BlackPearl Converged Storage System Software Composition

February 2019

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Executive Summary

As organizations turn greater focus to the true value of data, both historic and future, it becomes clear that data and digital content will most likely last much longer than the storage technology on which it is written.

Consolidation of both software and hardware has offered great advantages to large data centers in every vertical market across the globe. In many cases, however, this consolidation has led to fewer options on the backend – proprietary formats, limited expansion, vendor lock-in, or the requirement of specialized software to further direct the lifecycle of the data under management.

Spectra's BlackPearl® Converged Storage System delivers a feature-rich software application in the ultimate hardware platform to modernize your storage workflow. The purpose-built solution for persistent data incorporates hard drives, flash drives, CPU, RAM, Network Cards, SAS or Fibre Channel HBAs into various packages – the BlackPearl V Series, S Series, or P Series.

A modern approach to storage is about simplicity, flexibility, and expandability. BlackPearl solves the problem of costly and complex approaches associated with traditional storage systems by reducing the overhead of multiple software and hardware solutions running independently. The platform also allows for data to move in multiple directions to multiple targets, from storage to retrieval and across various hardware types, enabling users to customize their data management workflow to best fit their performance requirements. Finally, Spectra's TranScale® architecture offers licensing agreements which support the inevitability of ongoing data growth, allowing users to protect their initial BlackPearl investment by seamlessly upgrading capacity while continuing to use their existing components.

When data is being retained for years, decades, or indefinitely, finding the solution with the best Total Cost of Ownership (TCO) is important. Not only does the BlackPearl Converged Storage System lower the acquisition cost of numerous servers and software applications, as well as the need for multiple vendors, but this consolidation reduces continuing administration costs and overhead – resulting in the lowest TCO for years to come. Reducing the cost of your storage while improving the performance of your content management systems are important goals for any company handling large volumes of data. Spectra's modern solutions make this possible by innovating where it matters. Tuned for performance and designed for incremental expansion, BlackPearl provides the right fit for any organization at successive stages of their growth lifecycle.

Figure 1 BlackPearl Converged Storage System

Introduction

Spectra's BlackPearl® Converged Storage System delivers a feature- rich software application in the ultimate hardware platform to modernize your storage workflow – all in a purpose-built solution for persistent data. BlackPearl incorporates hard drives, flash drives, CPU, RAM, Network Cards, SAS or Fibre Channel HBAs into various packages – the BlackPearl V Series, S Series, or P Series.

	BlackPearl V Series			BlackPearl S Series			BlackPearl P Series		
Interface	Disk Expansion	Tape Connect	Network	Disk Expansion	Tape Connect	Network	Disk Expansion	Tape Connect	Network
	Up to 2 ArcticBlue Chassis	One FC/SAS HBA	10 GbE Standard, 40GbE optional	Up to 9 ArcticBlue Chassis	Up to 3 FC HBA, Up to 1 SAS HBA	10 GbE Standard, 40GbE optional	Up to 9 ArcticBlue Chassis	Up to 3 FC HBA	40 GbE Standard
Cache	4 x 4 TB SAS HHD's			10 x 4 TB SAS HHD's			10 x 1.6 TB SSD		
	(Upgrade) 9 x 4 TB SAS HHD's, (Upgrade) 9 x 8 TB SAS HHD's, (Upgrade) 9 x 12 TB SAS HHD's			(Upgrade) 20 x 4 TB SAS HHD's, (Upgrade) 20 x 8 TB SAS HDD's					
Database	2 SSD's = Up to 300 Million Objects			2 SSD's = Up to 300 Million Objects			2 SSD's = Up to 300 Million Objects		
				4 SSD's = Up to 650 Million Objects			4 SSD's = Up to 650 Million Objects		
				6 SSD's = Up to 1 Billion Objects			6 SSD's = Up to 1 Billion Objects		
Throughput	200 - 300 MBps to tape sustained			Up to 600 – 800 MBps to tape sustained			Up to 3000 MBps to tape sustained		

Tuned for performance, BlackPearl provides the right fit for any organization. BlackPearl solves the problem of costly and complex approaches associated with traditional storage systems and reduces workflow inefficiencies. When your growth requires more throughput or capacity than your hardware platform can handle, Spectra's TranScale® architecture allows users to protect their initial BlackPearl investment by seamlessly upgrading capacity while continuing to use their existing components. Designed for incremental expansion, BlackPearl accommodates the storage requirements of organizations at successive stages of their growth lifecycle.

Each appliance is preconfigured with a specific set of components to make installation and setup simple and fast, to maximize reliability, and to decrease the complexity of maintenance.

The Tenets of Black Pearl Converged Storage System

The BlackPearl Converged Storage System was created to optimize both software and hardware as a single, self- managing, cloud-enabled storage platform. This fully integrated solution is delivered as an appliance. The platform's software design is structured to facilitate growth by offering "growth-enabling" licensing. Combining that software philosophy with a hardware that is "TranScalable" across capacities, technologies, and interfaces has produced the ultimate software-refined, hardware-optimized, and purpose-built platform for persistent data.

It is sometimes helpful to describe a new solution by starting with what the solution is *not*. Hierarchical Storage Management (HSM) solutions are often placed in the same storage space as BlackPearl.

HSM software has inherent limitations/challenges which have prevented it from working effectively outside of very large data environments with dedicated storage personnel.

