

IBM Spectrum Accelerate

An agile software defined storage solution for enterprise and cloud



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Abstract

Today almost every organization regardless of size, industry or geography faces an unprecedented explosion of data. You need an efficient storage infrastructure that can get the most value from your data at the least cost and with the least effort and the greatest flexibility. Software defined storage transforms data economics for traditional and new era applications with greater speed, agility, and efficiency and at the same time maintains the required security and reliability that are essential for business critical data.

IBM® Spectrum Storage™ is the first software family designed to deliver simplified storage capacity and services with proven advanced functions and extreme management ease.

A member of the Spectrum Storage family, IBM Spectrum Accelerate™ is a new, powerful software defined storage solution for enterprise and cloud that builds on the proven power of IBM XIV® storage and runs on a customer's hardware of choice. The technology featured by Spectrum Accelerate lends itself extremely well to accommodating dynamic business requirements and leveraging commodity storage hardware. This paper reviews key aspects of Spectrum Accelerate and explains how they combine to deliver a robust, high-performing, flexible and feature-rich solution for storage needs.

Introduction: new challenges drive the need for a new storage management approach

Growing data volumes and new workload complexities are two of the most significant factors affecting storage management. Dynamic economics, shifting technologies, or adjusted priorities all compel organizations to improve responsiveness and attain an edge over competitors. Effective and efficient storage management is critical in today's changing environments. This has led to the emergence of new solution approaches to satisfy unprecedented requirements for storage growth, performance quality assurance and functionality.

Enterprise applications are increasingly running in virtualized environments, yielding a workload profile and a set of new requirements that many traditional storage arrays are not designed to handle effectively or efficiently.

Virtualized application runtime environments present challenging performance and service requirements from storage solutions. Many traditional storage solutions were designed to accommodate the needs of applications that featured a predictable workload profile and focused on support for enterprise grade requirements concerning data resiliency, protection and security. Today, however, enterprise applications are increasingly running in virtualized environments, yielding a workload profile and a set of new requirements that many traditional storage arrays are not designed to handle effectively or efficiently. Furthermore, many organizations end up deploying different storage arrays for different workloads, resulting in a storage infrastructure that cannot be easily scaled, managed or optimized for shifting application requirements.

A storage solution designed to accommodate change effectively and efficiently will minimize risk and maximize business responsiveness, allowing customers to:

- Employ storage hardware of choice and leverage existing storage, thereby reducing overall CAPEX.
- Support dynamic storage requirements easily and conveniently, whether they are driven by new clients, new applications or new application priorities.
- Minimize administrative cost and effort required to satisfy performance requirements for applications with unpredictable workloads, dynamic workloads, or both.
- Satisfy capacity and performance growth requirements and apply a simple management metaphor to all managed storage.
- Adjust, extend and upgrade solution options.

Coping with change via agile storage solutions

Software defined storage solutions use advanced software for managing data stored on the commodity hardware of choice as an alternative to the traditional storage array. Traditional storage features a design combining software and hardware tested to meet vendor criteria for reliability, performance and functionality, but the tightly coupled nature of such design might, despite its potential advantages, prevent it from satisfying customer preferences for deployment flexibility, solution interoperability and management coverage.

Conversely, software defined storage solutions offer flexible deployment and hardware options, augmented by an opportunity to implement a common management approach. With the right hardware configuration, standalone software defined storage solutions can also match the reliability, performance and functionality offered by storage appliances.

A software defined storage solution is designed to satisfy constantly changing storage requirements and prevent the challenges and complexities associated with traditional storage arrays. Such solutions implement an abstracted service for storage that replaces a need for multiple solutions. Software defined storage solutions can facilitate the definition of storage requests and services with quantitative objective criteria such as cost, capacity, performance, scalability, availability, QoS and security. They are designed to enable flexible, policy-based and hardware-independent processing, handling, management, and automation of requests and services.

A software defined storage solution can help customers accommodate change by:

- **Eliminating reliance on hardware for critical storage aspects** by delivering functionality, scalability, performance and reliability via software rather than relying on hardware. This offers customers freedom to use their hardware of choice, leverage existing hardware, apply functionality across all storage, and apply a common management framework for their storage that is not hardware-dependent. The operational benefits are huge with regard to storage planning, setup, extension, performance optimization, troubleshooting, migration and remote replication.
- **Leveraging external storage service options** by presenting more options for deploying hybrid storage models, including combining on-premises storage with off-premises cloud storage services for select workloads with considerable cost savings.
- **Enabling customized solutions** by exposing services through industry-standard interfaces, allowing for custom process automation, orchestration and consolidation, as well as new extensible services.

