

# IBM FlashSystem in IBM PureFlex System Environments

## IBM Redbooks Solution Guide

IBM® FlashSystem™ storage systems deliver high performance, efficiency, and reliability for shared enterprise storage environments. FlashSystem storage systems help clients around the world address performance issues with their most important applications and infrastructures, which provide capabilities for big data and cloud-computing environments. IBM PureFlex™ System (a member of the IBM PureSystems™ family) combines storage, networking, virtualization, and management into a single infrastructure.

This IBM Redbooks® Solution Guide provides an overview of IBM PureFlex System, and illustrates how an IBM FlashSystem storage system that is running in a PureFlex System environment adds performance, IBM MicroLatency™, macro efficiency, and enterprise reliability to a cloud-computing ready solution.

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. Figure 1 illustrates the benefits of IBM FlashSystem products that are integrated in to an IBM PureFlex System environment.

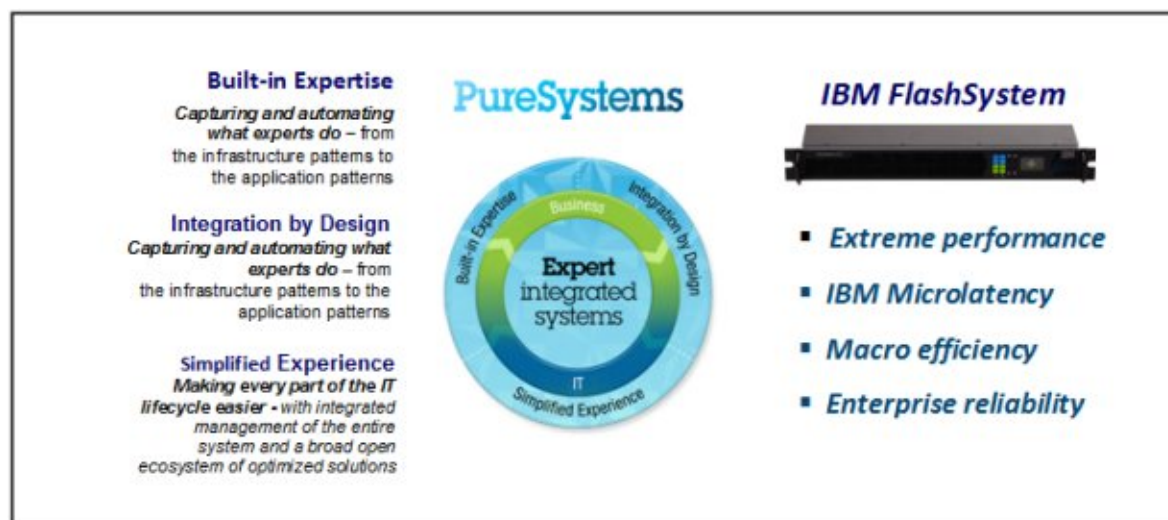


Figure 1. FlashSystem benefits running on PureFlex Expert integrated systems

## Did you know?

- FlashSystem storage systems deliver up to 525,000 read IOPS with less than 110 microseconds of latency, which means that PureFlex System can support high performance workloads that require microsecond latencies that cannot be supported by using traditional hard disk drive and solid-state drive architectures.
- FlashSystem products have low power consumption, a small footprint, and can be easily integrated into your existing PureFlex System environment.
- FlashSystem storage products can be ordered individually or bundled with SAN Volume Controller to provide advanced functionality, such as Thin Provisioning, IBM Easy Tier®, and IBM FlashCopy®.

For information about how to order FlashSystem or the FlashSystem Solution bundling features, see the following link:

<http://ibm.co/13IFrdu>

## Business value

Today, customers are challenged with the lack of solutions to manage an exponential growth in the volume of structured and unstructured data, as well as shrinking product cycles and focus on top-line growth. Customers are looking for infrastructure solutions that can be deployed rapidly, managed easily, and that can run optimally without compromising reliability. In a 24x7 market, clients often strive to achieve maximum performance that is coupled with deep features and functionality. And this performance must be delivered in a cost-effective manner. The following section describes these challenges, what customers want, and how FlashSystem storage running in a PureFlex System environment can help overcome these challenges.

### The challenge

Businesses today face the following several critical challenges that impact profit margins, productivity, revenue, and customer satisfaction:

- Complex IT infrastructure
- Aging infrastructure with little or no flexibility
- Server and storage capacity saturation
- Low utilization and efficiency (un-optimized applications)
- Significant performance bottlenecks
- High operational cost
- Increasing management and administration costs
- Increasing energy footprint (high workload deployment delay)

### What customers want

To overcome these challenges, companies are looking at end-to-end solutions that offer the following items:

- Seamless hardware integration across server, storage, and networking
- Centralized management on the compute, storage, and network layers
- High-performance compute nodes, which are ideal for high-end virtualization, mainstream databases, and memory-intensive high-performance workloads

- Enterprise-class storage solution with Fibre Channel, which provides reliability along with virtualization support, tier support, thin provisioning, compression features, high performance, low latency, and low cost
- Integrated FlashSystem storage in the existing infrastructure
- Enterprise-class networking solution to support growing businesses' bandwidth needs and support for open standards, such as 802.1qbg with virtual machine-aware switches
- Improved workload optimization and deployment solutions

### **The solution: FlashSystem running in a PureFlex System environment**

Flash technology fundamentally changed the paradigm for IT systems, enabling new usage cases and unlocking the scale of enterprise applications. Flash enhances the performance, efficiency, reliability, and design of essential enterprise applications and solutions by addressing the bottleneck in the IT process (data storage), enabling a truly optimized information infrastructure.

PureFlex System is a comprehensive infrastructure system that provides an expert integrated computing system, combining servers, enterprise storage, networking, virtualization, and management into a single structure. Its built-in expertise enables organizations to simplify management and flexibly deploy integrated patterns of virtual and hardware resources throughout unified management. FlashSystem storage products running in a PureSystem Environment as an end-to-end solution help overcome these challenges.

Figure 2 shows the synergies of FlashSystem with PureFlex and Flex systems.

