



BlackPearl Object Storage Disk Disk-Only Solution for Media and Entertainment

Striking the right balance between performance and cost



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Introduction

Media companies with vast amounts of content must address the challenges associated with balancing limited IT budgets against their ever-expanding repositories of digital assets. This requires the selection of innovative and agile solutions to help them focus on their core business in this dynamic and competitive landscape. Such solutions need to be fast, adaptive, cost-effective and open to enable them to maintain control over their content and an edge over their competition.

Spectra's BlackPearl® Object Storage Disk Solution, powered by the Spectra BlackPearl® Converged Storage System, is a modern, object-based, disk storage system that is easy to manage and scales as needed to over 15 petabytes. The disk based solution allows media companies to manage their storage cost effectively and accommodates environments that are tapeless, or that desire mixed storage. BlackPearl Object Storage Disk delivers a low total cost of ownership (TCO), easily and quickly adapting to changing workflows and business needs.

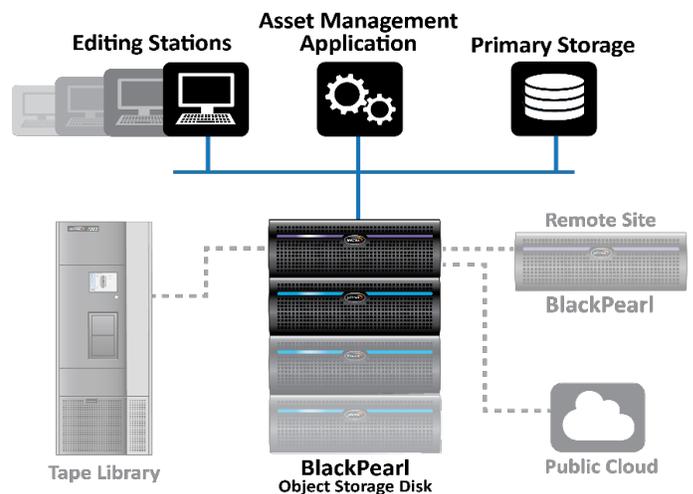
BlackPearl Object Storage Disk for Media Workflows

BlackPearl Object Storage Disk complements production storage in any environment -- as nearline storage and archive storage -- in one single system. For quick concurrent access to media, it provides a balance between cost and expected performance. BlackPearl Object Storage Disk was designed with the needs of media workflows in mind; it delivers a solid return on investment for key media organizations.

News environments – BlackPearl Object Storage Disk offers all attributes required of a storage system, such as low cost, seamless scalability, and the fast response time required to store and retain breaking news, anniversaries, obituaries and election cycles, etc.

Creative and graphics – These groups benefit from BlackPearl Object Storage Disk for storage of their seasonal campaigns or tentpole events. These assets and projects typically sit untouched for many months or for extended periods of time. As the event nears, these assets must be accessed quickly to repurpose, then go dormant again.

Sports broadcasters and regional sports – These networks can leverage BlackPearl Object Storage Disk to retain, search and access prior-season content, b-roll, promos, teasers, social media, new media, and remote or studio productions -- for reference or monetization.

