



# What Sellers Need to Know

IBM<sup>®</sup> FlashSystem<sup>™</sup>  
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## What is IBM FlashSystem?

The IBM FlashSystem is flash memory storage array appliance that provides both outstanding performance and latency to customers looking to eliminate the I/O bottleneck caused by relatively slow disk drives. Flash technology has been around for a long time but is just now redefining the landscape of storage due to the reliability improvements and acceptable cost benefit value proposition.

FlashSystem appliances are easily integrated into existing storage architectures to reduce storage latency and instantly speed up applications that are dependent on disk access. They can also be used as a top tier of storage, alongside traditional arrays in tiered storage architectures, such as IBM San Volume Controller (SVC) or Storwize V7000 storage virtualization platforms using IBM Easy Tier functionality.

## Flash Value Proposition

Flash has measurable performance impact by addressing the weakest link in the IT stack – storage latency. Flash is very fast storage with latencies measured in microseconds vs. milliseconds for a competitor’s product. Speeding access to storage creates a ripple effect, improving CPU utilization and reducing database, application and VMware licensing costs. In addition, Flash is green, consuming about 20% of the power and cooling of spinning disk. IBM FlashSystems also have sophisticated reliability features such as Variable Stripe RAID that are typically not present on locally attached flash devices.

### Business impact

- Improve application efficiency
- Unlock scale of business processes
- Provide best end-user experience (improve customer, employee satisfaction)
- Create competitive advantage by increasing the pace of business
- Decrease time to operation results (gets it done faster)

### Financial Impact

- Maximize CPU efficiency by driving up utilization
- Reduce application licensing cost by reducing the number of core required
- Reducing database licensing cost by reducing the number of cores required
- Extend useful life of existing storage assets
- Major power, cooling, and ‘rack estate’ savings (TCO)
- System life expectancy greater than 5 years

## What Makes IBM FlashSystem Different?

IBM FlashSystem products compete against other flash appliances/arrays, traditional storage arrays with hard drives and solid state drives (SSDs), and direct-attach solid state storage devices such as flash PCIe cards. IBM FlashSystem products have performance, reliability and efficiency advantages over each.

### Key Technology Points

- The flash media in IBM FlashSystem is NAND (Negated AND) memory. They use either enterprise grade multi-level (eMLC) or single-level cell (SLC) technology.
- Consumer-grade flash is MLC
- Choose the flash type device based upon workload profile.
- eMCL offers a 10x improvement over MLC
- SLC offers a 33x improvement over MLC
- In competitive situations, make sure the flash media type is the same. A common practice is to quote cheaper MCL flash media against IBM products that contain eMLC or SLC memory.
- Durability of MCL, eMCL and SLC technology - A solid-state-storage program-erase cycle (P/E cycle) is a sequence of events in which data is written to solid-state or NAD flash memory cell then erased and rewritten. Flash memory devices are capable of a limited number of P/E cycles because each cycle causes a small amount of physical damage to the medium. The number of P/E cycles a memory cell can sustain provides a guide for the useful life of a Flash storage device.
- Actual use may vary, but a rough estimate if the P/E cycles for each technology are: MCL numbers range from 1500 to 10,000, eMLC numbers range up to approximately 30,000 PE cycles per block, SLC devices can execute up to roughly 100,000 PE cycles per block.
- IBM's Variable Stripe RAID technology lengthens system life by improving both eMCL and SLC endurance.
- ***eMLC flash media will handle workload profiles that most enterprise applications require with a duty cycle greater than 5 years – which exceeds the economic useful life or the depreciation cycle of most storage assets***
- When floor space or power and cooling are considered important purchasing criteria, flash has a clear advantage, using 20% of power and cooling to handle a given workload.
- SSD is NOT the same as Flash Storage. SSD uses SAS protocol that treats the flash media like a traditional HDD (like only allowing one write at a time). This makes a SSD an operational replacement for a HDD. The SAS protocol adds unnecessary latency to SSD performance that is eliminated by flash technology controllers communicating directly with the flash media modules.
- IBM MicroLatency™ is IBM's branding of the latencies of FlashSystem being measured in microseconds rather than the milliseconds others use as their latency unit of measure.

## FlashSystem Application Sweet Spots

- OLTP Databases
  - Financial, gaming, real-time billing, trading, real-time monitoring, query acceleration (DB2/Oracle)
- Analytical applications (OLAP)
  - Business intelligence, batch processing, ERP systems, reporting, massive data feeds
- Virtual Infrastructures
  - VDI, Consolidated virtual infrastructures, user profiles
- HPC/Computational Applications
  - Simulation, modeling, rendering, FS metadata, video on demand
- Cloud-scale infrastructures
  - On-demand computing, content distribution, web, GPFS, active file management.

