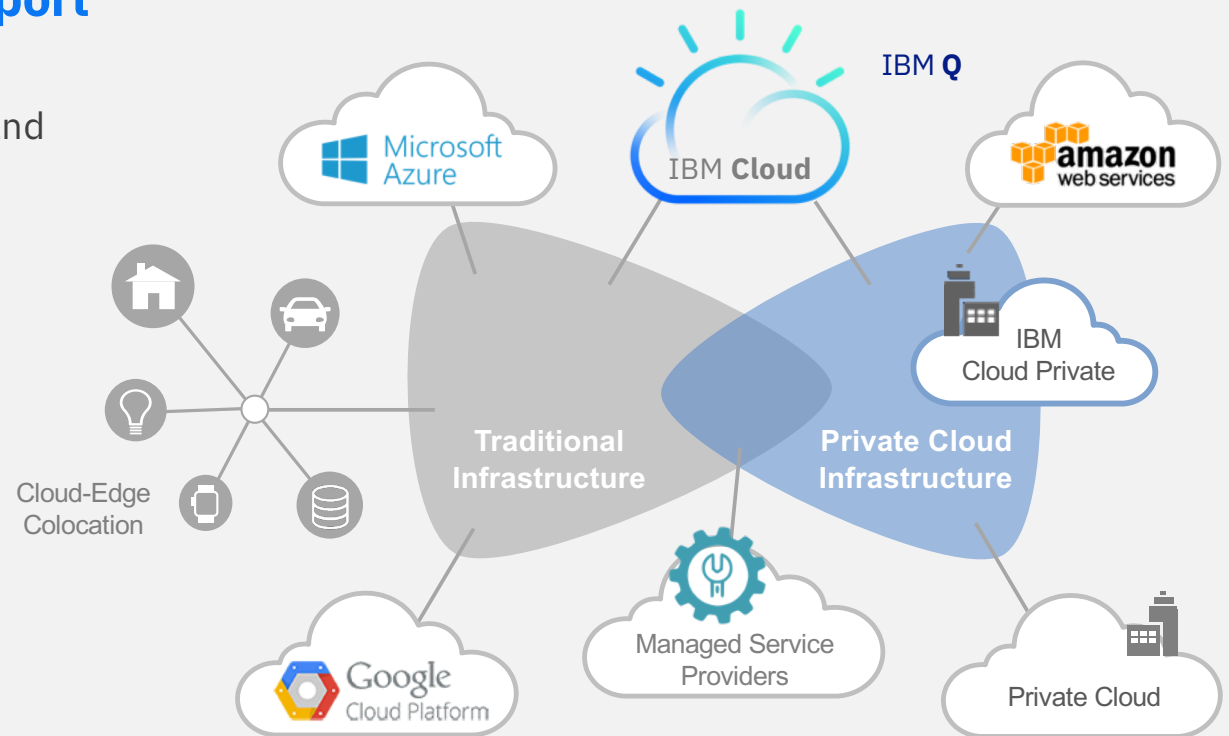
- Data Portability between Private and Public Clouds
- Secure and Compliant
- High ROI Use Cases

### Modern

- API Automation
- Native DevOps Capable
- Self-Service

### Agile

- Service Level Driven
- Software-Defined and Flash-Optimized
- Modern Backup and Replication



# Client Multi-Cloud Patterns



IBM Storage and SDI

What you have ...

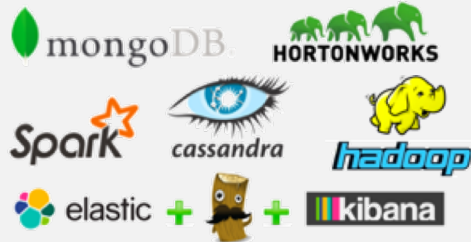


And you want to ...

## Modernize traditional workloads

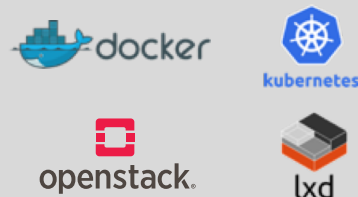
Private clouds for traditional application infrastructures as **agile, flexible** and **cost effective** as public clouds, and seamlessly extend to leverage public cloud infrastructure as business demands

IBM Storage delivers ...