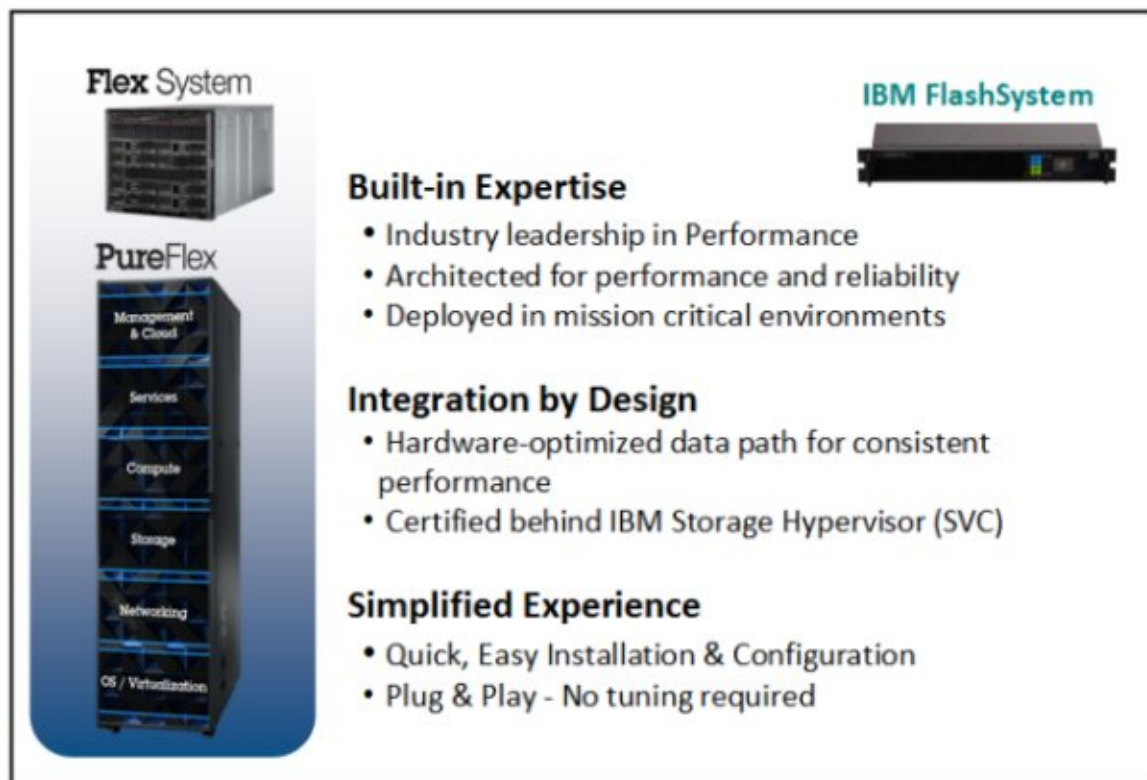


Figure 2. PureSystems and FlashSystem synergies

FlashSystem storage in a PureFlex system environment offers the following enhancements:

- Support for application workloads that require microsecond latencies and improved performance capabilities of applications that can use low latencies with IBM MicroLatency and extreme performance.
- With improved efficiency of design, more compute/storage capabilities can be packed in to the same footprint with macro efficiency.
- FlashSystem products have durable and reliable designs that use enterprise-class flash technology and patented data-protection technology with enterprise reliability. FlashSystem devices are designed for cost-effective and high-storage performance that is used to accelerate critical business applications. FlashSystem devices feature patented Variable Stripe RAID (VSR™), 2D flash RAID, Active Spare support, error correction code (ECC) at the chip level, and other reliability technologies.

Figure 3 shows the IT building blocks of PureFlex System, and the improved performance capabilities and improved efficiencies that IBM FlashSystem storage adds to this environment.

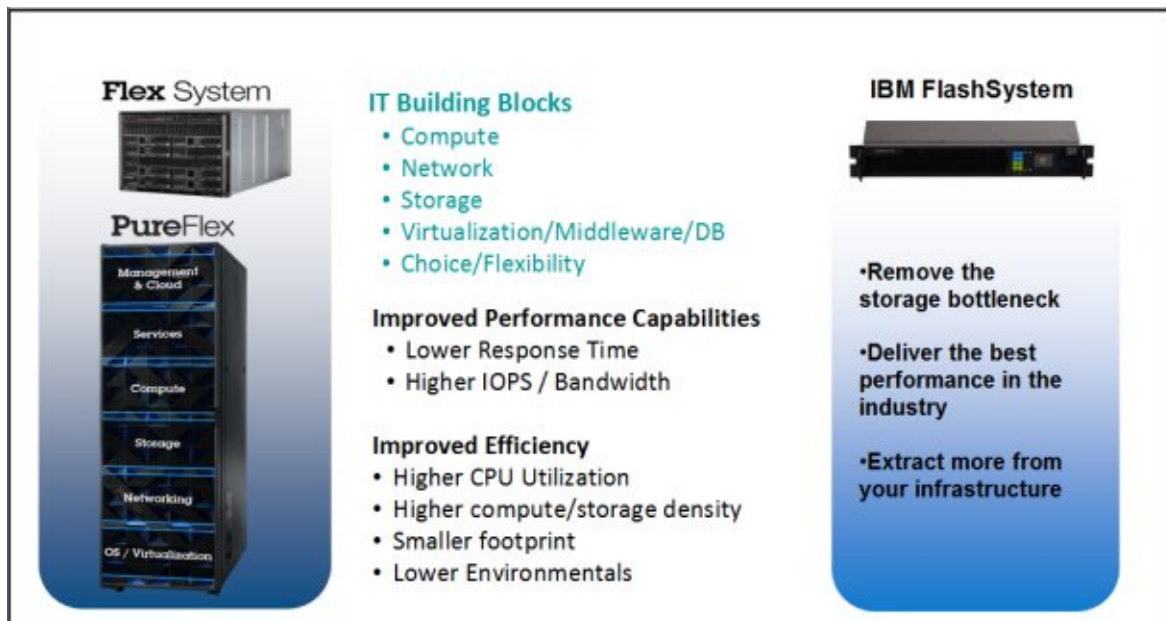



Figure 3 FlashSystem and PureFlex System efficiency in design - performance and scale

## FlashSystem

FlashSystem 710 and 720 are single level cell (SLC) flash. FlashSystem 810 and 820 are multi-level cell (eMLC) flash. A key differentiator between FlashSystem 710/810 and 720/820 storage systems is the high availability option, with 5 - 20 TB capacity that is offered by 720/820 products. Capacity is 1 - 10 TB for the 710/810 and 5 - 20 TB for the 720/820. Figure 4 compares the FlashSystem offerings.



	SLC Flash		eMLC Flash	
Model	710	720	810	820
Capacity	1.5 TB	5 or 10 TB	2-10 TB	10 or 20 TB
Latency (R/W)	100/60 us	100/25 us	110/60 us	110/25 us
IOPS	570K	525K	550K	525K
Bandwidth	5GB/s	5GB/s	5GB/s	5GB/s
Interfaces	4x 8Gb FC or 4x 40Gb IB		4x 8Gb FC or 4x 40Gb IB	
Data Protection	VSR™	2D Flash RAID™ (inc. VSR™)	VSR™	2D Flash RAID™ (inc. VSR™)

Figure 4. FlashSystem product choices

FlashSystem storage products combine extreme performance, IBM MicroLatency, macro efficiency, and enterprise reliability to provide the following advantages over other forms of storage:

### Extreme performance

FlashSystem provides the following features to produce extreme performance:

- FlashSystem products enable businesses to unleash the power of performance, scale, and insight to drive services and products to market faster.
- FlashSystem products increase application performance as much as 10x faster than other storage solutions. When compared to equivalent disk systems, IBM flash memory solutions deliver capacity in a single 1U rack, and are 19x more cost-efficient.
- These solutions include the latest in industry standard, solid-state flash memory technology, including enterprise multi-level cell (eMLC) flash technology and single-level cell (SLC) flash technology. Data is moved through the system as quickly as possible, with no bottlenecks.
- Capacity is 1 - 10 TB for FlashSystem 710 and 810 models and 6 - 24 TB for FlashSystem 720 and 820 models.