To move data from primary storage to tape, HSMs will leave a "stub file" (a small portion of the file) on disk and then move the rest of the file to tape. When the file is recalled, the HSM provides the data from the stub file, loads the appropriate tape, and then turns the recall over to the tape for the remainder of the restoration. If there are more read requests than there are tape drives available to provide the files, the application will time out. If you have "n" tape drives and "n +1" read requests, the system will most likely fail.

BlackPearl is not:

- An HSM solution
- An LTFS appliance box
- Unlimited tape drive

BlackPearl is:

- An object storage solution
- An effective and reliable method of moving data between data tiers
- An open format storage device utilizing the LTFS format

Another issue arises from the sheer complexity of HSM software. Not all file types are read from beginning to end. Some file types require the beginning *and* end of a file to start the read. This becomes a tremendously complex operation to be managed by an HSM, and has been responsible for the lack of consistent or even successful operation.

Linear Tape File System (LTFS) appliances are also often seen in this area of storage. While different LTFS solutions vary in their approach to data storage, most of these appliances attempt to present multiple tapes as a single name space to NAS – in essence making tape appear as NAS. The same time-out issues described above occur with reads from an LTFS appliance. Furthermore, being able to share information in the "virtual NAS name space" is very complicated and often creates errors and/or failure when sharing data between servers, making it nearly impossible to have multiple users access the same file at the same time.

While the BlackPearl Converged Storage Solution moves data from disk to tape and utilizes the LTFS open format, it is <u>not</u> correct to describe the solution as an HSM or an LTFS appliance. BlackPearl is an object storage solution. Object storage is a way to structure data storage, similar to a file system, but comes without the limitations to growth and performance found in traditional file systems. Furthermore, BlackPearl utilizes hypertext transfer protocol (HTTP). HTTP is the underlying protocol used by the World Wide Web. It defines how messages are formatted and transmitted and is capable of working with delays in response. This is an ideal protocol for moving, retrieving and sharing data and will not "time out" as described above.

Illustrating the Software Composition of a BlackPearl Converged Storage System

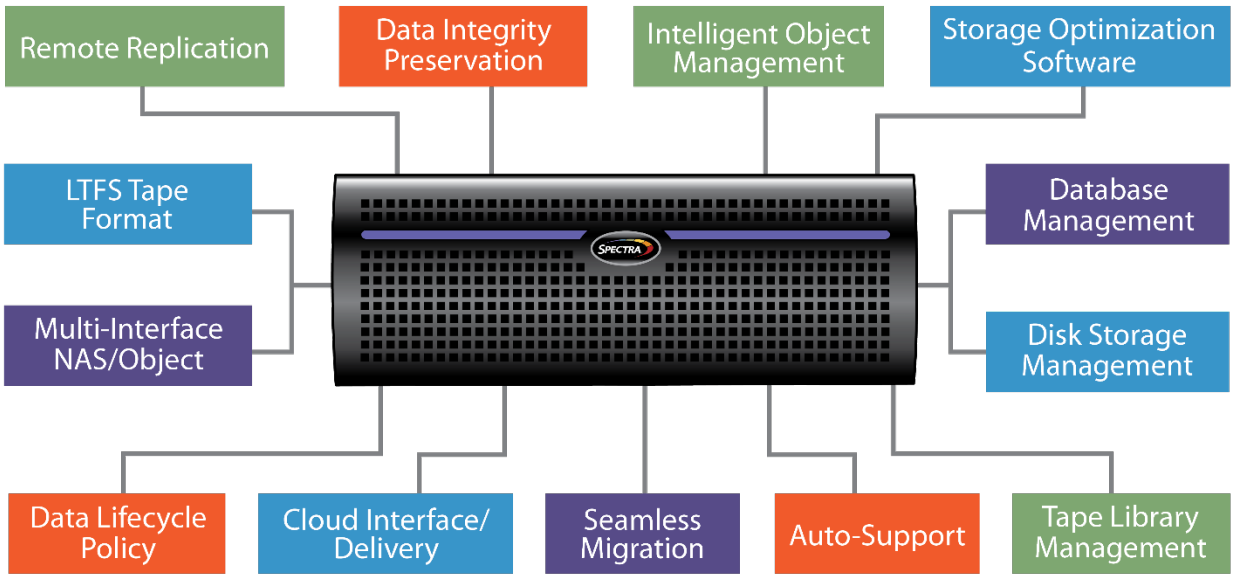


Figure 2 BlackPearl software composition

BlackPearl's Tape Library Management

Data centers that store long-term data on tape are often required to purchase expensive software to manage their tape libraries – software that moves data from primary disk storage to interim storage and finally to tape. Most of these products are 'third-party', not supplied by the tape or archive storage vendor. This software is expensive because charges are incurred for usage and support based on individual licenses. Some software vendors charge a license per tape partition, per slot, or per tape drive; however, the majority charge for licenses on a per terabyte capacity. Charging per capacity means it is harder for the customer to scale and realize the full benefits of new technology. As capacity increases per tape (i.e., from LTO-5 at 1.5TB per tape to LTO-8 at 12TB per tape) the end user pays the same $/TB license for third-party software. Moreover, if the end user keeps the same number of tape slots and fills up all those tapes with data, the user pays eight times as much for their software license because they are storing 8 times more data in the same footprint (in the case of the LTO-5- vs. LTO-8, for example).