## Transform with next-gen applications

**AI and Big Data infrastructure** to support High Performance Data Analytics and HPC leveraging the power of the Open Source community, supporting the very small to the largest clusters in the world



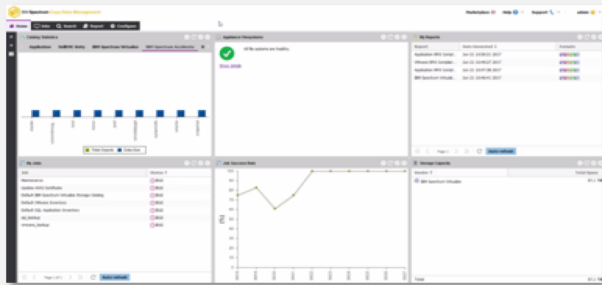
## Refactor apps / containerize

**Integrated Docker and Kubernetes**  
Private clouds for app modernization and agile development with full portability to leverage public cloud infrastructure



# IBM FlashSystem 9100 – Enterprise NVMe Flash Array

## NVMe-Accelerated and Multi-Cloud Enabled



## NEW IBM FlashSystem 9100

- NVMe-Accelerated Enterprise Flash Array – 100% NVMe end-to-end
  - Industry Leading Performance and Scale - NVMe IBM FlashCore Modules and NVMe industry standard SSD
  - Flexible, Modern, Agile
  - Supports Physical, Virtual and Container Environments
- IBM Storage Insights: AI-empowered predictive analytics, storage resource management, and support platform delivered over the cloud
- Includes Spectrum Storage Software for array management, data reuse, modern data protection, disaster recovery, and containerization
  - IBM Spectrum Virtualize
  - IBM Spectrum Copy Data Management
  - IBM Spectrum Protect Plus
  - IBM Spectrum Virtualize for Public Cloud
  - IBM Spectrum Connect

## NEW IBM FlashSystem 9100 Multi-Cloud Solutions

- Solution blueprints for Data Reuse, Protection and Efficiency
- Solution blueprints for Business Continuity and Data Reuse
- Solution blueprints for Private Cloud Flexibility and Data Protection



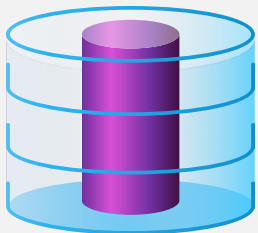
**FlashSystem 9100**



# IBM Spectrum Virtualize for FS9100

## Modernize Your Storage without Changing Your Storage

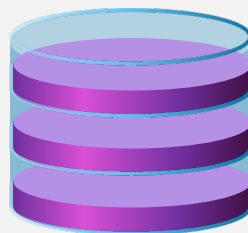
- Agility and efficiency of software-defined storage without replacing your existing storage
- Consistent storage services applies to all storage
- No need to redo automation / orchestration when new storage platforms come into play
- Higher level of simple and consistent data mobility supporting multi-cloud



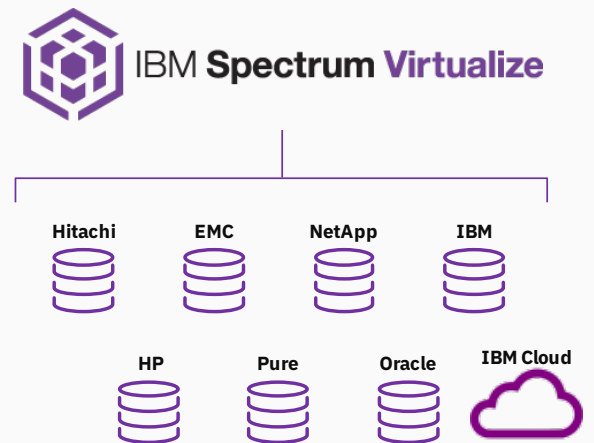
**Compression and deduplication**

store up to 5x as much data

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**Thin provisioning can double the amount of data stored**