## **IBM MicroLatency**

IBM MicroLatency provides the following features:

- FlashSystem products deliver a fast response time to accelerate critical applications. MicroLatency (with a roughly 110 ms access time) enables faster decision making by facilitating an extreme-performance data path to accelerate critical applications and help you achieve a true market-based competitive advantage.
- DRAM on each module helps enable fast writes at 25 ms. A purpose-driven and highly parallel design maximizes host processor efficiency and productivity.

## **Macro efficiency**

FlashSystem products can help you consolidate hardware and software, increase deployment speed, reduce work for IT staff, and provide power and cooling savings:

- FlashSystem storage can help you achieve business benefits with the following components:
  - A 1U form factor, which has a minimal footprint for optimum ROI.
  - Two dual-port 8 GB Fibre Channel controllers or dual-port 40 GB QDR InfiniBand controllers.
  - 350 watt or less power draw.
  - Hot-swap flash modules to enable uninterrupted operations.
  - You can place up to a petabyte (PB) of FlashSystem storage in a single rack, on a single floor tile.
- FlashSystem storage systems offer the following energy-efficiency features to save energy, reduce operational costs, increase energy availability, and contribute to a green environment:
  - Energy-efficient flash components help lower operational costs.
  - FlashSystem storage systems offer one of the industry's best IOPS per watt ratio to maximize energy savings.
  - FlashSystem storage systems use hexagonal ventilation holes, a part of IBM Calibrated Vectors Cooling™ technology. Hexagonal holes can be grouped more densely than round holes, providing more efficient airflow through the system.

## **Enterprise reliability**

FlashSystem provides the following features to provide enterprise reliability:

- FlashSystem products have durable and reliable designs that use enterprise-class flash technology and patented data-protection technology.
- FlashSystem storage uses flash solid-state storage technology. FlashSystem devices are designed for cost-effective and high-storage performance that is used to accelerate critical business applications. FlashSystem devices feature patented Variable Stripe RAID (VSR™), 2D flash RAID, Active Spare support, error correction code (ECC) at the chip level, and other reliability technologies.
- Two-dimensional flash RAID eliminates single points of failure and provides enhanced system-level reliability. VSR technology helps reduce business interruptions and prevent chip failures to enhance the two-dimensional protection mechanism. It also maintains performance capacity levels.

## IBM PureFlex System

IBM PureFlex System is designed to enable companies to improve the way they deploy and manage their IT environments to achieve key benefits:

- Consolidation:
  - An integrated infrastructure that supports compute, network, and storage resources to reduce physical space, hardware and software costs, maintenance, and energy usage.
  - A highly flexible choice for compute, OS, and hypervisor technology, yielding low cost in moving legacy applications and adding new applications.
  - Integrated storage management of IBM Storwize® V7000, or through the SAN Volume Controller / FlashSystem solution that is externally attached and configured with IBM PureFlex System.
- Optimization:
  - "Single pane of glass" management of all resources with automated processes, yielding a reduction in the skill requirement and time that is required to manage and deploy a system.
  - Dynamic System Scaling: Workload Optimization, deployment under five minutes, and faster storage deployment and provisioning.
  - Dynamic Workload provisioning and deployment.
  - Tightly integrated server, network, and storage resources, which leads to improved setup time and energy savings of up to 42 percent.
- Innovation:
  - Rapidly deploying new applications with built-in patterns of expertise.
  - Patterns are applied across compute, storage, and network resources of the IBM PureFlex System, providing a foundation for simplifying the deployment of tuned partner applications.
  - Faster and simpler application deployment. ISVs can provide virtual appliances that can be downloaded and run as is, complete, and ready for use.
- Security:
  - IBM PureFlex System uses the Trusted Computing Group standards to create a secure infrastructure across the compute, network, and storage elements. Security is ensured at various levels:
    - Secure Boot: Ensures that only trusted firmware, hypervisor, and workloads are run on the IBM hardware.
    - Hardware SPI headers: Uses methods to read the flash device headers in the field to validate firmware authenticity and ensure that the system is not a victim of supply chain attacks.
    - Secure Management traffic: Ensures that traffic between the Chassis Management Modules, Flex System Manager, and compute nodes are encrypted and secure. Network isolation between servers is implemented by using VLANs.
- Management:
  - IBM Flex System™ Manager provides a single pane of glass to manage hardware, software, virtualization, workloads, networks, and storage elements seamlessly.
  - The management solutions come with integrated views, an intuitive GUI, and can manage and deploy workloads intelligently based on resource availability and predefined policies, and manage events and alerts to increase system availability and reduce downtime while reducing operational costs.



- o Flex System Manager is provided as an appliance in a dedicated compute node. Here are the key features of Flex System Manager:
  - Multiple view overlays to track system health, firmware inventory, and environmental metrics .
  - Configuration management for the setup of compute, network, and storage devices.
  - Remote presence application for remote access to compute nodes with single sign-on.
  - Flex System Manager enables virtualization and workload optimization through various policies, such as resource utilization, resource pooling, and intelligent automation.

Figure 5 shows the PureFlex System components and form factor from the front and back.