BlackPearl Features:

- Unlimited tape drives
  - ✓ LTO-5, LTO-6, LTO-7, LTO-7 Type M, and LTO-8
  - ✓ IBM® TS1140, TS1150, TS1155, and TS1160
- Unlimited tape partitions
- Unlimited tape slots
- External tape cartridge mgmt.
- SW support based on slot count, not capacity of storage

Figure 3 BlackPearl accommodates both LTO and IBM® TS series tape media

With the exception of the Cloud-Out feature, the BlackPearl model does not charge for each/any license. The software support contract enables users to connect as many tape drives and library partitions as desired, as well as manage ejected tapes at no additional cost. Software upgrades are also included with the BlackPearl software support contract (while other vendors may charge for software upgrades).

BlackPearl Delivers Storage Optimization Software

Most competing tape management systems (typical middleware software, HSM software and LTFS appliances) use a file-based interface for their tape storage. Some may have a small capacity

cache buffer, with basic intelligence, to provide a landing zone for data and stubbing (for HSM). However, they still lack the ability to remove the 'one-file-at-a-time' workflow for tape management, causing performance issues. LTFS appliances can be basic in their overall function, allowing the administrator to assign multiple tapes into a single NAS volume, but containing no further intelligence. For example, they do not support multiple copies of data on tape.

BlackPearl uses a unique approach to tape using the BULK PUT/GET commands in a REST interface. REST is more resilient and simpler than CIFS or NFS. It allows for network interruptions and provides client-server communication. The BULK commands, with an object storage structure, provide a more efficient way to move more data to and from the BlackPearl, with less overhead. The commands are completed on a Job basis, allowing a client to pick up an interrupted job mid-progress. The cache management of BlackPearl is optimized for tape, using chunks to split a job into multiple sub-tasks and allowing parts of the job to be processed in parallel. Each chunk's default capacity is about 2% of the tape media capacity (i.e., LTO-8 at 12TB would default to a chunk size of ~240GB). Within a BULK PUT job, there is a lot of room for parallel transfer; multiple files can be sent in parallel within one chunk, and multiple chunks can also be sent in parallel.

BlackPearl Features:

- Cache management
- Bulk reads/writes
- Fine-tune capacity vs. performance
- Storage domain
- LRU algorithms for disk pool cleanup capacity management

This allows for higher throughput into the system. The Software Development Kit (SDK) will default to 10 connections for parallel multi-threaded transfer. Some of our BlackPearl Certified Clients expose the multi-threading as an optional parameter to further tune performance for a specific customer environment.

To further increase efficiency and throughput performance to and from the 'backend' storage on the system. BlackPearl now internally aggregates multiple chunks into a single tape operation using a new Chunk Aggregation feature. When BlackPearl is about to start a task to write or read data, it will look ahead at other Jobs in the queue and determine if they have chunks ready to be written to or read from the same storage target (i.e. same tape cartridge). If the chunks from multiple jobs are using the same target, then BlackPearl will group these chunks together and read or write them in the same operation without pausing. This will increase efficiency by reducing the number of tape mounts since we utilize that same tape cartridge for all available tasks while mounted in the tape drive. This will increase throughput since we are streaming more data from the same tape in a single operation, which is critically important when writing to tape since all writes are sequential. Spectra continues to innovate BlackPearl making it the most efficient and safest enterprise storage system for data

BlackPearl has many knobs used to optimize storage, either for capacity efficiencies, or for throughput efficiencies. There are also knobs to organize and structure data placement. For example, one knob is a Storage Domain, which will create a boundary, structuring and organizing how data is placed onto a specific set of physical media (i.e., tape cartridges). BlackPearl also optimizes the cleanup of older data by using a Least Recently Used (LRU) algorithm to delete older unused data before deleting recently used data.

BlackPearl Remote Application

BlackPearl Converged Storage System has an object storage replication capability – creating a dual active availability, where the same data is available in the same bucket across two BlackPearl systems. This is an asynchronous replication, where BlackPearl will replicate the job (and metadata) immediately, but the job's data will get processed based on job priority, cache bandwidth and WAN speeds. Once the job is finished (status = complete), the data for that job is fully persisted and available on each BlackPearl.

BlackPearl Object Storage Replication Features:

- Active - Active or bi-directional replication between buckets on two BlackPearl systems
- Automated recall if local copy is unavailable or if remote copy is on a higher storage class/tier (based on setting preference)

Database Management

A simple LTFS appliance mightmerely aggregate several tapes into a single NAS volume, providing a 'global' namespace for multiple tapes.

Similarly, an HSM will maintain a database or catalog of where it moved data, but the client application always thinks the data is on a spinning disk tier (either cache or primary storage). This means that within an HSM, the data in the lower tiers is not directly accessible; the data has to come back through the cache or primary storage tier before the end user can copy data to their local storage.

BlackPearl Features:

- Object bucket catalog
- Metadata storage database
- Object name searchable
- Backed up on a schedule with its own data policy

Spectra took a larger scope with BlackPearl regarding storage management and aggregation into a single namespace – BlackPearl both aggregates multiple tape cartridges and multiple tape partitions (and/or tape libraries), abstracting the storage from the end user. The user writes data to a bucket (tape only, disk only, or a mix of storage types). When the BlackPearl notices the bucket needs more capacity, it will apply additional capacity to a storage domain (apply tape cartridges or disk pools to the storage domain). The bucket using that storage domain will now reflect the additional capacity added. The database on BlackPearl maps out where this data is located, providing a catalog of the data and all associated information.