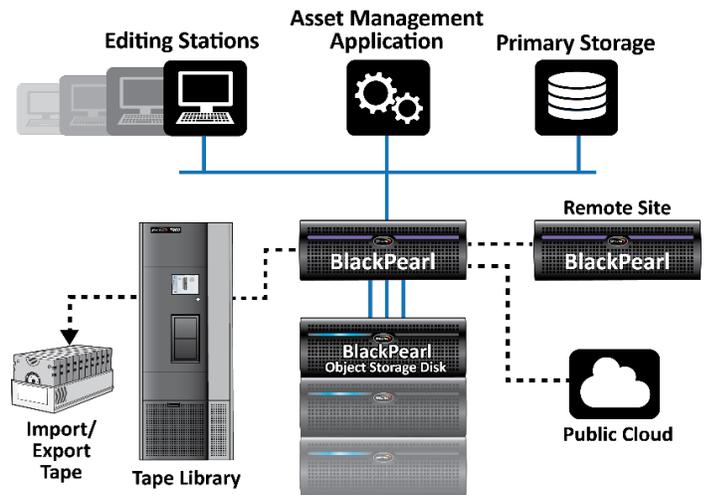


Video and post-production houses - High quality videos (i.e., 4K, 8k, and even 16K) that result in exponential file size growth can be offloaded from expensive primary storage and parked on lower cost BlackPearl Object Storage Disk systems. Implementing a seamless tiered storage infrastructure with BlackPearl Object Storage Disk to augment production storage reduces the overall cost of storage, while providing a highly efficient workflow and production environment that ensures files can be accessed as needed.

Leveraging Spectra's BlackPearl Converged Storage System Architecture

To understand the value of BlackPearl Object Storage Disk, one must understand the power of Spectra BlackPearl Converged Storage System. Spectra's BlackPearl Converged Storage System was designed to provide a single portal to multiple tiers of storage – intelligently moving and retaining content seamlessly on disk, tape and/or cloud - without the need for costly middleware. BlackPearl Converged Storage System is an agnostic storage platform that easily and seamlessly integrates with any MAM, PAM or DAM application utilizing a simple RESTful API. These integrations allow for asset management applications to effortlessly ingest, manage, archive, search and retrieve all media assets, regardless of their location. Utilizing the BlackPearl Converged Storage System's intelligent data policy engine, Advanced Bucket Management (ABM), redundant copies of media are stored on multiple storage mediums, including disk, tape and/or public cloud.

BlackPearl M&E Storage Architecture



Unique to BlackPearl Object Storage Disk...Power Down

BlackPearl Object Storage Disk is the first power-managed, disk-based object storage platform that can be used as nearline or archival storage. Offloading from high-priced production storage to low-cost BlackPearl Object Storage Disk, with costs as low as six cents per gigabyte, provides significant savings. Additionally, the spin-down disk technology used by BlackPearl Object Storage Disk allows for independent bands of disks to power down when idle. This minimizes the degradation of disks, extending the life of the subsystem up to seven years. Most disk systems require a refresh every three to four years. BlackPearl Object Storage Disk provides significant cost savings in both the procurement and deployment of a new subsystem, as well as reducing the overall time and labor required to migrate assets from the old to the new subsystem.

To place these cost savings into a CAPEX model, let's compare traditional nearline storage used by legacy middleware against the cost and longevity of BlackPearl Object Storage Disk. If the cost of traditional nearline storage is ~\$500/TB, and has to be purchased twice during a seven-year period, the actual cost will be closer to \$1,000/TB. When the total cost of BlackPearl Object Storage Disk is ~\$100/TB for a smaller 2PB storage system, the capex savings can amount to \$1.7 million USD over the seven-year period.

Cost Benefits of Power Down Disk

Using Spectra Drive Lifecycle Management, BlackPearl Object Storage Disk will intelligently spin down disk drives when their band has been idle for a period of time (one hour). This reduces power consumption, minimizing the wear factor on the drives, extending their lifespan. Each band is individually operated, powered down, and quickly spun up again as needed. Whether the band is spun up or spun down, this action is transparent to the user, and the Certified BlackPearl (MAM or PAM) client seamlessly restores data.

Let's examine this feature in a real world workflow example: #1.) In a 10PB system using nine BlackPearl Object Storage Disk chassis (45 bands), when the system is idle, say over a weekend or after hours, all the bands are spun down using merely 2,015Wh. That is a very efficient power density; 2KWh for a 10PB system is less than 0.2Wh per TB.