**“Spectrum Virtualize makes even highly complex physical landscapes easy to manage.”**

**Rick Harvey**

*Director of IT Infrastructure  
University of Rochester Medical Center*



# IBM FlashSystem 9100

## NVMe-Accelerated Enterprise Flash Array

IBM Storage and SDI

### Future proof end-to-end NVMe

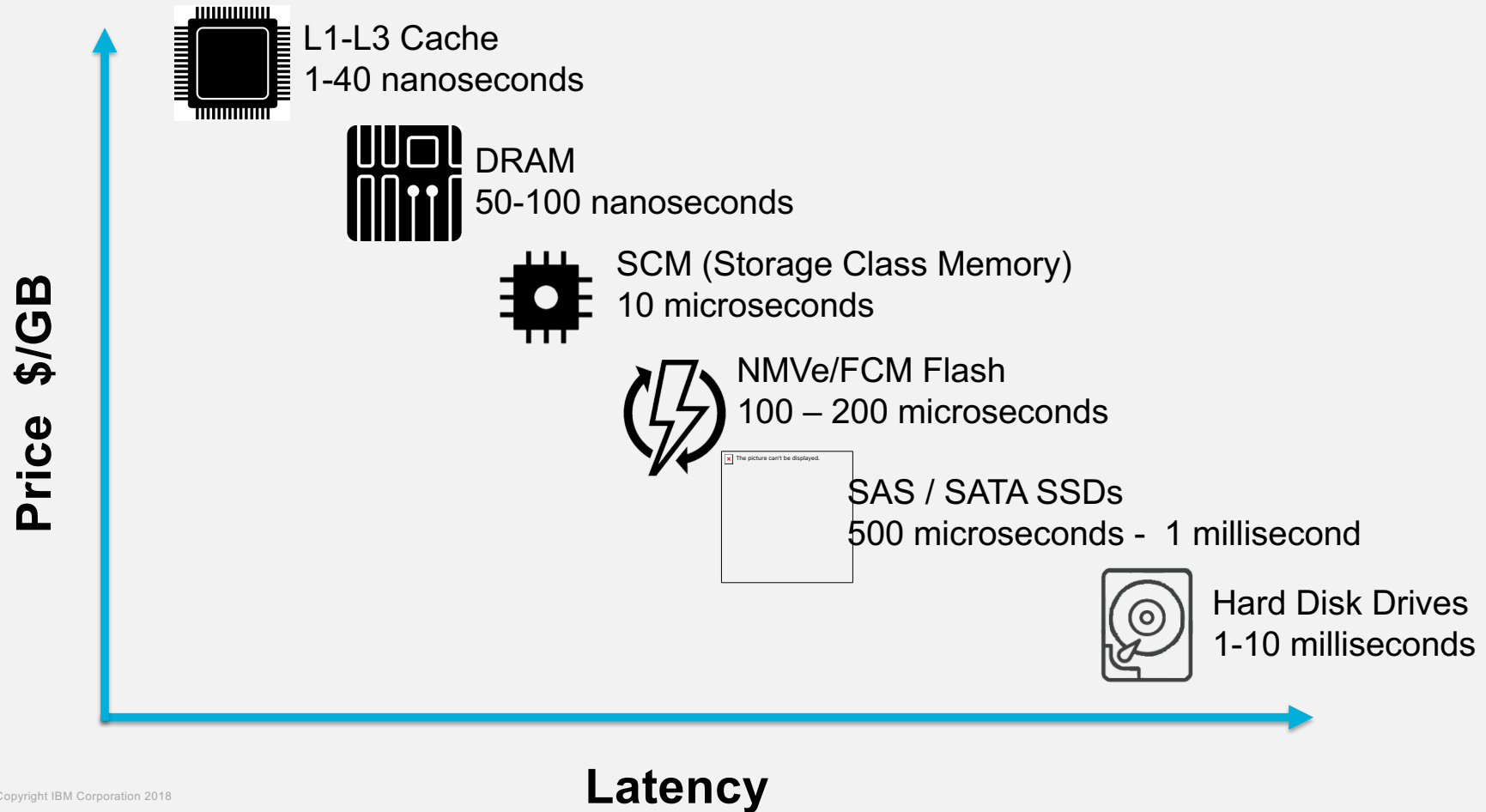
- Unmatched performance – NVMe & FlashCore
- Consistent low latency with Peak IOPS for transactional workloads and massive bandwidth for AI/ML workloads
- **5X** data reduction delivers 2PB in 2U and 32PB in a single rack dramatically reducing CAPEX and OPEX
- Built in encryption and FIPS 140-2 compliance
- Built for **100% data availability** for systems using HyperSwap



# How is NVMe Different than SAS

- NVMe is a new protocol designed for Flash Technologies
  - NVMe reduces latencies and increases bandwidth
  - NVMe initiator stack is performance optimized
  - Capable of future support of NVMe Storage Class Memory (SCM) media
- Supported NVMe drives are Self Encrypting
- Format behaviour more akin to FS900 than SAS
- FS9100 enclosure services are on a PCIe Switch rather than a SAS bus
  - Provides more bandwidth and lower latency to each drive