## Not so Sweet Spots

Flash is not the answer for all issues. Spinning disks still may make sense in certain situations such as CPU bound applications and for very large active capacities with high growth rates. Poorly written code can also limit the benefits of flash technologies.

## FlashSystem Use Cases

Here is a breakdown of 3 specific use cases:

### SAP Acceleration with IBM FlashSystem

Customer Challenge – The vast majority of the Worlds SAP Databases consumes less than 2TB of Storage. SAP offers accelerated performance by adopting the HANA in-memory database architecture. This often leads to a significant re-architecture of the entire SAP infrastructure, which drives high cost and a risk of disruption in service delivery.

IBM FlashSystem shared flash storage systems will:

- Eliminate I/O bottlenecks in mission critical SAP workloads
- Provide the lowest latency of any SAN-based storage solution for time-sensitive workloads with IBM MicroLatency™
- Enable a small, cost-effective pool of flash storage to deliver extreme performance improvements
- Support a phased approach to HANA adoption by delivering consistently higher performance for SAP BW workloads with no re-architecture required

## Virtual Servers and VDI with IBM FlashSystem

Customer Challenge - Virtualized servers and Virtual Desktop Infrastructure (VDI) push conventional storage systems to their performance limits due to the high frequency of reads associated with virtual system start up resulting in poor application response times and a bad customer experience. Introducing an IBM FlashSystem into virtualized environments will result in up to **16x** faster response times for the most common virtualized applications. Couple this performance of the 'log on' or 'boot' storm and make system use productive again.

IBM FlashSystem shared flash storage systems will:

- Eliminate I/O density and hot spot issues that are common in highly virtualized environments
- Control and mitigate 'log on' or 'boot' storm performance issue
- Deliver storage consolidation without sacrificing performance, thus driving a higher V:P ratios thus increasing server utilization

## Oracle Acceleration with IBM FlashSystem

Customer Challenge – Most Oracle applications are highly read-intensive. As such, additional processing power alone does little or nothing to improve performance. By placing all read data on low latency flash storage, reads will be performed much faster, boosting Oracle performance by up to 12x over conventional disk systems with no tuning or changes to the code or system architecture.

IBM FlashSystem shared flash storage systems will:

- Decrease I/O wait time in mission critical Oracle workloads
- Deliver the lowest latency available on any SAN platform
- Accelerate commonly I/O-bound workloads, including transactional, batch and complex analytics

## Storage Architectures using Flash

Flash technology is used in a variety of storage architecture. As a full line storage vendor, IBM provides products in every category. Knowing the advantages of each architecture allows proper product positioning tailored to the customer environment, budget and situation. The following is a look at the various architectures listed as well as key advantages and disadvantages of each. They are listed in order of low latency (speed) to highest latency.

### ***1. In-Memory Acceleration***

This architecture is application specific and features the entire database and applications inside the physical memory (DRAM) of the system. In-Memory databases are fast because they are designed from the ground up to optimize in-memory database access as well as eliminate data-path access complexity inherited by a traditional RDBMS and data access located on storage. Examples of In-Memory databases include SAP HANA, Oracle Exadata and IBM DB2 BLU.

### **FlashSystem Opportunity**

IBM FlashSystem addresses many of the same issues that cause customers to consider in-memory solutions. Adoption of this technology involves system purchases, data center re-architecture, and different software licensing. The IBM FlashSystem is a non-invasive solution at potentially a fraction of the price of a In-memory transformation.

#### **Advantages**

- Very Fast – eliminates latency from disk access
- May eliminate need for SAN storage

#### **Disadvantages**

- Likely requires HW re-architecture
- Can't lay an in-memory DB on top of an existing DBs
- Software must be rewritten for the new database
- Requires DRAM and Servers and careful sizing

#### **Vendors/Products**

SAP HANA, Oracle Exadata, IBM DB2 BLU

## **2. In-Server Cache**

This architecture involves installing a PCIe card with flash storage into a server. This is ideal for server-specific application response time issues.

### **FlashSystem Opportunity**

The IBM FlashSystem can be used in concert with in-server cache to provide access to flash data across systems. If the in-server cache is configured as cache, IBM FlashSystem will provide quick access to the server's storage.