IBM Spectrum Accelerate: a highly-agile solution for storage

IBM Spectrum Accelerate is a highly agile software defined storage solution with powerful advantages for new and traditional workloads in enterprise environments and for purpose-built cloud infrastructures. Spectrum Accelerate is part of a comprehensive IBM software defined storage strategy to address cloud, analytics, mobile, social and security workload challenges.

Spectrum Accelerate works by pooling server-attached storage into a consolidated hyper store which is exposed via iSCSI. [Figure 1] Spectrum Accelerate leverages the same technology used by the customer-proven, high end IBM XIV integrated system, and offers a major part of the capabilities that have made XIV an outstanding solution for high end enterprise environments.

Spectrum Accelerate features three of the most critically-acclaimed aspects of the XIV technology:

- Consistent tuning-free high performance
- Exceptionally simple management tools that eliminate many traditional planning, setup and maintenance chores
- Innovative features including advanced snapshot, synchronous and asynchronous replication, multi-tenancy, QoS, and support for RESTful API, with self-provisioning supported through IBM SmartCloud® Storage Access.

Spectrum Accelerate features critically-acclaimed aspects of the XIV technology: Consistent tuning-free high performance; exceptionally simple management tools; and advanced snapshot, replication, multi-tenancy, and QoS support.

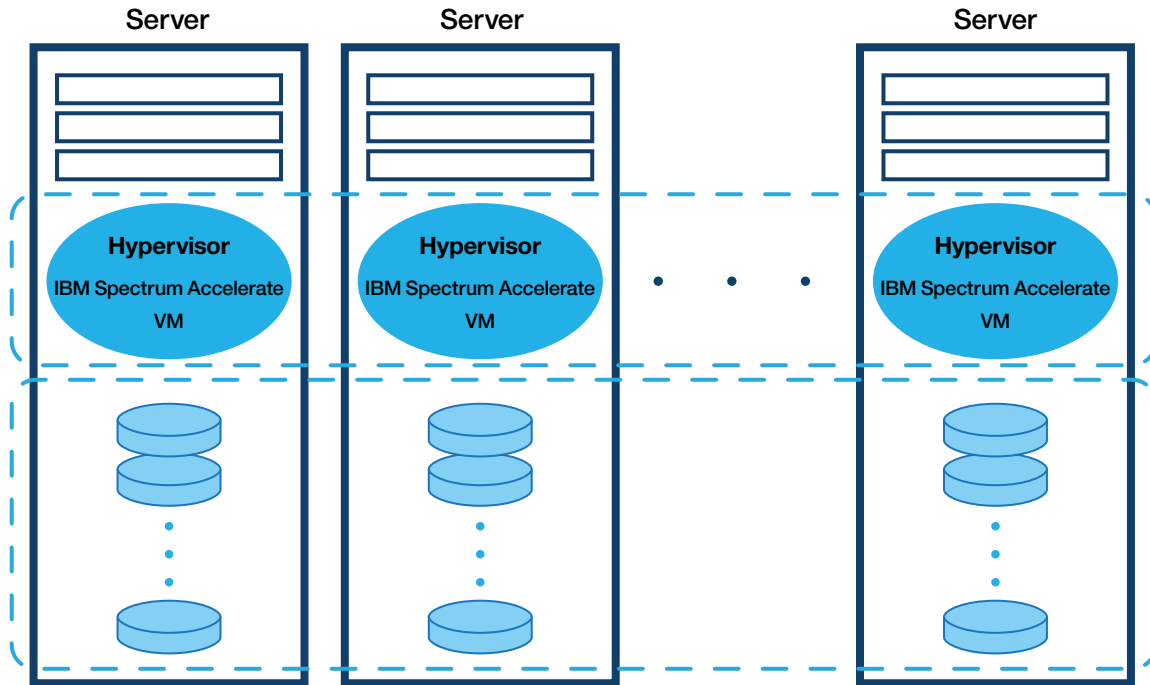


Figure 1. IBM Spectrum Accelerate is deployed as VMs on multiple servers whose locally attached storage is pooled into a consolidated hyper store.