# What does SCM capable mean?



# Accelerate business execution with IBM FlashCore NVMe Modules

IBM Storage and SDI

## FlashCore technology differentiators:

- No performance impact due to hardware-based compression and encryption
- Outstanding data reliability
- Innovative ECC algorithm efficiently corrects high bit rate errors
- Endurance without latency penalty
- Optimal flash chip use through dynamic health checks
- Asymmetrical wear leveling
- FIPS 140-2 certification

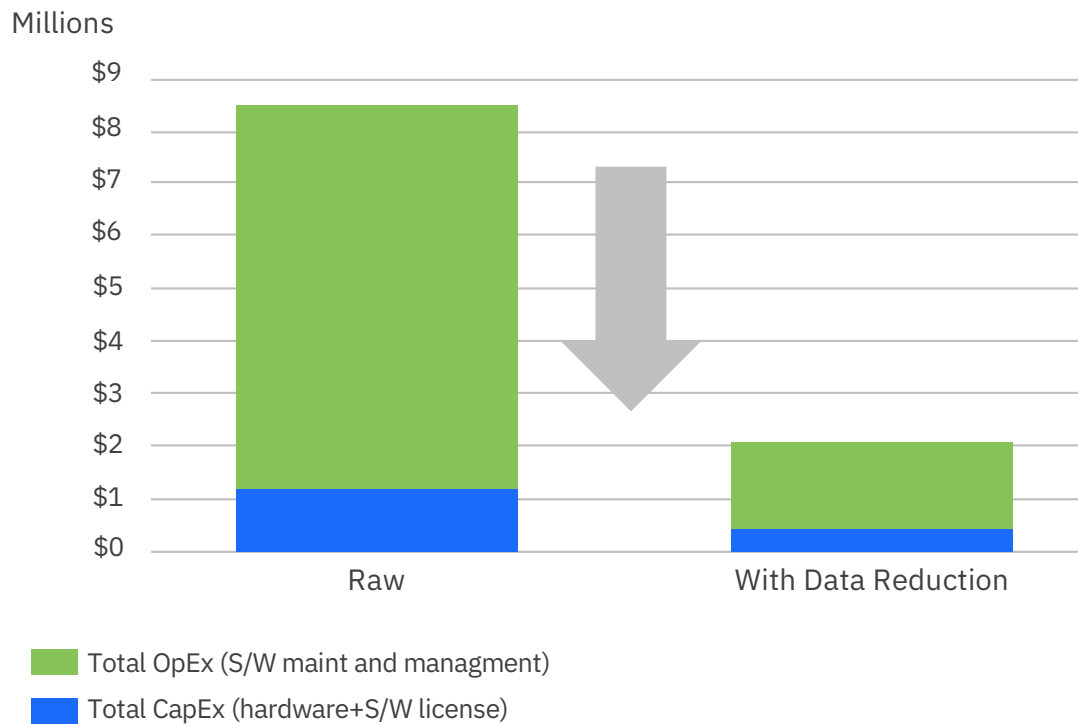


**4.8TB, 9.6TB, 19.2TB**  
capacity options with  
up to 5:1 compression

# IBM FlashSystem 9100

## Data Reduction 3 Year Financial Impact

IBM Storage and SDI



**SAVINGS –**  
**CAPEX: \$832,000**  
**OPEX: \$5.6M**

### FlashSystem 9100

Approx. 968 TB usable configuration  
5:1 data reduction  
All software functions included  
Typical street price

# Transformation of Performance and Capacity

IBM Storage and SDI

↑ **Scale out**  
10 million IOPS  
136GB/sec in 8U

↓ **Zero Performance Impact**  
Up to 3.6PB NVMe accelerated compressed data in 8U

↑ **Performance Density**  
Up to 8PB of NVMe Data storage in 8U with data reduction\*\*

*Performance and density to Modernize and Transform business efficiency*

1.25M IOPS,  
17GB/s per  
rack unit

Up to 1PB  
data storage  
per rack unit

Up to 230TB  
raw per rack  
unit

# IBM Storage Insights

IBM Storage and SDI

AI-empowered Storage Analytics, Storage Resource Management, and Support Platform

## Knowledge Base

Best practice +  
Call Home Alerts +  
Known issues +  
Support feedback



## Analytics

Identify impending issues or  
configurations that do not  
meet best practice



## Identify

AI finds matches!