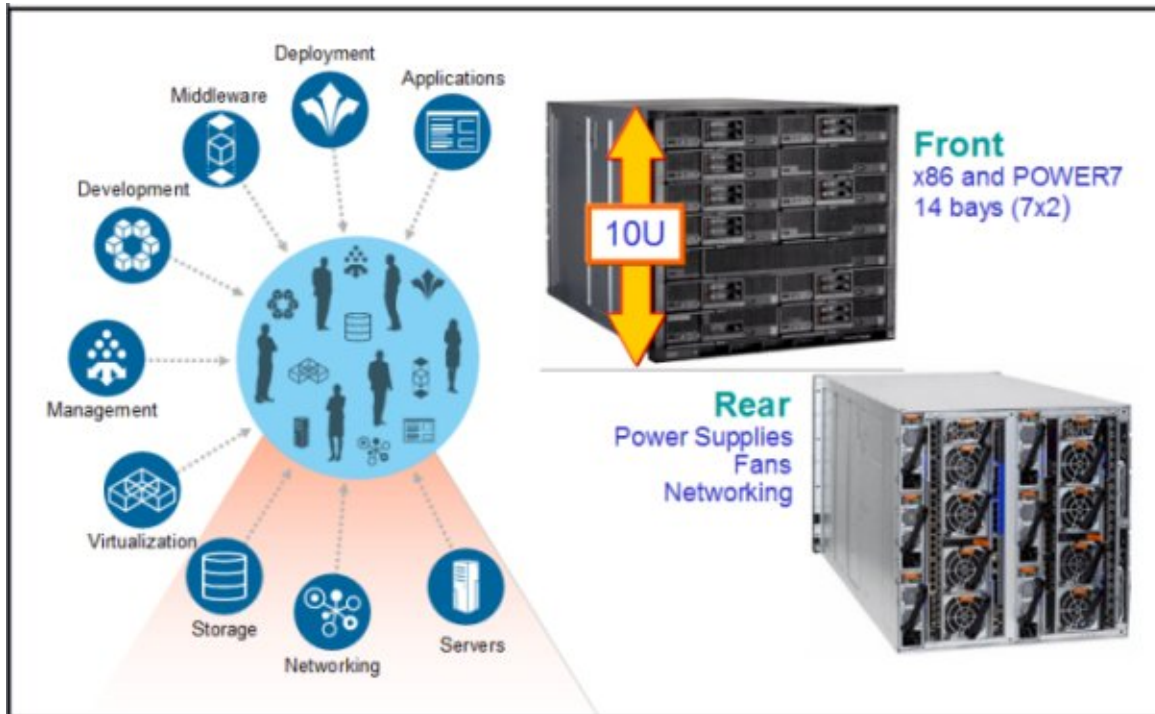


Figure 5. PureFlex System components and form factor - front and back

## Solution overview

Deploying FlashSystem storage, which is a shareable, rack-mounted, and all-flash array, into a PureFlex System environment adds unparalleled reliability, capacity density, and the fastest response time. Our solution consists of compute nodes, the FlashSystem 820 / SAN Volume Controller bundle, a LAN infrastructure, and a SAN infrastructure that connects it all together with the value that FlashSystem brings to IBM PureFlex System in a cloud-scale infrastructure. An IBM PureFlex System solution with FlashSystem storage systems consists of the following components:

- Server building blocks include the IBM PureFlex System.
- Flash storage systems (IBM FlashSystem 820) are attached directly to the chassis by using top of the rack Fibre Channel switches, and the SAN backbone. For more functionality, a tier 0 Flash layer is bundled with the SAN Volume Controller, which is built into this solution architecture and uses flash as a way to accelerate mission critical workloads.



Figure 6 illustrates the IBM PureFlex System building blocks and supported attached storage, including the FlashSystem SAN Volume Controller bundle.

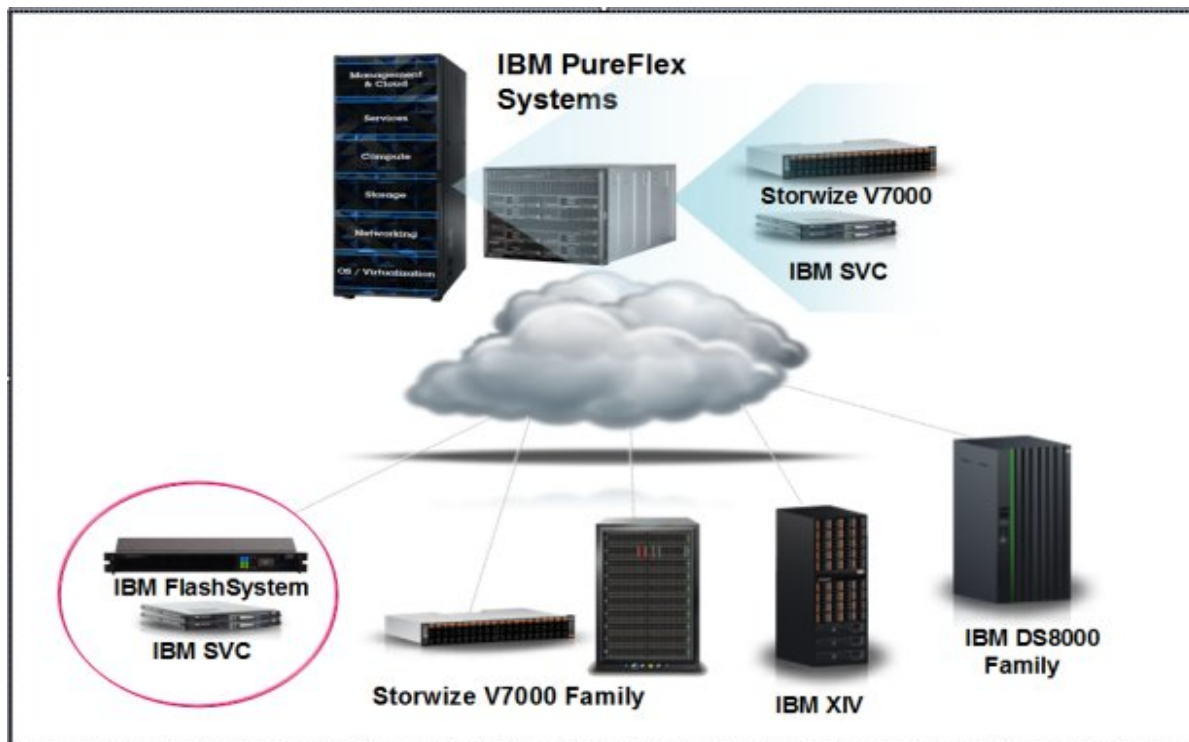


Figure 6. IBM PureFlex System - supported storage and the IBM FlashSystem / SAN Volume Controller bundle

### FlashSystem and the SAN Volume Controller bundle

SAN Volume Controller is widely regarded as the industry-leading standard when it comes to storage virtualization. SAN Volume Controller has been shipping for almost 10 years (at the time of writing) and provides a single point of management and control for small to large heterogeneous storage environments. For more information about SAN Volume Controller, see the following website:

<http://www.ibm.com/storage/svc>

FlashSystem storage systems can also be used as the top tier of storage with traditional arrays in tiered storage architectures, such as the IBM Easy Tier functionality that is available in the SAN Volume Controller or IBM Storwize V7000 storage virtualization platforms.

For information about how to order FlashSystem storage or the FlashSystem solution bundling features, see the *New IBM FlashSystem 720 and FlashSystem 820 high-performance flash storage systems* Announcement A13-0197 at the following website:

<http://ibm.co/14X6yOV>

## SAN Volume Controller compatibility

The SAN Volume Controller product supports a wide range of host operating systems, server platforms, Fibre Channel (FC) SAN switches, and storage controllers. An interoperability matrix for each SAN Volume Controller version is available at the following website:

<http://www.ibm.com/systems/storage/software/virtualization/svc/interop.html>

## Solution architecture

Figure 7 illustrates an architectural overview of the FlashSystem 820 bundled with SAN Volume Controller in a PureFlex System environment solution, including the IBM Flex System Enterprise Chassis, which houses various IBM Flex networking switches, compute nodes, integrated networking fibre switches, and the integrated Flex System Manager appliance. The IBM FlashSystem 820 bundled with SAN Volume Controller is attached to a SAN environment through a fibre switch in the integrated networking component in PureFlex System.