Spectrum Accelerate delivers an attractive value proposition for those who require the performance consistency, management scaling and enterprise features of XIV but seek to leverage existing data center resources, deploy a build-your-own storage infrastructure rapidly, or utilize lower-cost hardware for non-critical use cases such as development and test. Spectrum Accelerate offers customers extended deployment options for XIV technology that accommodate additional use cases in enterprise and purpose-built cloud environments. Spectrum Accelerate also offers an opportunity to experience and evaluate the performance capabilities of the integrated XIV system in preparation for critical high-end application deployment.

Advanced architecture

IBM Spectrum Accelerate features a grid-based architecture. The solution is designed to support deployment on x86 servers and leading hypervisors—today, on the VMware vSphere ESXi hypervisor. It supports hybrid deployment scenarios such as creating a bridge between on-premises and off-premises clouds, or creating a “do it yourself” bridge between integrated hardware storage and software designed solutions. Spectrum Accelerate is designed to scale out from small to large capacity points and features a unique data distribution approach that eliminates hot spots and negates any need for manual or system background performance optimization.

Spectrum Accelerate protects data by maintaining two copies of each 1MB data partition constituting a storage volume, with each copy residing on the storage of a different virtual machine (VM). Upon disk or VM failure, Spectrum Accelerate automatically runs a process to restore (rebuild) storage redundancy—without administrator intervention. Spectrum Accelerate implements an exceptionally quick rebuild process for the data stored on the failed drive, harnessing the power of all managed drives with a negligible effect on running applications.

Spectrum Accelerate also features a comprehensive, high performance implementation of snapshots. Spectrum Accelerate architecture significantly minimizes setup and planning operations involving snapshots, and realizes high snapshot performance with near-zero impact on general system performance. The system supports a large number of space-efficient snapshots and rich snapshot functionality including writable snapshots, the ability to take a snapshot of another snapshot, the ability to restore a snapshot from another snapshot, and the ability to take a snapshot of a consistency group. Spectrum Accelerate also features special snapshot functionality with mirroring, enabling snapshot mirroring.

Proven resiliency and RAS

IBM Spectrum Accelerate offers advanced data distribution which enables high system availability, a feature that is not typically offered by traditional architectures.

Many traditional storage solutions commonly place all volume capacity within a subset of the system's drives. That approach has several limitations that can adversely affect availability and performance, notably a small spindle-count per volume, a long rebuild duration of hours or even days following drive failure,

and a higher risk for data unavailability due to environmental factors. Traditional storage solutions may also feature support for standby spare drives that are employed if failed system drives need be replaced and their data needs be rebuilt. Such drives are not often subject to health monitoring examination before their actual usage, which increases the likelihood of drive problems surfacing when drive health is critical for recovery. Also, once staged, spare drives are subject throughout the data rebuild process to high workload spikes that might reduce drive performance and health.

With Spectrum Accelerate, the volume data is stored on one-megabyte-sized data partitions that are distributed across all system drives in a pseudo-random fashion, with each partition being mirrored to another drive. This results in a large spindle-count per volume, an extremely short data rebuild duration as previously mentioned, and a lower risk for impact by environmental factors affecting a subset of system drives.

As for spare storage, Spectrum Accelerate features the concept of hot spare capacity, pre-allocating free capacity on all drives rather than dedicating standby drives for data rebuild scenarios only. The result is timely health inspection and monitoring of all spare capacity and minimized likelihood of drive failure due to extreme workload spikes. It also facilitates higher storage performance because the system can leverage a larger number of spindles.

Spectrum Accelerate also features powerful RAS, including externalization of hardware events and additional system aspects that enable quick detection of system-related issues, and simplified serviceability.

High performance and QoS

IBM Spectrum Accelerate is designed to achieve high performance for dynamic workloads. Spectrum Accelerate features the unique capability to sustain high performance without any manual or system background tuning.

One of the most critical factors responsible for the exceptional performance of Spectrum Accelerate is its special data distribution. Each volume is distributed across all Spectrum Accelerate managed drives in a manner that obviates hotspots, resulting in

no need to ever tune the system—either manually or through a background system process. [Figure 2] Customers experience Spectrum Accelerate hotspot-free performance from the moment the solution is deployed and continue to enjoy it, with no tuning needed.

The Spectrum Accelerate flash caching is designed to accommodate diverse workloads demanding extremely high performance.