#### **Advantages**

- Fastest Flash Solution
- Very low latency & high bandwidth
- Can be configured as cache or storage

#### **Disadvantages**

- Limited in sharing of data
- Limited in density
- Requires 'some' CPU and memory resources
- Challenged in data mobility, replication and clustered applications.

#### **Vendors/Products**

IBM, Fusion-io, Vioin, EMC XtremIO

### **3. Networked, All-Flash HW-Based Arrays**

This architecture features Flash implemented in a hardware appliance that include the ability to network the storage.

#### **FlashSystem Opportunity**

This is the architecture used by IBM FlashSystem product line. The main competitor in this group Violin does include some advanced management features such as snapshots, clones, replication, deduplication and thin provisioning in their product set. Depending upon the customer need, the IBM SAN Volume controller, which adds advanced management functions such as storage virtualization, storage tiering, advanced copy services and real time compression, should be proposed with the FlashSystem unit.

#### **Advantages**

- Lowest latency on networked, shared Flash
- Higher efficiency levels on server, application and storage
- FPGA controlled data path and data protection
- Controllers built to leverage and optimize flash media

#### **Disadvantages**

- Capacities relatively smaller than disk-hybrid arrays

#### **Vendors/Products**

IBM FlashSystem, Violin – non-HA series 3000, HA series 6000

### **4. Networked, All-Flash SW-Based Architectures**

This architecture features flash implemented in an appliance that uses software for flash optimization and integration of advanced storage functionality.

#### **FlashSystem Opportunity**

These appliances feature advanced storage functionality. Depending upon the customer need, the IBM SAN Volume controller, which adds advanced management functions such as storage virtualization, storage tiering, advanced copy services and real time compression, should be proposed with the FlashSystem unit.

#### **Advantages**

- Provides advanced storage functionality
- Allows products faster to market leveraging existing technology.
- Better power, cooling and performance than traditional disk hybrids
- Better TCO when considering capacity and good-enough latency

#### **Disadvantages**

- Compromises performance (latency) for functionality

**Vendors/Products**

EMC XtremIO (announced May 2013), HP 3PAR (SSD architecture), HDS VSP (SSD architecture using MLC technology), Dell Compellent

**5. Hybrid Arrays**

These arrays use a combination of SSD flash and traditional hard disk drives. Software is used to tier the data, moving 'hot' data to the SSDs and cooler data to the HDDs to optimize performance.

**FlashSystem Opportunity**

These systems generally have integrated tiering software to utilize the combination of SSD and HDD. IBM FlashSystem can serve at the top tier storage layer for these units, speeding up access to the data.

**Advantages**

- Better power, cooling and performance than traditional disk hybrids
- Better TCO when considering capacity and good-enough latency
- A few SSDs can speed up slow disk arrays
- Cost effective, Great for capacity consolidation
- Good-enough "performance"

**Disadvantages**

- Uses SAS protocol instead of flash controller, which does not leverage full speed and functionality of flash media.
- SSD is only used for the most used data.

**Vendors/Products**

IBM: DS8000, XIV Storage System, V7000, Hitachi: Unified Storage (110,130,150), Unified Storage VM, Virtual Storage Platform, HP: 3PAR P10000 (V-Class), EMC: VNX 7500, Symmetrix VMAX 10000, NetApp: FAS 6200, N-Series, EF540, N-Series NetApp

## IBM FlashSystem 840

IBM FlashSystem 840 is designed to provide scalable performance and availability and includes:

- Up to sixteen ports of 8 Gbps or eight ports of 16 Gbps Fibre Channel
- Up to sixteen ports of 10 Gbps Fibre Channel over Ethernet (FCoE) support
- Up to sixteen ports of 10Gb iSCSI
- Up to eight ports of 40 Gbps QDR InfiniBand
- RAID 0 or RAID 5
- 2 TB to 48 TB of usable capacity
- AES XTS 256 data-at-rest encryption
- Full enterprise-grade RAS features
- 2U Form factor

## IBM FlashSystem V840

IBM FlashSystem V840 Storage System is designed for high availability and combines FlashSystem technology with the advanced functions of software-defined storage. This product features two FlashSystem V840 control enclosures, one FlashSystem V840 storage enclosure, an 8 Gb FC adapter packaged in a 6U form factor package.

A FlashSystem V840 system scales up to twelve flash modules in 2TB (providing Raid 5 protection capacity of 4TB, 12TB and 20TB) or 4TB (providing RAID 5 protection capacity of 8TB, 24TB and 40TB) units.