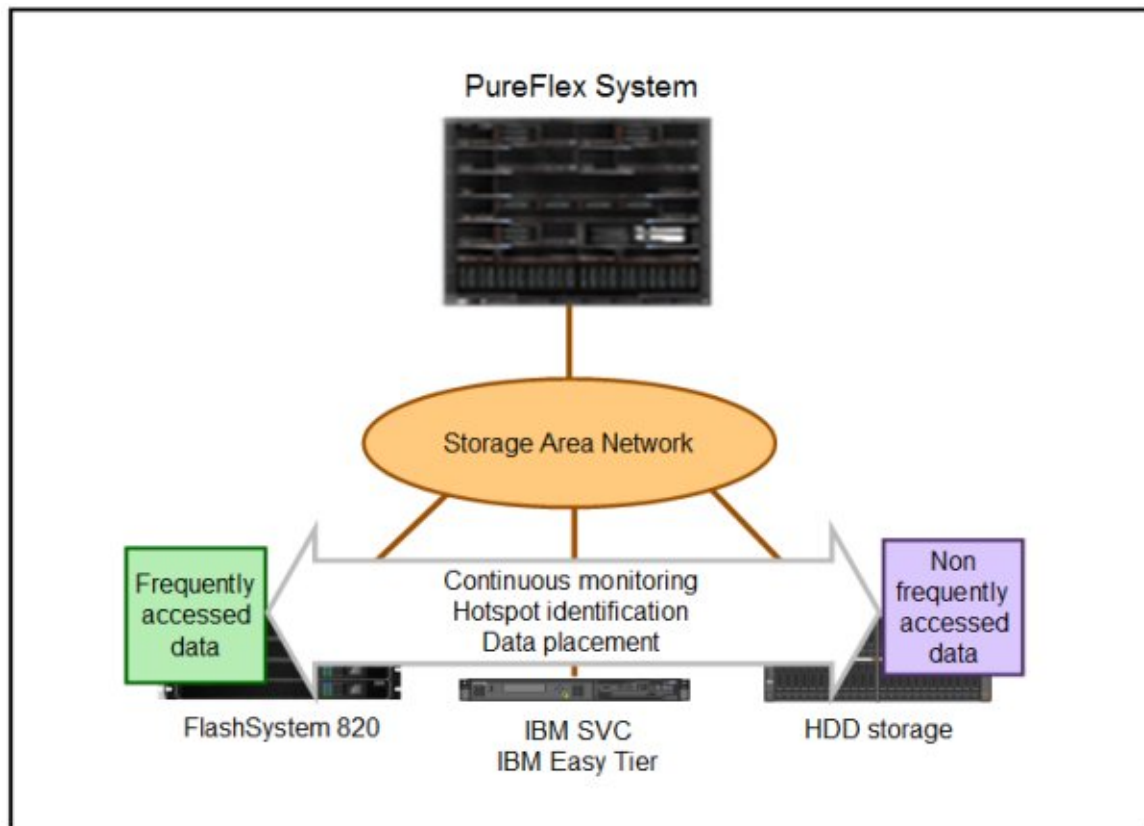


Figure 7. Solution architecture components

The SAN Volume Controller product helps administrators control storage growth more effectively by moving low-activity or inactive data into a hierarchy of lower-cost storage. Administrators can free disk space on higher-value storage for more important, active data. It is achieved by creating various groups of storage, corresponding to underlying storage with various characteristics, for example, speed and reliability. With SAN Volume Controller software, you can better match the cost of the storage that is used to the value of data that is placed on it. Using this solution, you can combine FlashSystem as tier 0 storage with HDD storage, and the data placement and management can be automatically managed by Easy Tier.

## **Solution building blocks**

The following section describes the building blocks that are used in this solution.

### **IBM FlashSystem and SAN Volume Controller bundle**

By combining SAN Volume Controller and IBM FlashSystem in a Flex System Environment, you gain the performance of IBM FlashSystem with IBM MicroLatency and the advanced storage functionality of SAN Volume Controller, which includes the following features:

- Thin provisioning: Allocate storage “just in time”
- Improved utilization: Harvest all SAN capacity
- Disaster avoidance: Location proof data availability
- Easy Tier: Storage efficiency
- FlashCopy: Point-in-time copies
- Mirroring/copy services: Data replication and protection
- IBM Real-time Compression™: Up to 5x more data in the same physical space

### **IBM PureFlex System building blocks**

The basic requirements and building blocks for this solution include the IBM Flex System Enterprise Chassis, which houses various IBM Flex System compute nodes, the Flex System Manager appliance, and networking adapters and switches. These items are described in this section.

#### **IBM 42U 1100mm PureScale Dynamic Rack**

The IBM 42U 1100mm PureScale Dynamic Rack is a server cabinet that is optimized for use with IBM System x® and IBM BladeCenter® systems, and with IBM PureSystems and IBM Flex System products. It offers extraordinary density in a cabinet that can be prepackaged with your choice of equipment and shipped directly to your data center.

The IBM 42U 1100mm PureScale Dynamic Rack solution consists of the IBM 42U 1100mm Enterprise V2 Dynamic Rack (9363-4PX) and IBM 42U 1100mm Enterprise V2 Expansion Rack (9363-4EX).

#### **IBM Flex System Enterprise Chassis**

Here are the major components of the IBM Flex System Enterprise Chassis:

- Fourteen 1-bay compute node bays, which support nodes that are based on both IBM POWER® and x86 processors.
- Six 2500-watt power modules with a redundant power supply.
- Ten fan modules.
- Four physical I/O modules.
- Networking solutions that include Ethernet, Fibre Channel, FCoE, and InfiniBand.
- Two Flex System Manager management appliances for redundancy. Flex System Manager manages up to four chassis.
- Two IBM Chassis Management Modules (CMMs). CMM provides single-chassis management support.

#### **Compute nodes**

IBM PureFlex System offers two major categories of compute nodes that are based on x86 processors (Table 1) or IBM POWER processors (Table 2).

Table 1 shows IBM PureFlex System product offerings.

Table 1. IBM PureFlex System product offerings

Product	Value proposition	Features
Flex System x220 (standard node)	Ideal for infrastructure workloads and entry virtualization	Two Intel Xeon® E5-2400 processors, 16 cores, and 12 DIMMs
Flex System x240 (standard node)	Ideal for mainstream virtualization and enterprise workloads	Two Intel Xeon E5-2600 processors, 16 cores, 24 DIMMs, two hot-swap drives, two PCI Express I/O adapter slots, and an option for two internal USB connectors
Flex System x440 (double-wide node)	Ideal for high-end virtualization, mainstream databases, and memory-intensive high-performance workloads	Two Intel Xeon E5-4600 processors, 32 cores, 48 DIMMs, four I/O adapter slots, and an option for up to two internal drives for local storage

Table 2 shows IBM POWER product offerings.

Table 2. IBM POWER product offerings

Product	Value proposition	Features
System p260 (standard node)	Ideal for infrastructure workloads and entry virtualization	Two IBM POWER7® processor sockets, 16 memory slots, two I/O adapter slots, and an option for up to two internal drives for local storage.
System p24L (standard node)	Ideal for mainstream virtualization and enterprise workloads	Two POWER7 processor sockets, 16 memory slots, two I/O adapter slots, and an option for up to two internal drives for local storage. The IBM PureFlex System p24L Compute Node is optimized for lower-cost Linux installations.
System p460 (double-wide node)	Ideal for high-end virtualization, mainstream databases, and memory-intensive high-performance workloads	Four POWER7 processor sockets, 32 memory slots, four I/O adapter slots, and an option for up to two internal drives for local storage.