## Notification

Client Admin



IBM Support



Proactive Insights  
and Notifications

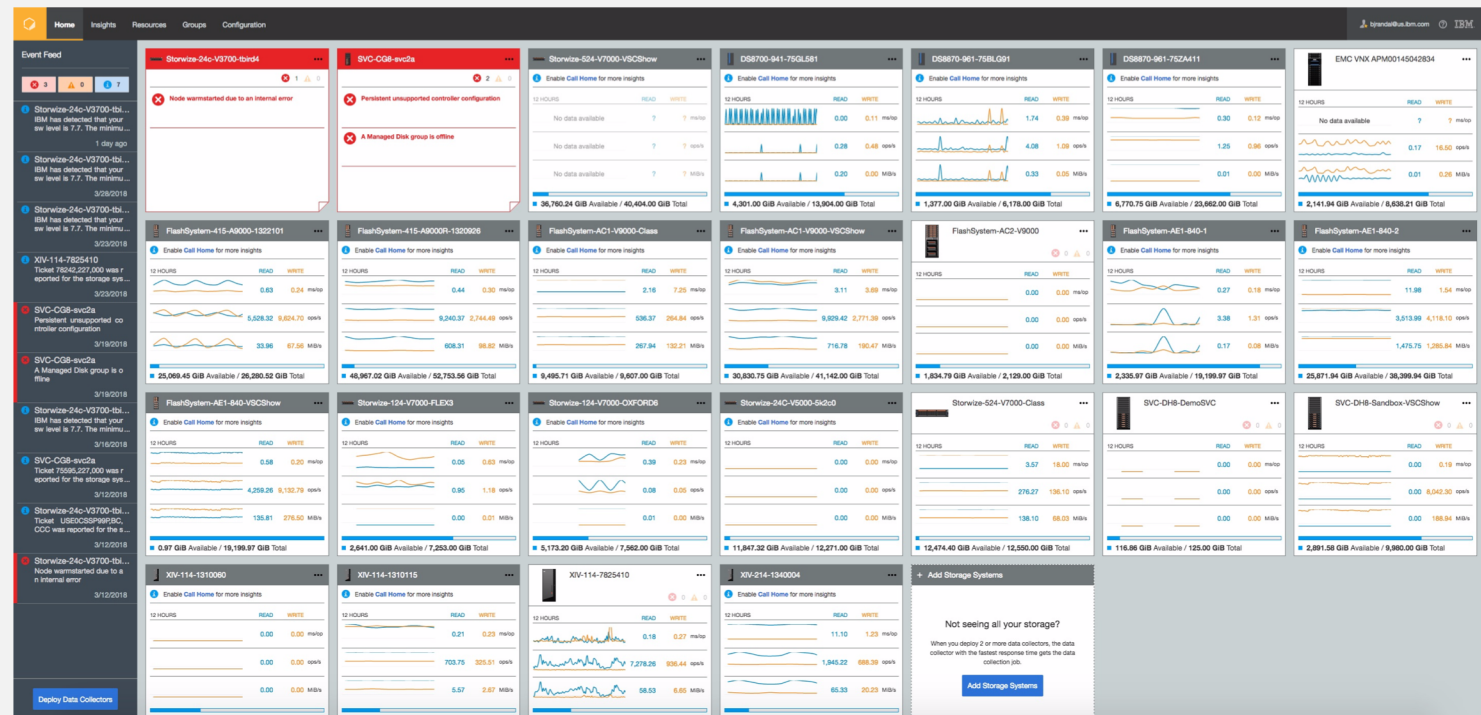
# IBM Storage Insights

## Unified dashboard of the storage environment

IBM Storage and SDI

One place to look

- Inventory at a glance
- Call home events
- Capacity
- Key performance metrics
- Validate call home is on and working





# Complete Peace of Mind with IBM FlashSystem 9100

IBM Storage and SDI

- **IBM data reduction guarantee**

Flexible guarantee: up to 5:1 data reduction  
Express guarantee: 2:1 data reduction

- **IBM availability guarantee**

IBM guarantees 100% data availability for systems using HyperSwap and deployed by IBM Lab Services

- **IBM controller upgrade program**

No up-front charges, no contractual commitment to buy

- **7 year 24x7 Support**

Up to 7 years support available with flash media retention offerings

- **Endurance**

IBM FlashCore Modules will be covered for read/write endurance while you are under warranty or maintenance

- **Migration**

Up to 45 days to migrate data at no extra charge



*Eligible storage systems vary by program terms and conditions specified in guarantee contracts apply*