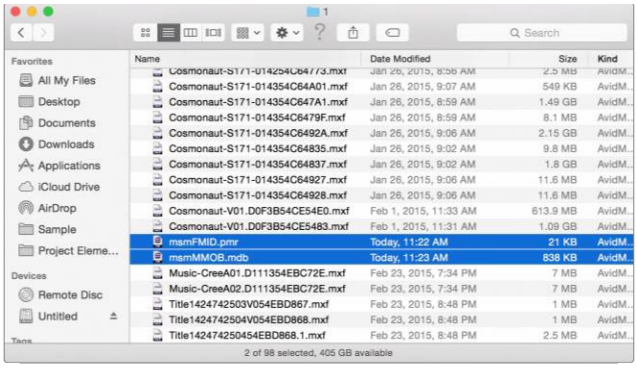


Figure 4 Screenshot of BlackPearl database

BlackPearl further allows additional metadata to be sent with the data, which is also stored in the BlackPearl database. The object 'name' field is indexed in the database, allowing it to be searched with an API call. The database on BlackPearl is backed up based on a customizable configurable policy. The default data policy is two copies on separate tape cartridges. Creating an additional backup copy to the cloud provides supplemental disaster recovery protection for the database.

BlackPearl also has a database backup feature, where the BlackPearl database is backed up into its own isolated bucket. Bucket isolation is used to separate out the backup from other data, and decreases restore time by using a smaller set of tapes or a specific isolated disk pool (i.e., two SAS drives in a small mirrored online pool). The backup runs on a schedule and follows a specific data policy set of rules to write out the number of copies to various storage mediums. BlackPearl will also send a system message with the barcodes of the tape(s) once the database backup job has completed.

Disk Storage Management

HSM systems allow for disk, but only in a rigid tiered structure where 'intelligence' moves data off disk to lower tiers, or off tape back onto disk. Third-party solutions may support other 'primary storage' vendors like EMC's Isilon as their disk tier, using it as a secondary storage for archive data.

The BlackPearl Converged Storage System enables both online disk (with Enterprise SAS HDDs) and Archive/Nearline Disk (with Spectra® ArcticBlue® Archive HDDs). In a data policy on BlackPearl, each disk tier can be set as a temporary or permanent target, and multiple storage domains (for multiple copies) are applied to a data policy. Data is directly accessed from ArcticBlue, unlike the way most traditional HSM's move data back to a higher tier first, prior to sending it to the client.

BlackPearl's Disk Features:

- Full power of advanced bucket management (ABM) policies
- Power management for Nearline ArcticBlue pools - using advanced idle states on the Archive HDDs
- Built-in utility to assure maximum value
- Intelligently will turn off compression when data is not compressible
- Enterprise HDDs, SAS, 4TB, 8TB and 12TB (Online Pools)
- SATA, 8TB (ArcticBlue – Nearline Pools)

Intelligent Object Management (IOM)

As the name implies, Intelligent Object Management (IOM) is a suite of features that is part of the same code base which allows BlackPearl to more intelligently manage objects. IOM consists of four main components:

- Self-Healing
- Automatic Tape Compaction
- Data Policy Modification
- Migration

Self-Healing

With the Self-Healing feature of IOM, BlackPearl will automatically self-heal or repair a bad copy of an object if another good copy exists. For example, if a customer has a policy to write one copy of an object to tape and one copy to disk, and the copy on tape is discovered to be unreadable, then a new tape copy will automatically be created from the disk copy. As with previous versions of BlackPearl, the administrator will be notified of the bad copy, but now the bad copy will automatically be replaced.

BlackPearl might detect a bad copy of an object when attempting to do a restore of the object or during a scheduled or client-requested object verification. If an entire tape cartridge is determined to be bad, BlackPearl will automatically recreate all bad objects on the tape cartridge as long as another copy of the data is available. If the only good copy is available on an ejected tape, then the administrator will be alerted to return the ejected tape to the tape library so that the self-healing can be done.

Automatic Tape Compaction

One of the challenges of using tape is in environments where files are regularly deleted. When data is deleted from tape, it creates empty space on the tape where the deleted data was stored. This empty space cannot be reused until the tape is reformatted. The only way to reclaim the empty space is to move all active files to another new tape so that the tape with the deleted files can be reformatted and reused.

With the new Automatic Tape Compaction feature, BlackPearl does just that. Administrators can optionally set the tapes with a specific percentage of deleted data to be automatically “compacted” by moving the active data to new tapes. This movement is a set as a low priority Job in BlackPearl. Data from the old tapes is first written to the BlackPearl cache in segments called “chunks”. This data is then read from the cache and written to new tapes. Data is not deleted from the old tapes until BlackPearl confirms that the data has safely been moved to the new tapes.

Data Policy Modification

With the new Data Policy Modification feature in IOM, customers can now modify BlackPearl data policies after they have already been in use. For example, a customer may have an existing data policy in place to make a single data copy to tape. After the data policy has been in use for some time, the customer may decide to make a second copy to the Cloud. With the new Data Policy Modification feature, the customer can add the Cloud copy after the policy is already in use. Once the data policy is modified, not only will all new data entering BlackPearl be written to both tape and cloud, but BlackPearl will, in the background, read all of the existing data that was previously written to tape and copy it to the Cloud. This Data Policy Modification feature works for any combination of storage targets – tape and tape, tape and disk, disk and disk, disk and replicated BlackPearl, disk and Cloud, etc. Existing data that is copied to a new storage target is set as a low priority Job in BlackPearl.

Migration

As tape and disk storage technologies evolve, customers need an easy way to migrate their data to new storage technologies. For example, a customer that has data on LTO-5 tapes might want to move the data

to LTO-8 tapes. With the new Migration feature in IOM, customers can easily upgrade to new storage technologies without disrupting users. Migration will occur automatically in the background. Data is migrated as a low priority Job in BlackPearl. Users can continue to archive and restore data without interruption.