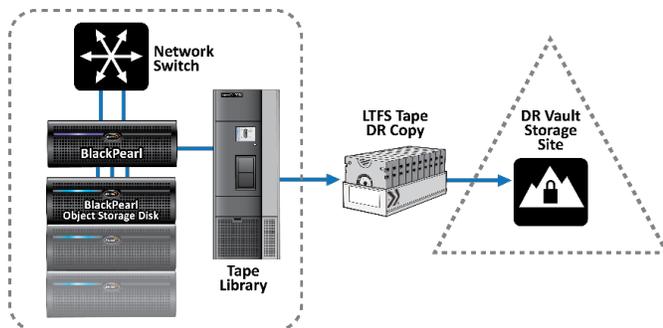
When writing to one band, only that band is powered up. This means that 1/45 (2.22%) of drives are using full power, the system is using just 2,140Wh. A marginal increase over the completely idle system.

Full power-on in large systems (45 bands) is rare since I/O activity across all bands is hard to achieve due to the size of data set (10PB); whereas, a smaller 10-band system could easily see I/O activity across all bands. Let's assume a sports highlight reel job will restore some data from every band so 100 percent of bands spun up. We are now using 7,700Wh for the 10PB system. Note, an hour after the bands' I/Os stop and the system is idle, they will spin back down, dropping the power usage closer to one of the previous power numbers.

The power-down feature provides a large OPEX savings in a data center, reducing the burden on both the electrical system and HVAC system. Comparing this to an always-on storage system (common with legacy middleware environments as a nearline cache), cost savings approaches tens of thousands of dollars annually, if not monthly, will become evident.

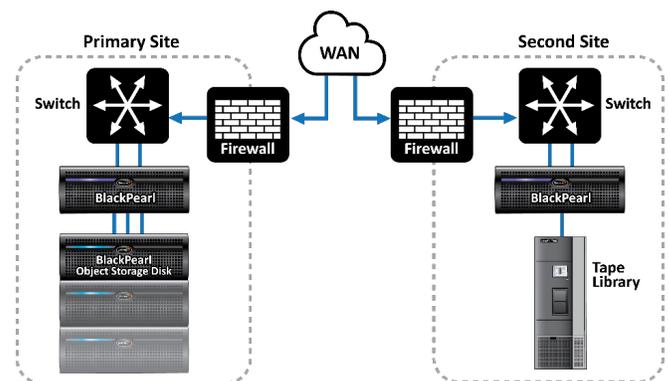
Disaster Recovery (DR) for Assets on BlackPearl Object Storage Disk

As with any other storage system, protecting assets is paramount to the overall business. BlackPearl Object Storage Disk offers a number of seamless disaster recovery options: including local recovery, from a remote site or from the cloud.



BlackPearl Object Storage Disk makes it simple to add DR. Whether it is part of the initial purchase, or added later as budget allows.

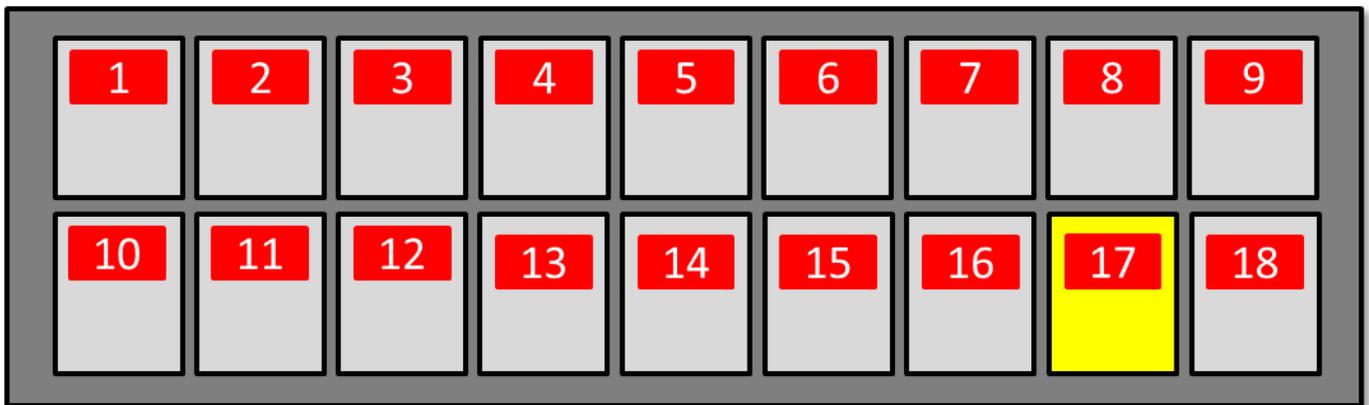
Replicating to a second site is the most robust option; it provides disaster recovery and high availability in a multi-site active-active deployment. This second site could contain BlackPearl Object Storage Disk and tape. This disk and tape option provides the most recovery options.