# IBM FlashSystem 9100 Multi-Cloud Solutions

IBM Storage and SDI

## *Proven solutions to transform infrastructure efficiency*

- Select from 3 new IBM FlashSystem 9100 Multi-Cloud Software Solutions
- Deploy rapidly and with confidence based on IBM validated blueprints
- Easily purchased together with FlashSystem 9100

Data Reuse,  
Protection  
and  
Efficiency

Business  
Continuity  
and Data  
Reuse

Private Cloud  
Flexibility  
and Data  
Protection



*Flexible, Modern, Agile and Blazing Fast*



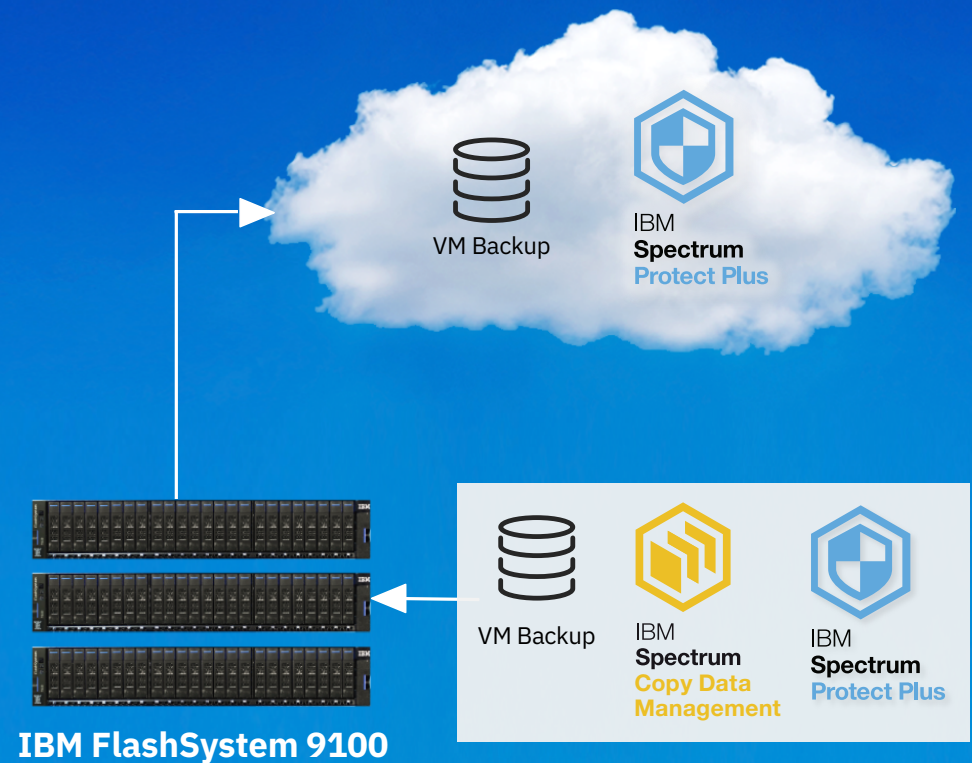
*Flexible, Modern, Agile and Blazing Fast*

# IBM FlashSystem 9100 Solution for Data Reuse, Protection and Efficiency

IBM Storage and SDI

## ***Protect and reuse data for maximum business agility***

- Comprehensive backup in virtual or physical environments
- Quickly spin-up and spin-down real world environments using CDM's API integration and templating
- Reuse backup and other data copies for:
  - DevOps
  - Analytics
  - Reporting
  - DR
- Orchestrate copies to maximize use of snapshots
- Leverage flash speed to enable multiple use cases to meet all your SLAs