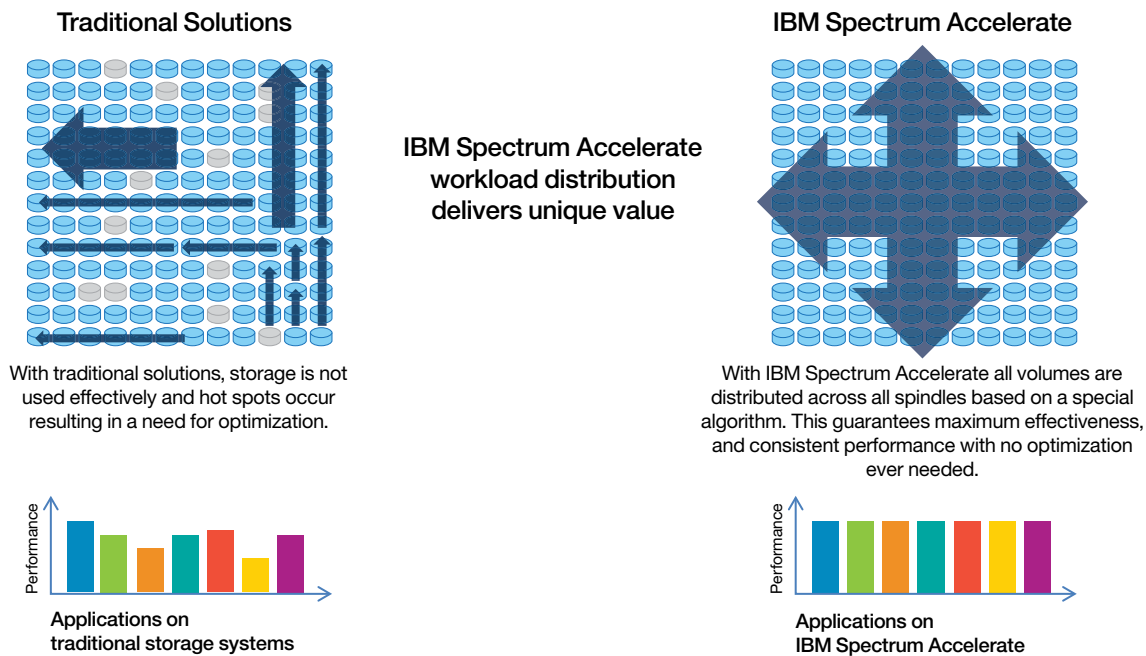


Figure 2. Spectrum Accelerate technology implements an advanced approach for data distribution that obviates hot spots rather than requiring manual or background tuning processes to be run, as with most traditional storage solutions.

Spectrum Accelerate patented cache management is another factor behind the solution's exceptional performance. Spectrum Accelerate systems feature an advanced caching implementation and are equipped with large amounts of DRAM cache. Spectrum Accelerate flash caching enables flash drives to be installed as an extension for read cache. Spectrum Accelerate flash caching implementation is designed to efficiently accommodate diverse workloads which may require extremely high performance, without a need for physical tiering.

Spectrum Accelerate support for QoS allows administrators to restrict the performance associated with selected tenants (in a multi-tenant setting), storage pools, or hosts. Coupled with the consistent performance realized with Spectrum Accelerate, QoS allows for the establishment of different performance tiers,

without incurring overhead of data movement and without the additional management effort and performance penalty associated with traditional storage tiering approaches.

Rich remote replication

IBM Spectrum Accelerate features support for advanced replication functionality, including synchronous and asynchronous mirroring for volumes and consistency groups, independent replication settings per volume/consistency-group, independent RPO and interval settings, minimal replication interval and RPO of seconds, snapshot mirroring, online and offline initialization, and failover and failback. Spectrum Accelerate also uses a simplified setup and management paradigm for replication that results in minimal training and administration efforts. [Figure 3]