Object Versioning

BlackPearl 5.0 now allows customers to keep multiple versions of the same object. Once multiple versions are uploaded to BlackPearl, if a client does a restore/GET of the object, BlackPearl will always provide the latest version, unless the client otherwise specifies the version.

One of the most powerful features of versioning is the ability to protect from accidental deletion. When BlackPearl receives a traditional DELETE command to delete a versioned object, it doesn't actually erase the data from the system. Instead, it simply removes the "Latest" flag from the latest version. All versions of the object are still retained after the delete command is received. Doing a traditional restore/GET of a deleted, versioned object will return a "file not found" error if a version is not specified in the restore request. But if a version is specified in the restore request, then BlackPearl can and will restore the requested version.

Figure 5 Spectra's Arctic Blue and BlackPearl disk options – SATA and SAS HDD

Multi-Interface Support

LTFS appliances may present multiple interfaces, but they are typically a pure file-based storage system and only use a file system (i.e., CIFS/NFS) interface for data movement – losing all the benefits of an object storage system and a RESTful interface.

In addition to object storage, BlackPearl now supports configuring NAS volumes (CIFS/NFS) directly on a BlackPearl Converged Storage System. Within a converged BlackPearl, NAS pools are set up as separate pools from the BlackPearl cache pool; Spectra will internally copy the data from the NAS pool to the BlackPearl cache pool – avoiding the network hop. This tight integration helps organize even a very complex

application into simple resources, making it easy to handle high loads. The capabilities of a RESTful interface are amplified by object storage systems, allowing for unlimited scalability. The lower emphasis on processing and high-capacity networks makes this combination especially effective in public and private cloud storage.

BlackPearl Features:

- Support for NAS (CIFS/SMB and NFS) data storage alongside object storage (Spectra S3)
- BlackPearl NAS uses same ZFS RaidZ parity options and the same flexibility of NAS pools (as Spectra Verde® Disk Solution)
- NAS interface (CIFS/NFS) co-exists with object storage interface (Spectra S3)
- NAS storage tiers also co-exists with object storage tiers disk/tape/cloud

LTFS Tape Format

It is essential to consider the proprietary nature of most systems. To write data to tape in an efficient way, most third-party software vendors use a proprietary format. Some vendors may even design and build their systems to lock customers into their products.

BlackPearl Features:

- Built on open standard code (FreeBSD and ZFS)
- Uses open LTFS format for tape

Using open standard code is a friendly, forward-thinking approach. LTFS reduces total cost of ownership (TCO), provides energy-saving features, and offers a long storage life. As a leader in the storage industry, Spectra is a proponent of LTFS and champions its adoption industry-wide. BlackPearl's FreeBSD (operating system) and ZFS (file system) are both based on open source code. LTFS is the only format that BlackPearl uses to write to tape, and is a portable way to exchange data. BlackPearl supports both exporting LTFS tapes as well as importing foreign LTFS tapes.

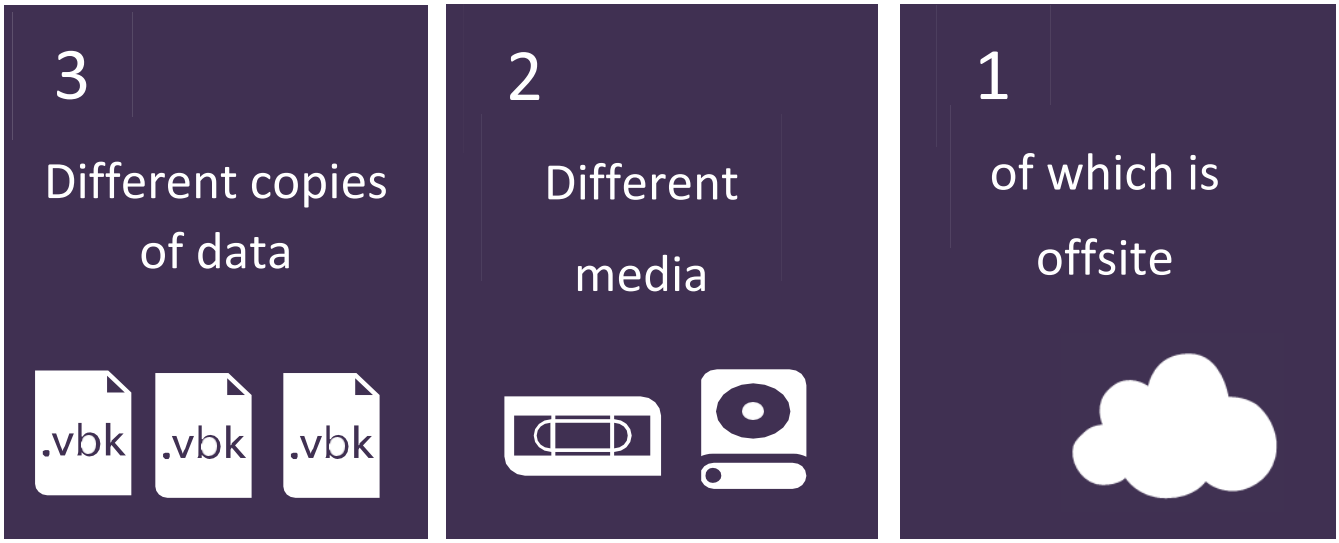
Data Lifecycle Policy

The role of storage systems is to ensure the data lives on during its lifecycle, and some systems have robust policies to help ensure the data is protected and available. HSM tends to set broad or global policies for all data, and typically does not allow for multi-tenancy or multiple policies for different work groups, projects, or applications. The best way to protect data is with the *3-2-1 … 1* rule: *three* copies of data stored on *two* types of media, with one copy kept *offsite,* and one BlackPearl copy kept *offline*. While keeping a copy offline is an extra step, it makes it much harder for a hacker or user to corrupt, delete or destroy that data. BlackPearl provides the safest place to store data, while also delivering fast access, and higher availability of data at a lower total cost of ownership. BlackPearl (ABM)