## IBM Flex System Manager

The IBM Flex System Manager™ (FSM) is designed to optimize the physical and virtual resources of the IBM PureFlex System infrastructure while simplifying and automating repetitive tasks. From easy system setup procedures with wizards and built-in expertise, to consolidated monitoring for all of your resources (compute, storage, networking, virtualization, and energy), the Flex System Manager provides core management functionality along with automation. It is an ideal solution that allows you to reduce administrative expense and focus your efforts on business innovation.

The FSM provides a real-time interactive chassis map to simplify monitoring and management of resources in the Enterprise chassis. The FSM provides access to power and health monitoring of nodes and also configuration of installed nodes, and simplifies deployment of workloads across compute nodes. It is a central point of management for every element in the Enterprise chassis. A single FSM can manage up to four enterprise chassis.

For a single user interface, you get the following features:

- Intelligent automation
- Resource pooling
- Improved resource utilization
- Complete management integration

### **IBM Flex System Fabric EN4093 10Gb Scalable Switch**

The IBM Flex System Fabric EN4093 10Gb Scalable Switch supports 10 Gb and 1 Gb Ethernet. It provides unmatched scalability and performance while also delivering innovations to help address a number of networking concerns and providing capabilities that help you prepare for the future. It is suited to clients who are building a 10 Gb infrastructure or implementing a virtual environment, require investment protection for 40 Gb uplinks, and who want to reduce TCO, improve performance, and maintain high levels of availability and security.

### **IBM Flex System FC3171 8Gb SAN Switch**

The IBM Flex System FC3171 8Gb SAN Switch from QLogic provides an integrated, simple connection to existing SAN fabrics and storage. It is based on QLogic Fibre Channel expertise. The switch is designed to set up quickly and be easy to manage. You can minimize time and risk and support faster access to your data faster and make quicker and better business decisions. It combines ports to provide port aggregation to increase bandwidth, and automatic failover.

## **Usage scenarios**

High-performance computing and computation intensive applications such as simulations, modeling, advanced graphic rendering, metadata, scratch space, video-on-demand, content on demand, and thread efficiency, are all excellent candidates for running in a PureSystem environment with FlashSystem storage. Businesses that incorporate cloud scale infrastructures, on-demand computing, capacity on demand, elastic capacity, content distribution, and web caching, are all candidates for IBM FlashSystem technology.

### **FlashSystem / SAN Volume Controller Tiered scenario**

With the introduction of the SAN Volume Controller and IBM FlashSystem bundle, a solution exists that enables you to gain the following benefits:

- The performance, low latency, high efficiency, and reliability of IBM FlashSystem Integration.
- Advanced storage functionality of the SAN Volume Controller.
- Storage virtualization: Provides effective cloud deployment.
- Thin provisioning: Allocates storage “just in time”.
- Easy Tier: Storage efficiency:
  - FlashCopy: Point-in-time copies
  - Mirroring/Copy services: Data replication and protection
  - Real-time Compression: Up to 5x more data in the same physical space
- An ability to deploy cost-effectively and quickly and realize immediate results through services:
  - IBM FlashSystem and SAN Volume Controller integration bundle
  - FlashSystem SAN Volume Controller Data Migration

The IBM FlashSystem is all about being fast and resilient to minimize latency. For clients who want advanced software features such as mirroring, FlashCopy, thin provisioning, Real-Time Compression (RtC), and broader host support, the best way to achieve all of that is by deploying IBM FlashSystem 820 behind a SAN Volume Controller (or Storwize V7000). For clients who need efficiency, this also can be used with Easy Tier, with the SAN Volume Controller/ Storwize V7000 automatically promoting hot blocks to the FlashSystem. The tiered storage solution not only efficiently uses solid-state drives to increase performance up to 200% on critical applications, but also can reduce costs by migrating less critical data to less expensive media.

Figure 8 shows an example of a usage scenario that combines the SAN Volume Controller and IBM FlashSystem with a tiered approach to storage management of a storage FlashSystem. In this solution, write I/O is performed to both FlashSystem and arrays for both VDisk Mirror 1 and 2. Read I/O is performed from FlashSystem to boost performance with microsecond latency.

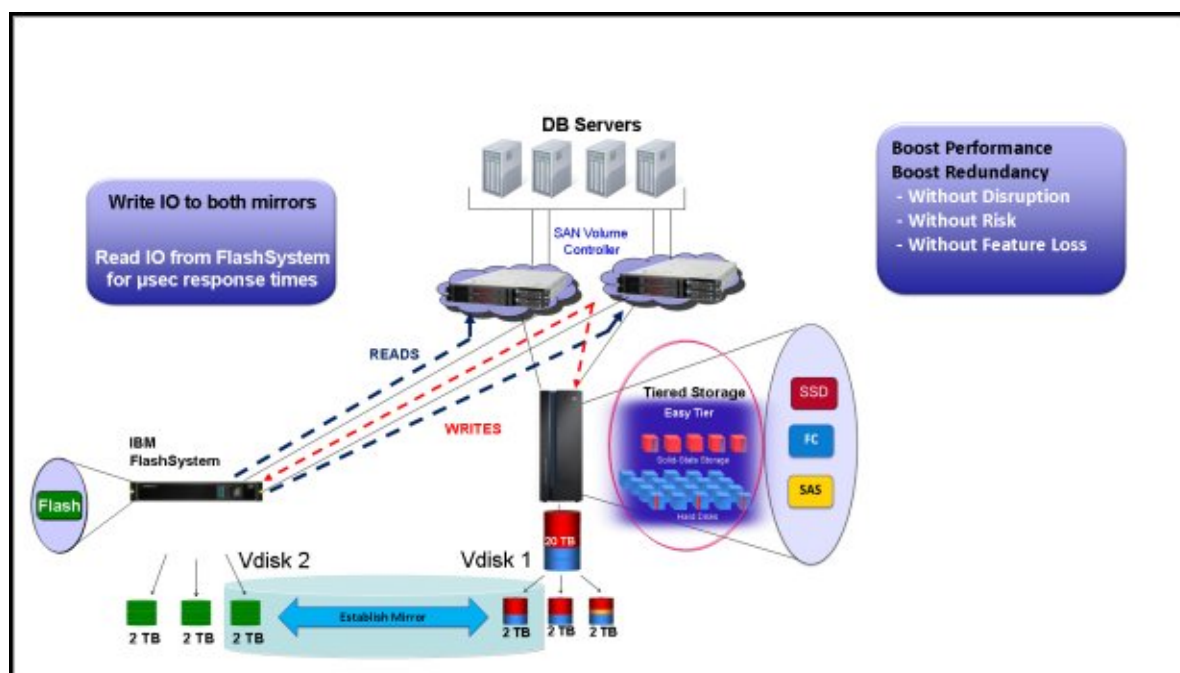


Figure 8. IBM FlashSystem / SAN Volume Controller tiered scenario with mirroring

In addition to the storage virtualization function, SAN Volume Controller offers other enterprise capabilities to use with IBM FlashSystem 820:

- Business continuity with Copy Services
- Backup and optimal workload availability with FlashCopy
- \$/TB value with thin provisioning and Real-Time Compression (RtC)
- Drive storage efficiency with Easy Tier

**Note:** This high performance enterprise class featured solution is scalable to 1.5M IOPs for large-scale enterprise systems performance

Figure 9 shows four examples of configurations that can be used within the FlashSystem and SAN Volume Controller bundle.