Protection, Performance and Capacity: What to Expect

A unique feature of BlackPearl Object Storage Disk is its use of large arrays of disks (up to 16) in individual wide bands. The spread of data over large numbers of drives delivers greater read performance (nearly 1 GB/sec). This data distribution coupled with optional replication delivers the best performance, protection and recovery. Other object storage systems commonly use a 20+6 erasure coding which requires higher overhead, achieving only 20/26 of the capacity. While this method provides good data protection, it requires a greater number of drives and delivers lower usable capacity (less than 77 percent usage). Spectra's implementation of ZFS software uses double or triple parity to maximize data integrity.

Objects written across 18 drives with Galois field-based erasure-coded includes parity protection to recover from a single block failure or the loss of entire drive(s). Individual block failures are recreated and saved on the original drive. Failed drives automatically rebuild to an available spare.



To counter the higher overhead of other object storage systems, BlackPearl Object Storage Disk uses a 16+2 band size. In a 107-bay expansion enclosure, utilizing 5 bands of 16+2 plus one band of 13+2 with two hot spare drives, the usable percentage of RAW capacity is 87 percent (93/107). This capacity is available on both enterprise drives, the second and third generation drives (12TB and 16TB drives respectively).

To understand the performance characteristics, one needs to understand the architecture of the storage system. Data written to the object pools first lands on the BlackPearl cache, where checksum verification ensures integrity of content received. From the cache, the data is persisted to storage bands based on the associated buckets policy. Properly sized cache on appropriate BlackPearl will optimize the write performance from 200 MB/sec up to 3000 MB/sec.

The read performance of BlackPearl Object Storage Disk is a function of the number of storage bands, as it services restores directly from storage bands bypassing cache. The read performance is up to 1GB/s from a single band. More bands will increase capacity and, thereby, increase the overall performance based on the number of concurrent access.



Expansion: Incremental Scaling as needed

Not only is BlackPearl Object Storage Disk reliable (up to seven years of life) and economical (as low as six cents a gigabyte), it also easily scales to accommodate ever-growing content. In order to scale the BlackPearl Object Storage Disk system, users can increase capacity and performance by adding additional bands and/or expansion nodes. Added bands automatically provision into available storage. Each BlackPearl Object Storage Disk expansion node connects to the master node using a direct external SAS cable. BlackPearl supports up to 9 expansion nodes, scaling to 15.4PB within a single rack. Spectra Logic's storage solutions, including BlackPearl and BlackPearl Object Storage Disk expansion nodes, are designed to easily add or swap drives, and replace components with spare parts optionally stored onsite. Expansion of additional bands and nodes require zero downtime with the optional preinstall of SAS HBAs in BlackPearl. With BlackPearl Object Storage Disk, organizations can better manage data that continues to expand at dizzying rates.

Data Integrity: Keeping Content Safe

BlackPearl Object Storage Disk systems ensure data integrity by providing multiple levels of integrity checks beyond those found in typical disk systems, resulting in a much better error recovery. The first level includes advanced file system checksums that protect against undetected errors. BlackPearl Object Storage Disk features an on-demand data integrity check that scans the drives for data corruption and automatically corrects any errors found. The integrity check runs on individual BlackPearl Object Storage Disk bands. In addition to file system checksums, the BlackPearl Object Storage Disk bands have double or triple parity protection with intelligent rebuilds using a hot spare hard drive. This level of protection allows for up to three drive failures while providing continuous access to data.