BlackPearl Features:

- Data policy engine (ABM)
  - ✓ Temporary or Permanent persistence rules
  - ✓ Multiple copies specified, on any targets available (disk, tape, cloud, or replication)
- Job managed system, with job priority for resource optimization

allows the storage administrator to set a 3-2-1 policy, replicating one copy to ArcticBlue, another to a disaster recovery tape library, and a third that is ejected from the library for offline storage. The job management system in BlackPearl allows it to process many jobs at the same time, juggling cache while reading data back from tape and replicating data to another BlackPearl, etc.



Cloud-Out/Delivery

There is a big push for cloud and varying cloud initiatives within many businesses. There are two sides to the public cloud: services (often with some type of computation element) and general cloud storage. Spectra focuses only on the storage aspect.

BlackPearl Features:

- Set public cloud out targets
- Azure and Amazon (including Glacier support)
- Automated restore if local copy is unavailable

Other vendors currently offer users the option to leverage cloud storage as an archive data tier, or as part of a disaster recovery plan, safekeeping a copy of their data online. They do not support Glacier as a location for data in the cloud, due to slow recall.

The approach with BlackPearl is a bit more straightforward. Spectra supports both Azure and AWS public cloud storage. There are policies on BlackPearl to choose (if at all) when BlackPearl will automatically restore data from the cloud if the local copy is unavailable (i.e., if the tape library is under maintenance). BlackPearl's use of public cloud storage would be best described as a disaster recovery copy.

Data Integrity Preservation

The primary way to preserve data is by knowing the exact bits when the data was first created – using a checksum, storing that checksum, and verifying that the data has not changed over time by doing periodic verification and recalculating the checksum tonsure the exact bits are the same.

Using an object-based storage system provides native checksum capability, where every object or object part gets a checksum no matter what. It is crucial to know if/when data has been tampered, changed, corrupted, etc. Verifying data with a checksum is the only way to really know.

BlackPearl Features:

- Checksum of object or object parts
- Scheduled and automated checksum verification

System Management

BlackPearl has many system-level features, which, as a whole, make BlackPearl easy to manage. Some are specific to the end user, like active directory, or our physical placement API command (i.e., EON Browser will show ejected tape icon: 1 copy ejected), but someare designed for the BlackPearl administrator. The administrator will use BlackPearl's web-based management GUI to set up, configure, monitor, update, and generally manage the BlackPearl system and software. Spectra includes standard management features in all of its products, such as AutoSupport Log (ASL) with phone home capability, SMTP (BlackPearl will email the admin when there is an error message or a system message, such as the tape barcodes of the completed database backup job), SNMP, and an easy software upgrade process.

The Visual Status Beacon (VSB) is the front bezel (with the LED) on the BlackPearl nodes. It is a critical communication mechanism that notifies any system administrator walking in front of the BlackPearl of the status of the system at a quick glance. The VSB will turn colors when something happens to the BlackPearl (if an HDD has failed and is rebuilding, if a power supply has gone bad, etc.). This makes it easier for a busy administrator to get a strong visual cue that action is required.

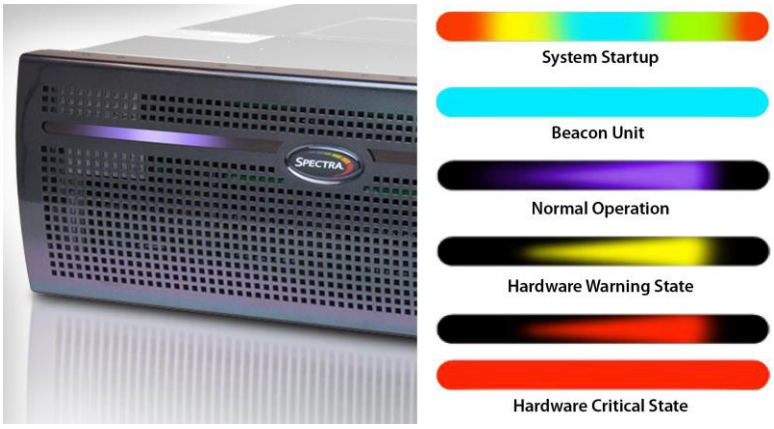


Figure 6 Visual status beacon

An important aspect of BlackPearl is capacity planning. The BlackPearl dashboard displays the capacity for each storage domain (used and available), and the number of scratch (empty) tapes or disk pools – these are tapes or pools that are not yet assigned to a storage domain. This information lets the administrator know how much capacity is available, and whether they need to purchase more.