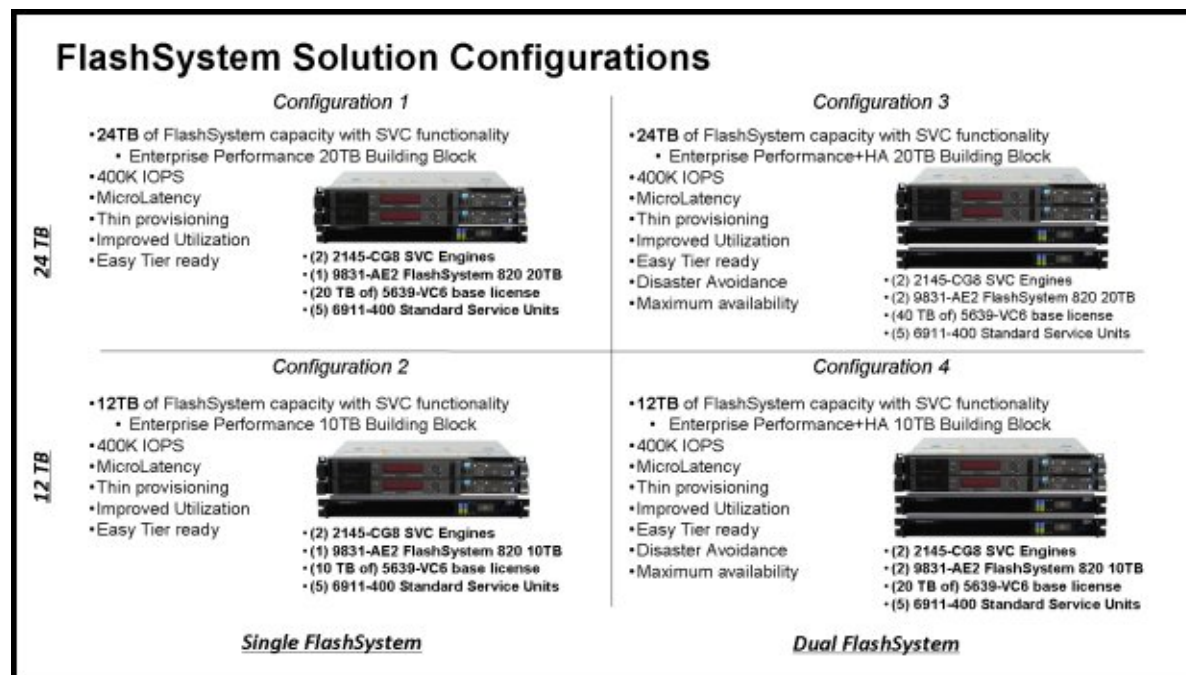


Figure 9. IBM FlashSystem and SAN Volume Controller configurations

### Mid-range storage system scenario

A mid-range storage system, either a racked IBM Storwize V7000 or a chassis model (IBM Flex System V7000 Storage Node), provides rich functionality and capacity for its modest performance (IOPS). When you examine either type of storage node, which includes the usage of Easy Tier, you try to match a certain amount of fast storage with spinning storage. This is typically a 10:1 ratio. For example, if you wanted to achieve 100 TB of capacity with Easy Tier, you could get 90 TB of spinning capacity and 10 TB of flash capacity. In the Storwize V7000 or Flex System V7000, you could achieve 10 TB of capacity with SSDs in the controller or expansion unit, but if you price the solution, you might find that 10 TB of IBM FlashSystem 820 is much more economical. To gain the maximum benefits in such a solution, you could use the Storwize V7000 or Flex System V7000 disk slots for the spinning capacity, and use the FlashSystem 820 as the fast tier.

### Disaster recovery scenario

Another example of a use case scenario is to use a disaster recovery (DR) solution, where you have two chassis that are 150 km apart. Each chassis has a Storwize V7000 or Flex System V7000 and a FlashSystem 820 with a "stretch cluster" configuration, where the VDisk is allocated from a pair of LUNs being mirrored by the Storwize V7000 or Flex System V7000 to produce a location proof storage infrastructure (in such an infrastructure, one site could be destroyed but the data still exists).



## Integration

FlashSystem products can be integrated into your existing PureFlex System environment with IBM SmartCloud Entry and IBM SmartCloud Monitoring.

### PureFlex System with SmartCloud Entry

IBM SmartCloud® Entry Version 3.1 is an entry-level private cloud offering that takes your IBM PureFlex System virtualized environment from a cloud-ready to cloud status. Users can request and provision an environment quickly through an easy-to-use, web-based interface. IBM SmartCloud Entry builds on your existing virtualization infrastructure. For IBM Power Systems™ environments, IBM SmartCloud Entry builds upon IBM PowerVM® virtualization and IBM Systems Director VMControl™. In IBM X-Architecture® environments, IBM SmartCloud Entry builds on the virtualization functions provided by VMWare.

If you order IBM SmartCloud Entry when you order your IBM PureFlex System, the software is installed on your system by IBM. You can purchase additional services to help you implement IBM SmartCloud in your environment. These services include configuring the infrastructure and training in how to use the product. If you did not order IBM SmartCloud Entry with your IBM PureFlex System, you can purchase the services to help you install the product and configure your environment and use the product. System managers can monitor and manage this environment for improved efficiency and utilization of the data center.

For more information about IBM SmartCloud Entry, see the following website:

<http://ibm.co/1dtuT6B>

### IBM SmartCloud Monitoring

IBM SmartCloud Monitoring optimizes workloads and provides visibility through health dashboards, which increases cloud availability. It intelligently optimizes the usage of current resources and plans for future growth. IBM Tivoli® Storage Manager and IBM SmartCloud Monitoring ensures resiliency and achieves high levels of virtualization density while managing risk as customers move to IBM PureFlex System with FlashSystem storage and seek to reduce costs.

For more information about IBM SmartCloud Monitoring, see the following website:

<ftp://submit.boulder.ibm.com/sales/ssi/ecm/en/ibd03005usen/IBD03005USEN.PDF>

## Supported platforms

For the supported hardware and platforms for the IBM PureSystem and the IBM FlashSystem portfolio of products, see the following link:

<http://www.ibm.com/systems/support/storage/ssic>

## Ordering information

The following section provides ordering information for the available FlashSystem products and solutions.

### IBM FlashSystem

Ordering information for FlashSystem storage is shown in Table 3.