*Flexible, Modern, Agile and Blazing Fast*

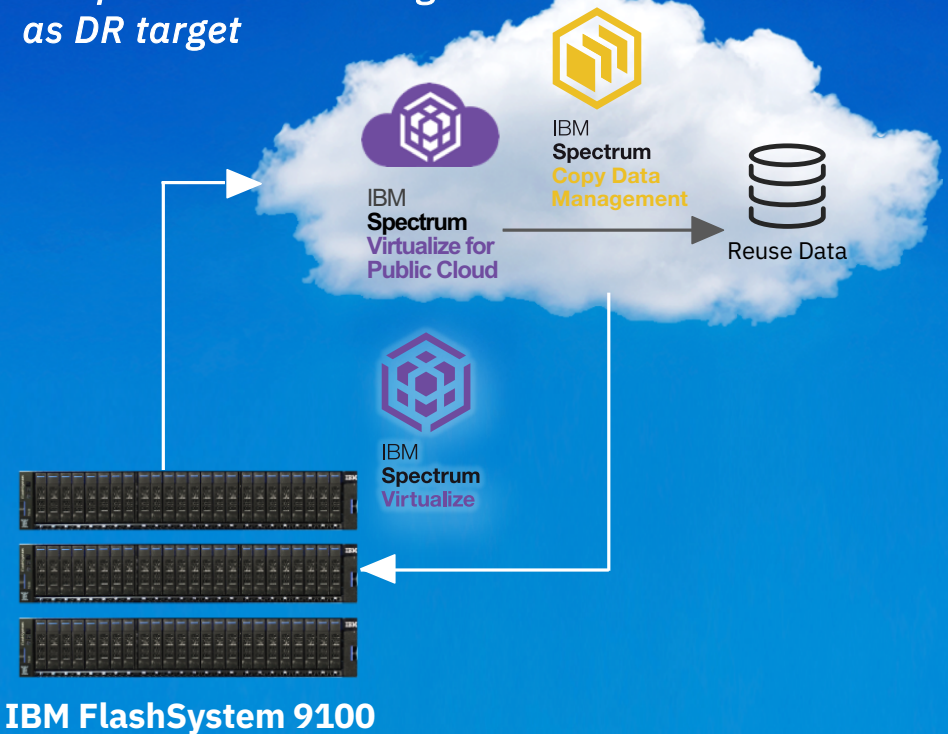
# IBM FlashSystem 9100 Solution for Business Continuity and Data Reuse

IBM Storage and SDI

***Deploy multi-cloud environments for business continuity and data reuse to reduce cost and improve agility***

- Reduce OPEX/CAPEX for business continuity by replicating to IBM Cloud
- Leverage cloud DR copies for
  - DevOps
  - Analytics
  - Reporting
- Recover applications in VMware Environments in IBM Cloud with near zero RTO/RPO
- Easily migrate workloads between on-prem, private and IBM Cloud

***Use public cloud storage as DR target***



*Flexible, Modern, Agile and Blazing Fast*

# IBM FlashSystem 9100 Solution for Private Cloud Flexibility and Data Protection

IBM Storage and SDI

## ***Transform on-premises storage with cloud efficiency and flexibility for Docker and Kubernetes environments***

- Maximize agility when deploying new-generation applications in on-prem environments or private clouds
- Automate storage provisioning and data protection
- Reuse backup and other data copies for DevOps, analytics and reporting with virtualized and Linux on bare metal environments
- Simplify deployment with pre-tested IBM Cloud Private and IBM Spectrum Access Blueprint



IBM Cloud Private



IBM  
**Spectrum**  
Copy Data  
Management



IBM  
**Spectrum**  
Connect



IBM  
**Spectrum**  
Access  
Blueprint



**IBM FlashSystem 9100**

*Flexible, Modern, Agile and Blazing Fast*

# Multi Cloud Solutions - Offering Components

IBM Storage and SDI

Ordering	BASE	OPTIONAL	OPTIONAL	OPTIONAL
Software Offerings Orderable with FlashSystem 9100	Multi-Cloud Enabled Base Software for FlashSystem 9100	IBM FlashSystem 9100 Solution for Data Reuse, Protection and Efficiency (per TB)	IBM FlashSystem 9100 Solution for Business Continuity and Data Reuse (per TB)	IBM FlashSystem 9100 Solution for Private Cloud Flexibility, and Data Protection (per TB)
Products				
Spectrum Storage Insights	✓			
Spectrum Connect	✓			
Spectrum Virtualize	✓			
Spectrum Protect Plus	✓ (5TB Starter Kit)	✓		
Spectrum CDM	✓ (5TB Starter Kit)	✓	✓	✓
Spectrum Virtualize for Public Cloud	✓ (5TB Starter Kit)		✓	
Blueprint	✓	✓	✓	Spectrum Access
Lab Services (Post GA)		✓ (optional)	✓ (optional)	✓ (optional)

# IBM FlashSystem 9100

## FlashSystem 9110 and FlashSystem 9150

IBM Storage and SDI

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)