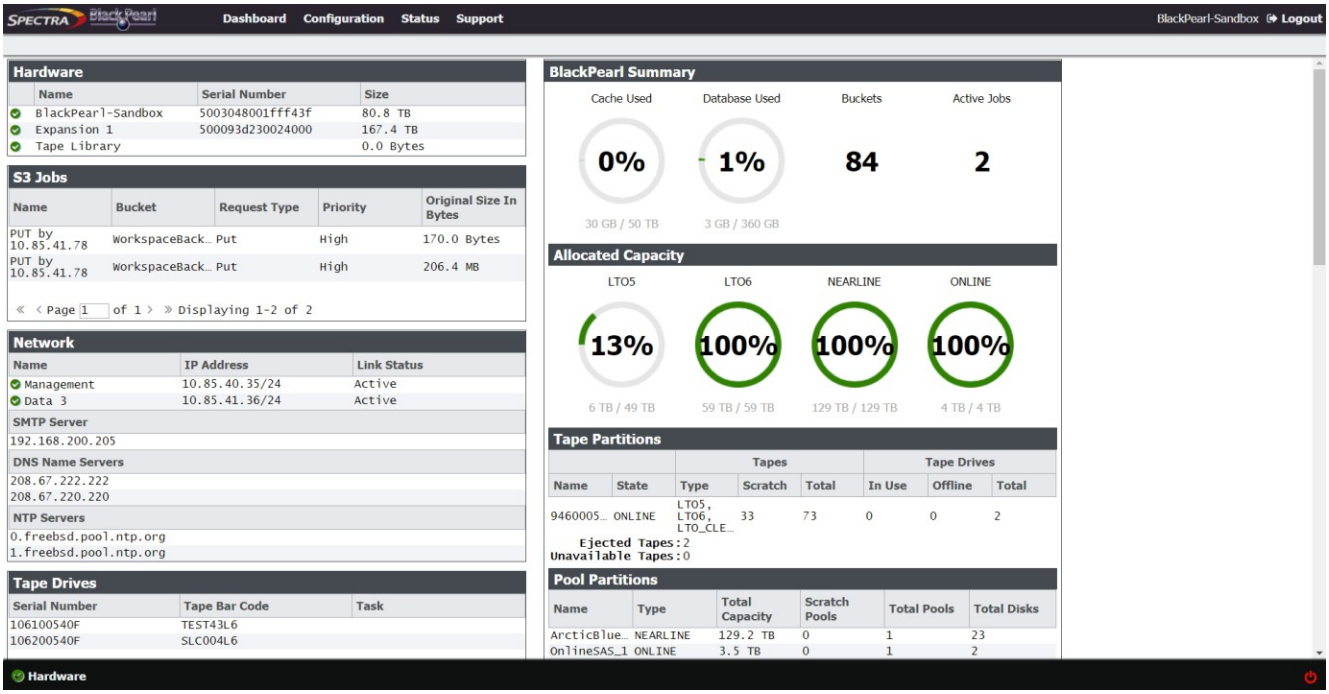


Figure 7 BlackPearl dashboard

BlackPearl also has performance graphs that allow the administrator to monitor how BlackPearl is doing. They can determine whether the platform is currently active, how many tape drives are being used, and get a general idea of the overall performance of the system. Performance graphs are available for disk pools (i.e., cache pools), tape drives (individual tape drives), disk drives (individual hard disk or SSD), CPU, as well as the network (individual ports). Performance data for any graph can be downloaded as a CSV file.

BlackPearl has a reporting system as well. Reports are generated on many different aspects of the BlackPearl. For instance, the 'bucket report' includes the capacity used on each bucket. From browser integration to a full web-based management GUI, to physical hardware display (VSB), to an integrated reporting system – the BlackPearl Converged Storage System combines multiple levels of management in a fully integrated system.

Figure 8 BlackPearl performance screen

SpectraGuard AutoSupport

One of the biggest features of Spectra solutions, including BlackPearl, is something that is not built into the product. Spectra's support team, staffed 24x7 in our Boulder, CO, headquarters, provides the world-class SpectraGuard Support. From the product level, Spectra offers multiple support specific features that contribute to an 'easier to manage' and 'easier to support' system, including: ASL, phone home capability, and easy software upgrades, among others. Spectra's outstanding support team is a unique feature of the solution. Our team goes the extra mile to ensure customer delight at every user touch point.

Solution Simplification

Many middleware systems (that support tape libraries) are multi-server solutions. Very large systems can have up to one data mover per tape drive. And some solutions will use expensive primary storage (like Dell EMC's Isilon) as an online cache.

BlackPearl simplifies all of the hardware and software into a single controller system, using direct JBODs for a scale-up capacity with online or archive disk storage tiers. With a BlackPearl P Series, more than 20 tape drives can be attached and are able to push over 3GBps sustained – all in a single server solution.