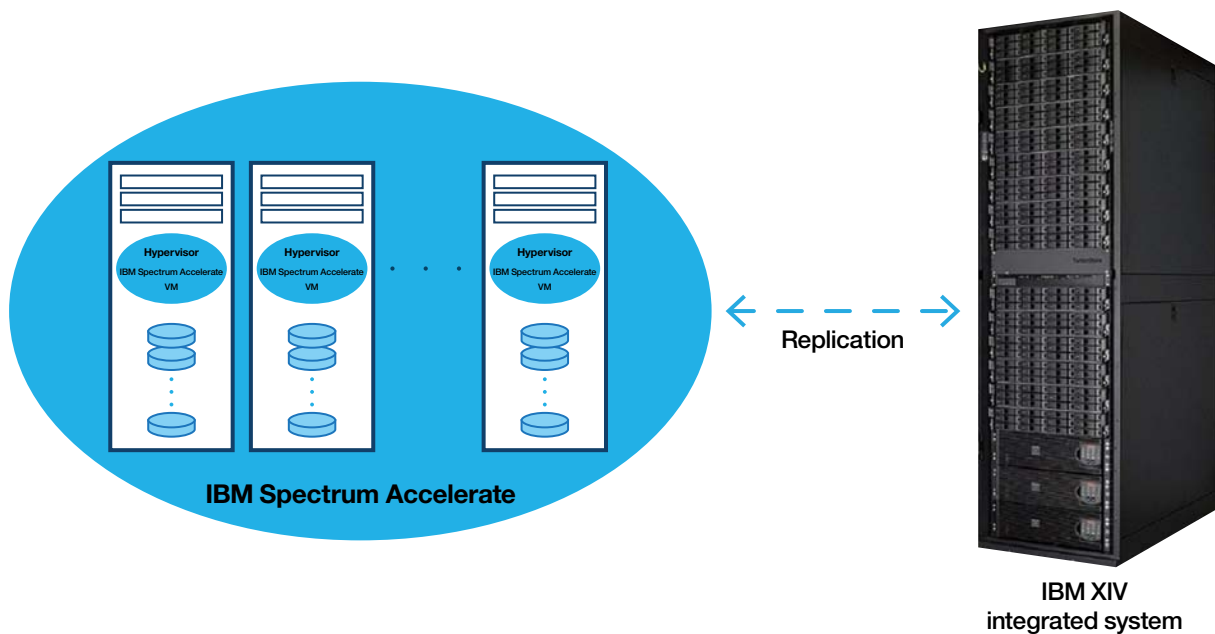


Figure 3. Interoperability between an IBM XIV-integrated system and Spectrum Accelerate allows for powerful deployment scenarios, such as remote replication.

Comprehensive security

IBM Spectrum Accelerate features comprehensive security functionality, including support for role-based access management, multi-tenancy [Figure 4], and auditing. Spectrum Accelerate integrates with Active Directory and Lightweight Directory Access Protocol (LDAP) servers for centralized management of user identity and privileges.

Simple management

IBM Spectrum Accelerate is inherently simple to manage. Spectrum Accelerate architecture does not require many of the administrative processes and operations common with traditional systems, such as RAID group and capacity allocation planning, performance optimization and capacity spare allocation. The architecture enables consistent high performance without the need for user tuning, along with simple capacity planning and streamlined health monitoring across the enterprise. As a result, many tools used by other systems to ease management are not needed by Spectrum Accelerate.

Spectrum Accelerate simplifies management for effective administration of enterprise-scale storage capacities at a fraction of the staffing and training requirements warranted by traditional solutions.

Spectrum Accelerate management highlights include the following:

- **Quick and simple storage provisioning** with data distribution that translates into hassle-free storage provisioning, averting the need to allocate physical drives, assign RAID levels or tune performance.
- **Intuitive graphical user interface**, which provides a simple, powerful view of the storage system and its operational status. The IBM Hyper-Scale Manager user interface provides central monitoring, automated alerts, consolidated views for real-time status, and access to multiple Spectrum Accelerate instances and related components. It features a design that has been critically acclaimed as an industry benchmark for storage management ease of use. Spectrum Accelerate also features on-the-go monitoring and notifications via a mobile dashboard that works with Apple iOS and Android devices.