### **FS9110**

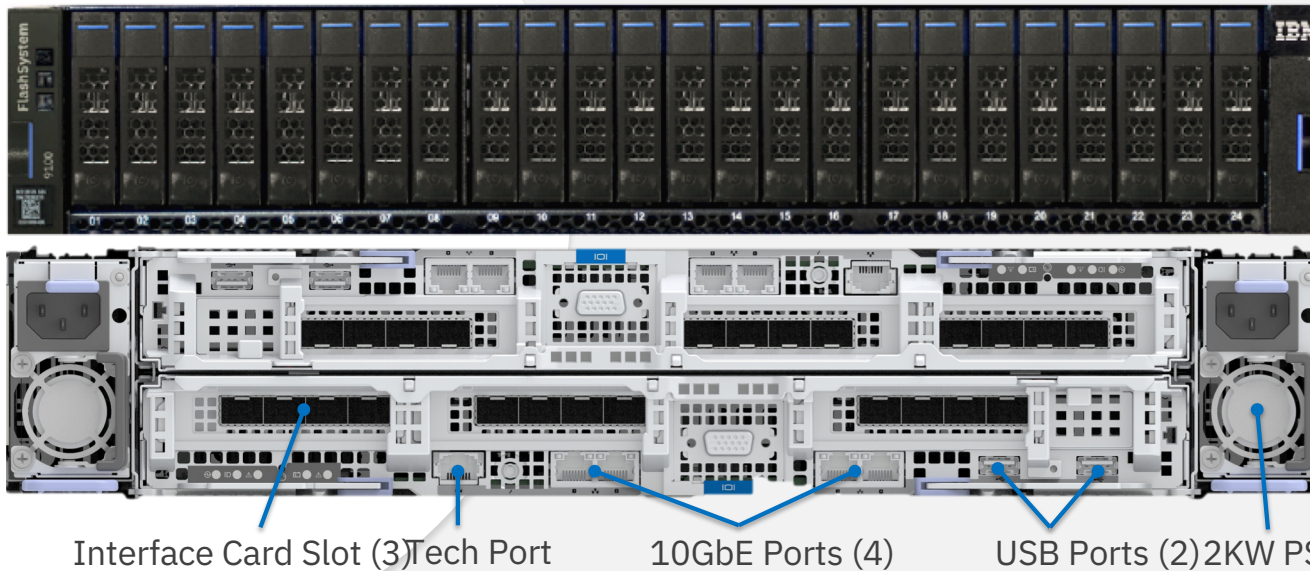
Dual 8-core processors per controller

Up to 1.5TB Cache per controller enclosure

### **FS9150**

Dual 14-core processors per controller

Up to 3 host adapters per controller





# Supported Flash Modules

## New Flash Core Modules (FCM)

Size	Compression Capable	Encryption Capable
4.8 TB	Yes	Yes
9.6 TB	Yes	Yes
19.2 TB	Yes	Yes

## Industry Standard NVMe Drives

Size	Compression Capable	Encryption Capable
1.92 TB	No	Yes
3.84 TB	No	Yes
7.68 TB	No	Yes
15.36 TB	No	Yes

# Valid Supported Memory Configurations Cache

IBM Storage and SDI

Canister	Control Enclosure	DDR4 DIMM Use/Canister
64GB	128GB	4 x 16GB
128GB	256GB	8 x 16GB
192GB	384GB	12 x 16GB
384GB	768GB	12 x 32GB
576GB	1152GB	12 x 16GB 12 x 32GB
768GB	1536GB	24 x 32GB

# Supported Host connections

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## Supported Adapters

Number of Cards	Ports	Protocol	Possible Slots
0-3	4	16Gb Fibre Channel	1, 2, 3
0-3	2	25Gb Ethernet (iWarp)	1, 2, 3
0-3	2	25Gb Ethernet (ROCE)	1, 2, 3
0-1	2	12Gb SAS Expansion	3

## On Board Ethernet Ports

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

# Capacity Can Be Added At Any Point In Time

IBM Storage and SDI



- If expansion beyond twenty-four drives is required, it is easily accomplished
- Capacity can be added with up to twenty 12Gb/s SAS 24F expansion enclosures
- Capacity can also be added with up to eight 12Gb/s SAS 92F expansion enclosures



FlashSystem 9100 will be trust based and all-inclusive

- Features are all included as part of the base license
- Internal Storage will be licensed on a per enclosure basis
- Encryption which will use key based activation for regional controls
- Externally Virtualized storage will be SCU licensed (same as with the SVC)

IBM Storage and SDI

Thank you