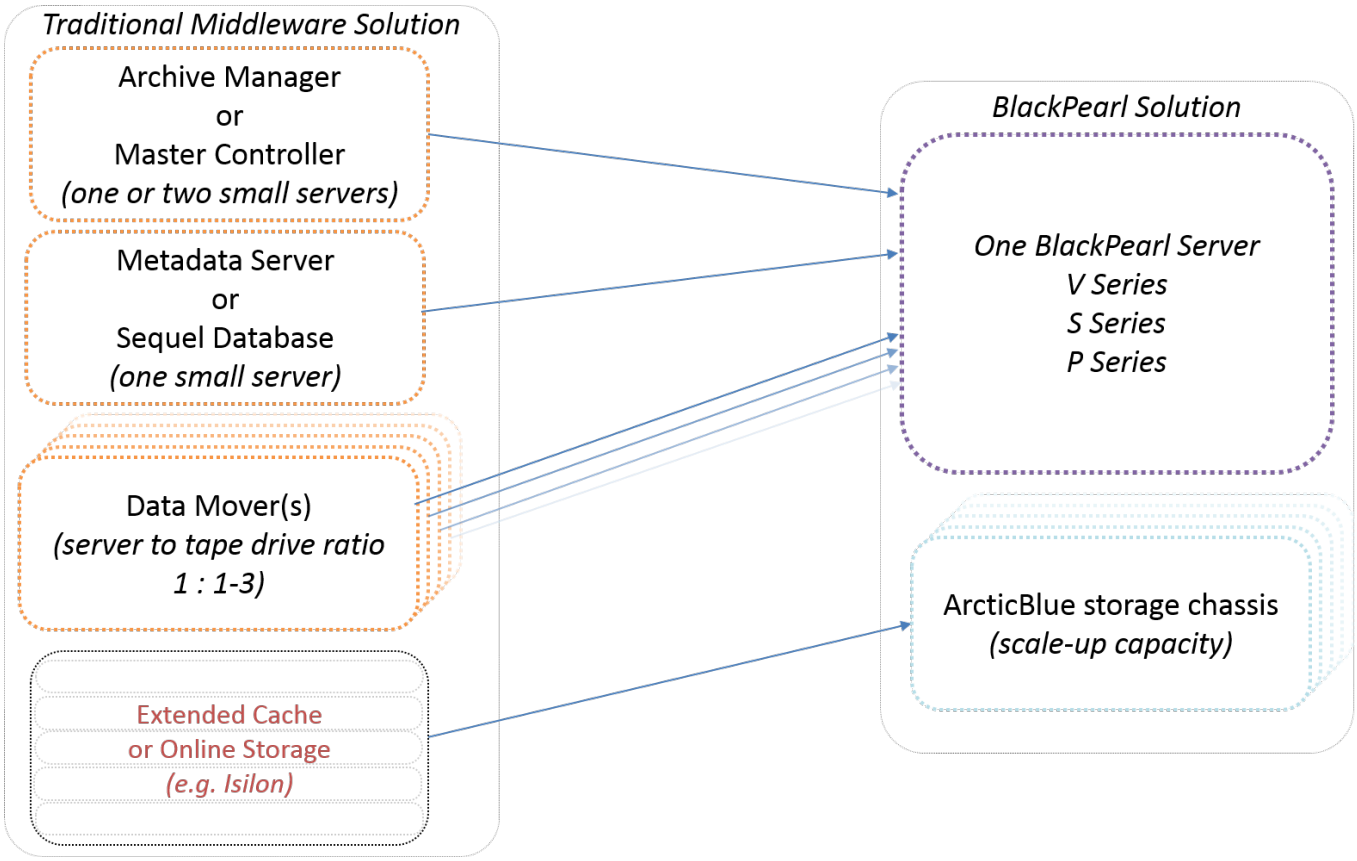


Figure 9 Simplify the solution - from middleware with multiple servers to a single-server BlackPearl

Conclusion

Consolidation of both software and hardware has offered great advantages to large data centers in every vertical market across the globe. In many cases, however, this consolidation has led to fewer options on the backend – proprietary formats, limited expansion, vendor lock-in, or the requirement of specialized software to further direct the lifecycle of the data under management.

As organizations turn greater focus to the true value of data, both historic and future, it becomes clear that data and digital content will most likely last much longer than the storage technology on which it is written. Spectra realizes that a purpose-built platform for persistent data must meet three basic criteria:

1. Reduce the cost and overhead of multiple software and hardware solutions running independently

Allow for data to move in multiple directions to multiple targets – from storage to retrieval and across multiple hardware types, including public or private cloud, depending on performance requirements and cost sensitivity

2. Offer licensing agreements which support the inevitability of ongoing data growth

A modern approach to storage is about simplicity, flexibility, and expandability. The Spectra BlackPearl Converged Storage System consolidates licensing, software and hardware support, all storage types, and ongoing management into a single, self-managing, cloud-enabled storage platform. It eliminates the challenges of multiple vendors and contracts without limiting the future direction of data protection.

There are several options for protecting data for long periods of time, but finding the best solution as well as the best Total Cost of Ownership (TCO) can be challenging. When data is being retained for years, decades, or indefinitely, TCO plays an even more important role in the decision process. Not only does the BlackPearl Converged Storage System lower the acquisition cost of multiple servers and software applications, as well as the need for multiple vendors, but this consolidation reduces continuing administration costs and overhead – resulting in the lowest TCO for years to come. Reducing the cost of your storage while improving the performance of your content management systems are important goals for any organization handling large volumes of data. Spectra's modern solutions make this possible by innovating where it matters.

Contact Us

Spectra realizes that a purpose-built platform for persistent data must be simple, flexible, and expandable. Spectra plans to update and publish this document with new data where needed. Please let us know your thoughts. Spectra Logic www.spectralogic.com

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About Spectra Logic

Spectra Logic develops data storage solutions that solve the problem of short- and long- term digital preservation for business and technology professionals dealing with exponential data growth. Dedicated solely to storage innovation for 40 years, Spectra Logic's uncompromising product and customer focus is proven by the adoption of its solutions by industry leaders in multiple vertical markets globally. Spectra enables affordable, multi-decade data storage and access by creating new methods of managing information in all forms of storage—including archive, backup, cold storage, private cloud and public cloud. To learn more, visit www.SpectraLogic.com.

303-449-6400 • 800-833-1132 • 6285 Lookout Road • Boulder, CO 80301 USA • spectralogic.com

V3-021419