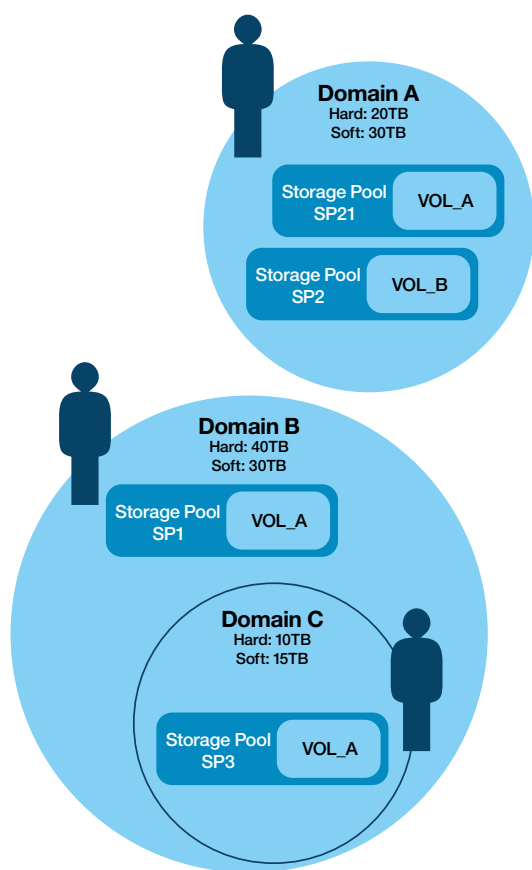


Figure 4. Spectrum Accelerate multi-tenant management supports establishment of multiple domains with segregated management and QoS.

- **Tierless management** that ensures consistent high-level performance for all workloads with data uniformly distributed across the system and a unique tuning-free approach. By maintaining data priority logically instead of physically, Spectrum Accelerate does away with the need for data movement between tiers and tiering policy management.
- **Comprehensive RESTful API implementation**, which allows custom process orchestration and automation. Implementation of Spectrum Accelerate is quick and simple, without the complexity of other solutions.
- **Self-healing** features offer proactive diagnostic processes to detect and address risks before they translate into larger problems. Automatic restoration of data redundancy after hardware failures, unprecedented rebuild speed and “call home” support all help ensure reliability and performance at all times, with minimal human effort.
- **Extensive reporting capabilities** enables rich, highly visual reports on I/O-related statistics, usage-related statistics and usage trends.
- **Reduced training:** Spectrum Accelerate architecture can simplify administration by eliminating many traditional management chores.
- **Efficient utilization:** Storage utilization is optimized via data distribution, thin provisioning and space reclamation. Thin provisioning is supported at the storage pool level, allowing for the creation of storage pools that are thinly provisioned along with pools that are not. An administrator can easily change a non-thinly-provisioned pool into a thinly-provisioned pool and vice versa without incurring data movement. The system also offers support for thick-to-thin migration, allowing for potentially large savings in capacity when migrating volumes from legacy storage. Spectrum Accelerate supports space reclamation with various operating systems and third-party storage management integration.

Exceptional TCO benefits

IBM Spectrum Accelerate can help improve total cost of ownership by reducing infrastructure and administrative costs, and improving storage utilization.

- **Reduced CAPEX:** Spectrum Accelerate allows clients to minimize storage costs by leveraging existing data center infrastructure instead of acquiring new hardware.
- **Reduced OPEX:** Spectrum Accelerate helps clients standardize hardware procurement, operation and service. It delivers high performance for large capacity workloads without requiring expensive drives, and also minimizes time to deploy, plan, setup, provision and manage storage.
- **New approaches for cloud storage deployment:** Spectrum Accelerate can accommodate a hybrid cloud storage solution by deploying XIV abilities in a combination with on-premises and off-premises approaches. Organizations can use Spectrum Accelerate alone, or in combination with XIV integrated systems for maximum performance, flexibility and administrative benefits stemming from a consolidated management experience. A compelling example for this use case concerns replication from an on-premises deployment of IBM XIV to an off-premises deployment of Spectrum Accelerate. (Figure 5)

Spectrum Accelerate: an outstanding value proposition

IBM Spectrum Accelerate allows clients to realize the power and value of XIV technology in new ways and leverage their choice of hardware and deployment options to optimally match the hardware to the performance needs of applications and to minimize costs.