IBM FlashSystem V840 Software V7 for FlashSystem V840 include:

- Virtualization of FlashSystem V840 Storage Enclosures enabling rapid, flexible provisioning and simple configuration changes
- FlashCopy
- Thin provisioning
- One-way data migration
- Innovative GUI management capabilities
- Extensive interoperability with support for most major server platforms and operating systems

FlashSystem V840 software optional features include:

- Real-time compression
- Remote mirroring through Metro Mirror and Global Mirror functions
- Virtualization of external storage

## IBM FlashSystem Product Breakdown

. Find below a breakdown of the important characteristics of the IBM FlashSystem.

| System                               | IBM FlashSystem 840                          |
|--------------------------------------|--|
| Model                                | 9840-AE1<br>9843-AE1                         |
| High Availability                    | Yes  |
| Flash Type                           | eMLC   |
| Hot Swap Flash Module                | Yes  |
| Size Flash Module (TB)               | 1,2,4  |
| Maximum Capacity Usable Options (TB) | 2,4,8,12,16,20,24,32,40,48                   |
| Size (Rack Units)                    | 2U   |
| Read IOPS (x1000)                    | 1,100  |
| Write IOPS (x1000)                   | 600  |
| Band Width (GB/s)                    | 8  |
| Latency microseconds (read/write)    | 135/90                                       |
| Native Interfaces & SAN              | FC-4Gb/s, FC-8Gb/s, FC-16Gb/s, FCoE, IB      |
| Data Protection                      | 2D RAID across flash chips and flash modules |
| System RAID?                         | System Level RAID 5 across modules           |
| Encryption                           | Available                                    |
| Power (Watts)                        | 625  |

## IBM FlashSystem vs. Violin Memory – HA Arrays

The following breakdown is a comparison of the closest competing product to the IBM FlashSystem.

| System                  | IBM FlashSystem 840         | Violin Memory 6212     | Violin Memory 6234     | Violin Memory 6606     | Violin Memory 6616     |
|-------------------------|-----------------------------|------------------------|------------------------|------------------------|------------------------|
| High Availability       | Yes                         | Yes                    | Yes                    | Yes                    | Yes                    |
| Flash Type              | eMLC                        | MLC                    | MLC                    | SLC                    | SLC                    |
| Capacity Raw (TB)       | 66                          | 13                     | 70                     | 7                      | 18                     |
| Capacity Usable (TB)    | 48                          | 10                     | 64                     | 5                      | 13                     |
| Size (Rack Units)       | 2U                          | 3U                     | 3U                     | 3U                     | 3U                     |
| IOPS (x1000)            | 1,100                       | 200                    | 750                    | 400                    | 1000                   |
| Band Width (GB/s)       | 8                           | .8                     | 4                      | 1.6                    | 4                      |
| Native Interfaces & SAN | FC (4,8,16), FCoE, IB       | FC,iSCSI/FCoE,IB,PCIe  | FC,iSCSI/FCoE,IB,PCIe  | FC,iSCSI/FCoE,IB,PCIe  | FC,iSCSI/FCoE,IB,PCIe  |
| Chip RAID?              | Yes (9+1 VSR across chips)  | No                     | No                     | No                     | No                     |
| System RAID?            | Yes (10+1+1 across modules) | Yes (4+1 across VIMMs) |
| Power (Watts)           | 625                         | 1,355                  | 1,500                  | 1,119                  | 1,693                  |

### IBM Strengths

- Durability of flash media technology eMLC vs MLC
- Multi-Level reliability: less modules to replace plus VSR + 2 RAID
- FlashSystem uses less than ½ the power and 1/3 the rack space
- Faster latency
- Faster Band Width
- Faster IOPS

### Violin Strengths

- Advanced management features integrated including snapshots, clones, replication, deduplication and thin provisioning.
- Single units have higher maximum capacities
- More interface selections

## FlashSystem White Papers

### **[Storage Switzerland: All-Flash needs end-to-end storage efficiency](#)**

This paper discusses the storage environment where Flash is advantages. It also discusses some of the advanced storage features and how they relate in a Flash environment. 11/2013

### **[Silverton Consulting: IBM FlashSystem 840 RAS for Better Performance and Data Protection](#)**

This whitepaper details the reliability, availability and serviceability (RAS) features of the IBM FlashSystem 840 and discusses what makes it different in the market. 11/2013