Table 3. Ordering part numbers and feature codes

Item	Product number	Feature Code	Description
IBM FlashSystem 720	9381-AS2		
IBM FlashSystem 820	9381-AE2		
IBM FlashSystem Bundle	9381-AE2	AF0W	24 TB of FlashSystem capacity with SAN Volume Controller functionality Enterprise Performance 20 TB Building Block  Two 2145-CG8 SAN Volume Controller Engines One 9831-AE2 FlashSystem 820 20TB 20 TB of 5639-VC6 base license Five 6911-400 Standard Service Units
IBM FlashSystem Bundle	9381-AE2	AF0X	12 TB of FlashSystem capacity with SAN Volume Controller functionality Enterprise Performance 10TB Building Block  Two 2145-CG8 SAN Volume Controller Engines One 9831-AE2 FlashSystem 820 10TB 10 TB of 5639-VC6 base license Five 6911-400 Standard Service Units
IBM FlashSystem Bundle	9381-AE2	AF0Y	24 TB of FlashSystem capacity with SAN Volume Controller functionality Enterprise Performance+HA 20TB Building Block  Two 2145-CG8 SAN Volume Controller Engines Two 9831-AE2 FlashSystem 820 20 TB 40 TB of 5639-VC6 base license Five 6911-400 Standard Service Units
IBM FlashSystem Bundle	9381-AE2	AF0Z	12 TB of FlashSystem capacity with SAN Volume Controller functionality Enterprise Performance+HA 10TB Building Block  Two 2145-CG8 SAN Volume Controller Engines Two 9831-AE2 FlashSystem 820 10TB 20 TB of 5639-VC6 base license Five 6911-400 Standard Service Units

## **IBM PureFlex System**

IBM PureFlex Systems can be ordered in the following configurations:

- IBM PureFlex System Express: Designed for small and medium businesses. The most affordable entry point for PureFlex System.
- IBM PureFlex System Standard: Optimized for application servers with supporting storage and networking, and is designed to support your key ISV solutions.
- IBM PureFlex System Enterprise: Optimized for transactional and database systems and has built-in redundancy for highly reliable and resilient operation to support your most critical workloads.

These are summarized in Table 4.

Table 4. IBM PureFlex System

Component	IBM PureFlex System Express	IBM PureFlex System Standard	IBM PureFlex System Enterprise
IBM PureFlex System 42U Rack	1	1	1
IBM Flex System Enterprise Chassis	1	1	1
IBM Flex System Fabric EN4093 10Gb Scalable Switch	1	1	2 with both port-count upgrades
IBM Flex System FC3171 8Gb SAN Switch, or IBM Flex System FC5022 24-port 16Gb ESB SAN Scalable Switch	1	2	2
IBM Flex System Manager Node	1	1	1
IBM Flex System Manager software license	IBM Flex System Manager with 1-year service and support	IBM Flex System Manager Advanced with 3-year service and support	Flex System Manager Advanced with 3-year service and support
Chassis Management Module	2	2	2
Chassis power supplies (std/max)	2/6	4/6	6/6
Chassis 80 mm fan modules (std/max)	4/8	6/8	8/8
IBM Flex System V7000 Storage Node, or IBM Storwize V7000 Disk System	Yes (redundant controller)	Yes (redundant controller)	Yes (redundant controller)
IBM Storwize V7000 Software	Base with 1-year software maintenance agreement Optional Real Time Compression	Base with 3-year software maintenance agreement Optional Real Time Compression	Base with 3-year software maintenance agreement Optional Real Time Compression

For more information about IBM PureFlex System and Flex System, for a quote, or to call IBM, see the following website:

<https://www-304.ibm.com/software/brandcatalog/puresystems/centre/>

## Related information

For more information, see the following documents:

- IBM FlashSystem family product page  
<http://www.ibm.com/storage/flash>
- IBM Redbooks Solution Guides for IBM FlashSystem family:  
<http://www.redbooks.ibm.com/redbooks.nsf/searchsite?SearchView&query=flashss>
- Overview of IBM PureSystems  
<http://www.redbooks.ibm.com/abstracts/tips0892.html?Open>
- *IBM PureFlex System and IBM Flex System Products and Technology*, SG24-7984  
<http://www.redbooks.ibm.com/abstracts/sg247984.html?Open>
- IBM Redbooks Product Guides about the components of IBM Flex System  
<http://www.redbooks.ibm.com/portals/puresystems?Open&page=pgbycat>
- *Implementing IBM SmartCloud Entry on IBM PureFlex System*, SG24-8102  
<http://www.redbooks.ibm.com/abstracts/sg248102.html?Open>
- *IBM SAN Volume Controller and IBM FlashSystem 820: Best Practice and Performance Capabilities*, REDP-5027  
<http://www.redbooks.ibm.com/redpieces/abstracts/redp5027.html>
- IBM Support Portal  
<http://ibm.com/support/entry/portal/>
- IBM System Storage Interoperation Center (SSIC)  
<http://www.ibm.com/systems/support/storage/ssic/interoperability.wss>
- US Announcement Letter - IBM FlashSystem 720 and IBM FlashSystem 820  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&htmlfid=897/ENUS113-047>
- IBM Offering Information page (to search on announcement letters, sales manuals, or both)  
[http://www.ibm.com/common/ssi/index.wss?request\\_locale=en](http://www.ibm.com/common/ssi/index.wss?request_locale=en)

On this page, enter IBM FlashSystem, select the information type, and then click **Search**. On the next page, narrow your search results by geography and language.

# Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service. IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

*IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.*

**The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law:** INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you. This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk. IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you. Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurement may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

## COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

**© Copyright International Business Machines Corporation 2013. All rights reserved.**

Note to U.S. Government Users Restricted Rights -- Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

This document was created or updated on September 16, 2013.

Send us your comments in one of the following ways:

- Use the online **Contact us** review form found at:  
[ibm.com/redbooks](http://ibm.com/redbooks)
- Send your comments in an e-mail to:  
[redbook@us.ibm.com](mailto:redbook@us.ibm.com)
- Mail your comments to:  
IBM Corporation, International Technical Support Organization  
Dept. HYTD Mail Station P099  
2455 South Road  
Poughkeepsie, NY 12601-5400 U.S.A.

This document is available online at <http://www.ibm.com/redbooks/abstracts/tips1042.html> .

## Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. These and other IBM trademarked terms are marked on their first occurrence in this information with the appropriate symbol (® or ™), indicating US registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at <http://www.ibm.com/legal/copytrade.shtml>.

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

BladeCenter®  
Calibrated Vectored Cooling™  
Easy Tier®  
FlashCopy®  
FlashSystem™  
IBM®  
IBM FlashSystem™  
IBM Flex System™  
IBM Flex System Manager™  
IBM SmartCloud®  
POWER®  
Power Systems™  
POWER7®  
PowerVM®  
PureFlex™  
PureSystems™  
Real-time Compression™  
Redbooks®  
Redbooks (logo)®  
Storwize®  
System Storage®  
System x®  
Systems Director VMControl™  
Tivoli®  
X-Architecture®



The following terms are trademarks of other companies:

VSR, and the Texas Memory Systems logo are trademarks or registered trademarks of Texas Memory Systems, an IBM Company.

Intel, Intel Xeon, Intel logo, Intel Inside logo, and Intel Centrino logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.  
Other company, product, or service names may be trademarks or service marks of others.