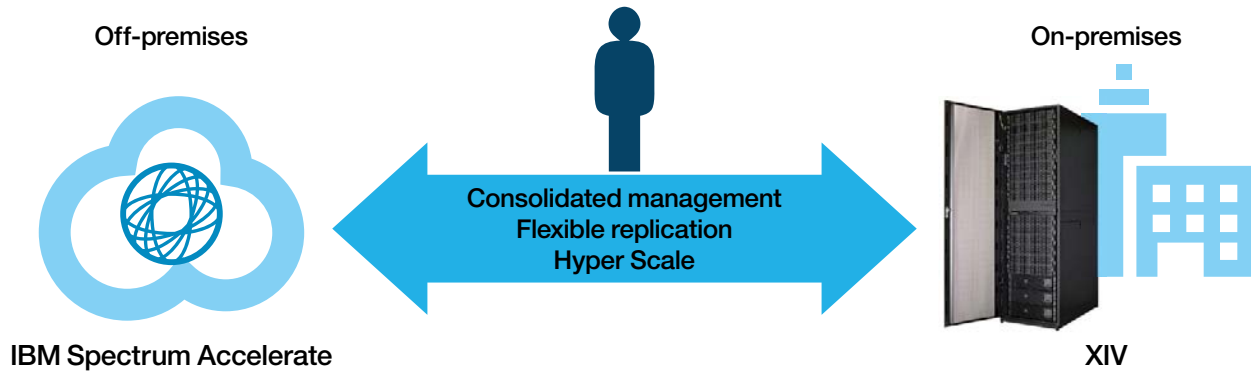


Figure 5. Case example #1: Spectrum Accelerate allows customers to realize a hybrid cloud deployment, featuring consolidated management of on-premises and off-premises storage, powerful replication options and more.

- **Disaster recovery:** Accommodate a requirement for highly-reliable, yet reduced cost remote replication options in environments that are already deploying XIV by setting up replication from a source volume on the XIV system to a destination volume on a system running Spectrum Accelerate. [Figure 6]

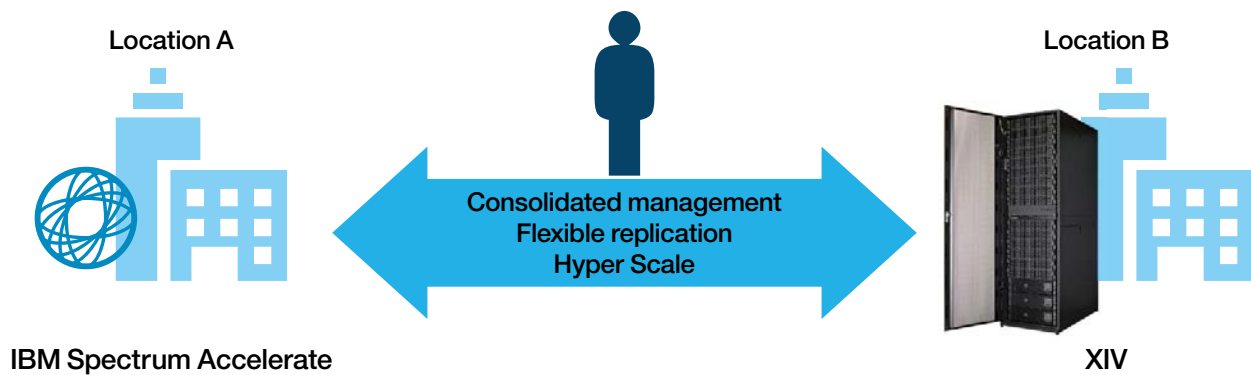


Figure 6. Case example #2: Spectrum Accelerate supports highly-reliable, reduced-cost remote replication with another Spectrum Accelerate system or with an IBM XIV-integrated system.