### **[Enterprise Strategy Group: The IBM FlashSystem 840: Technical Evolution to Deliver Business Value](#)**

This paper discusses the overall Flash market and the business value Flash provides. It also details the features of the IBM FlashSystem 840 that make it a market leader. 10/2013

### **[Enterprise Strategy Group: Market Landscape Report – Solid-state Storage](#)**

This industry white paper provides the cases for, types of and purchasing considerations for solid-state storage. This is a vendor agnostic downloadable report from HP's web site. 05/2013

### **[Demartek: SSD Deployment Guide](#)**

This guide is designed to provide basic information about SSDs and practical guidance for planning and deploying SSD technology and products. Although a bit dated, it contains valuable information on the current flash media technology currently being deployed. 04/2012

### **[IBM: IBM FlashSystem – Answering the call for performance in the telecom industry](#)**

This whitepaper presents the value proposition of IBM FlashSystem to the telecom industry 04/2013

### **[IBM: Accelerating eCommerce with IBM Flash](#)**

This whitepaper presents the value proposition of IBM FlashSystem with eCommerce solutions 04/2013

**[IBM: FlashSystem – Driving productivity and efficiency in the healthcare industry](#)**

This whitepaper presents the value proposition of IBM FlashSystem to the healthcare industry  
04/2013

**[IBM: Technical computing benefits with IBM FlashSystem](#)**

This whitepaper presents the value proposition of IBM FlashSystem with technical computing including extreme IOPS and very low latency 04/2013

**[IBM: Utilizing IBM FlashSystem in the Securities Industry](#)**

This whitepaper presents the value proposition of IBM FlashSystem to the securities industry  
04/2013

**[IBM: Faster Oracle performance with IBM FlashSystem](#)**

This whitepaper discusses methods for improving Oracle® database performance using flash storage to accelerate the most resource-intensive data that slows performance across the board. 05/2014

**[IBM: In-Memory databases versus flash arrays](#)**

A single IBM FlashSystem can support a cluster or grid of in-memory database servers with no additional costs, facilitating independent scaling of processor and memory needs of an application. This whitepaper highlights the benefits of external flash 04/2013

**FlashSystem IBM® Redbooks®**

**[IBM FlashSystem 840 Product Guide](#)**

This IBM® Redbooks® Solution Guide provides product details of the IBM FlashSystem 840.

**[IBM FlashSystem 840 combined with IBM SVC](#)**

This IBM® Redbooks® Solution Guide describes the benefits that are gained by integrating IBM FlashSystem 840 into IBM System Storage SAN Volume Controller environments.

**[Flash or SSD: Why and When to Use IBM FlashSystem](#)**

This IBM® Redpaper™ publication explains how to select an IBM FlashSystem™ or solid-state drive (SSD) solution. It describes why and when to use FlashSystem products, and reviews total cost of ownership (TCO), economics, performance, scalability, power, and cooling. 06/2013

### **[IBM FlashSystem in OLTP Database Environments](#)**

This IBM® Redbooks® Solution Guide describes how IBM flash storage systems drive extreme performance, cost efficiencies, and enterprise reliability to satisfy the demanding requirements of an OLTP implementation. 03/2013

### **[IBM FlashSystem in OLAP Database Environments](#)**

This IBM® Redbooks® Solution Guide explains how IBM flash storage systems drives extreme performance, cost efficiencies, and enterprise reliability to satisfy the requirements of an OLAP implementation. 03/2013

### **[IBM FlashSystem in IBM PureFlex System Environments](#)**

This solution describes the synergy between a FlashSystem storage system that is bundled with an IBM System Storage® SAN Volume Controller that is attached to IBM PureFlex Systems, and how running in this environment enables your enterprise to go beyond blade servers by providing high performance, easily integrated components, and increased flexibility for your enterprise. 08/2013

### **[Faster DB2 Performance with IBM FlashSystem](#)**

This IBM® Redbooks® Solution Guide provides an overview of IBM FlashSystem™ running in a DB2® environment with a focus on performance and the benefits gained from running DB2 with Flash storage. 06/2013

### **[IBM FlashSystem in a Virtual Desktop Environment Solution Guide](#)**

This Solution Guide describes the benefits of the IBM FlashSystem solution for VDI. 06/2013

### **[Faster Microsoft SQL Server Performance with IBM Flash System Storage](#)**

This IBM® Redbooks® Solution Guide provides an overview of how to identify storage performance bottlenecks and improve Microsoft SQL Server database performance by using IBM FlashSystem™ storage to accelerate the most resource-intensive data operations. 07/2013