- **Remote office/branch office (ROBO):** Accommodate a need for consistent, reliable, lower cost, high performance storage by deploying a robust storage solution that combines the enterprise-proven architecture of Spectrum Accelerate with inexpensive drives. [Figure 7]
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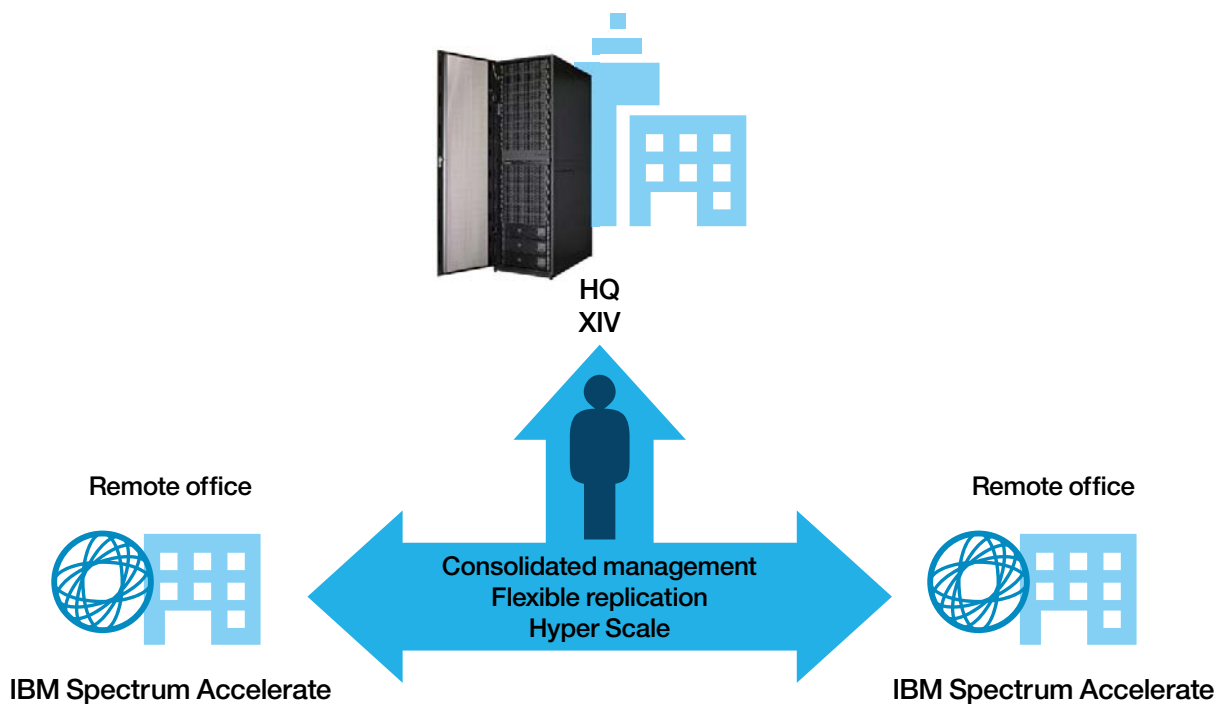


Figure 7. Case example #3: Spectrum Accelerate offers consistent, high storage performance at a lower cost for remote offices.

- **Special projects:** Accommodate the agility needed by ad hoc projects at reduced up-front and operational costs by using Spectrum Accelerate with the hardware most appropriate for such projects, allowing for easy repurposing of hardware infrastructure after the project is over.

Spectrum Accelerate is designed to provide value for many different areas in the enterprise, including C-suite executives and storage and cloud administrators. Enterprise CIOs can dynamically scale storage, minimizing up-front investments. Additionally, capital expenditures can be reduced by maximizing the utilization of existing infrastructure. Operating expenses can be reduced by facilitating self-service storage.

Storage administrators can guarantee enterprise-level SLAs for self-serviced CAMSS workloads that are storage-provisioned automatically. Benefits are continuous, offering high performance and reduced service time by allowing for hardware replacement without requiring external technician involvement.

Cloud administrators can deploy a storage solution on demand in a matter of hours by deploying virtual servers. Benefits include ordering and deploying the solution online, the ability to meet storage capacity requirements cost-effectively by adding a new node to a grid when needed, and the ability to repurpose storage without physical rack constraints. Additionally, Spectrum Accelerate architecture can reduce training requirements by simplifying administration considerably through the elimination of many traditional management chores.

Value point	IBM Spectrum Accelerate
• Ability to employ storage hardware of choice as well as leverage existing storage	✓
• Guaranteed consistent, tuning-free high performance for all application workloads	✓
• Advanced snapshots, consistency groups, remote synchronous/asynchronous replication; multi-tenancy	✓
• Proven resiliency and robustness of technology deployed by some of the world's largest firms; powerful RAS capabilities	✓
• Elimination of many traditional storage administration chores	✓
• Compelling QoS with consistent performing workloads	✓
• Full automation via REST	✓
• Flexible deployment: on/off premises or both, and with XIV systems—with consolidated management	✓
• Flexible licensing: perpetual or monthly; license is customer-level and hardware-independent, enabling use on different virtual arrays at any time	✓
• Reduction in CAPEX and OPEX	✓

Table 1. IBM Spectrum Accelerate – summary of advantages

Summary

IBM Spectrum Accelerate is a highly agile software defined solution that leverages proven IBM XIV technology. It combines the flexibility of software defined storage solutions with the architecture of a world-class, high-end integrated system. Spectrum Accelerate offers the ability to sustain consistently high, tuning-free performance for unpredictable workload profiles with exceptional ease of use and scalability. Spectrum Accelerate opens a world of new and extended deployment choices for enterprise and customer-built cloud environments.

For more information

To learn more, please contact your IBM representative or IBM Business Partner, or visit: ibm.com/storage or ibm.com/spectrumstorage

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