BlackPearl Object Storage Disk:

Global spare drive(s)
Triple or Double parity options
Flexible Band Sizes

Minimum Configuration Options (RAW TB):

Two bands, one HotSpare
Mirror

- With 16TB, 80TB
- With 12TB, 60TB

Double parity, largest recommended band size

- 16+2 with 16TB, 592TB
- 16+2 with 12TB, 444TB

Maximum Configuration:

Up to 15.4PB per rack
System power savings up to 80%

Performance:

Up to 1GB/second throughput

Power per Expansion Node:

All Bands Read/Write – 775 watts
All Bands Idle – 140 watts

The object storage checksum provides the second level of protection. It provides a file-level or part-of-file (chunk/blob) level checksum, where each file or chunk has its checksum calculated and stored with the object as metadata. An end-to-end checksum be performed where the host is required to provide a checksum for the file or blob prior to sending the data to BlackPearl. Once the file is transferred and in the cache BlackPearl verifies data against the checksum provided by the application, ensuring the integrity of the data in transit.

In addition to protecting the single copy of data on a BlackPearl Object Storage Disk band, another great way to provide more protection (while also increasing the availability of data) is to maintain an additional copy of data on a secondary BlackPearl Object Storage Disk band.

Content Integrity on BlackPearl Object Storage Disk:

- Continuous checks for bit rot and automatic error corrections
- Checksum verification of data at the file or file-part level, in-flight or static
- Optional multiple copies of assets on separate bands, or replicated BlackPearl Object Storage Disk system (local or remote)
- Optional DR copies on tape (internal to a library or exported) or on public cloud (i.e., Amazon or Glacier)

Multi-Tenancy

Having multiple applications is commonplace in modern media workflows. Sharing a storage platform for multiple applications and across multiple workflows is crucial to keeping TCO of storage as low as possible. Administrators can create users, groups and buckets, allowing multiple applications to share and access a single BlackPearl Object Storage Disk system.

Access Control

The administrator can set up access control lists (ACLs) to share content between different users or applications on a per-bucket basis. The access lists include options for read, write, list, job and delete-control.

High Availability

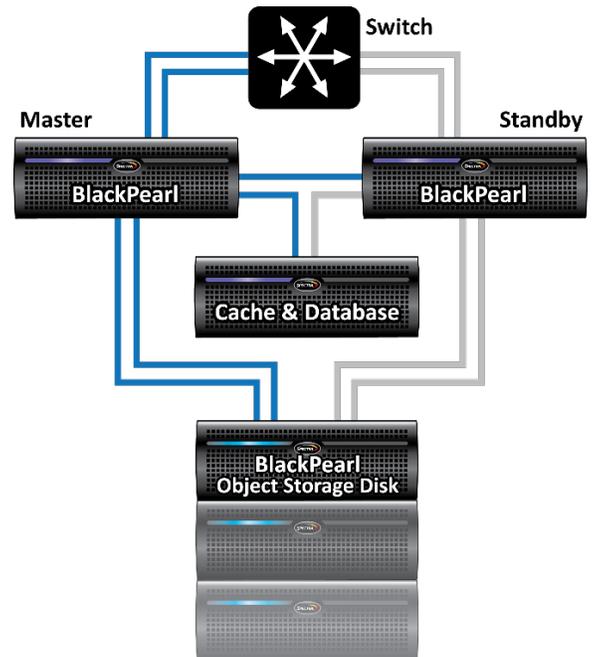
Protecting content to ensure availability is just as critical as having fast concurrent access to data. If multiple copies of data at one location or multiple sites is required, the native bi-directional replication on BlackPearl provides high availability. Multi-site replication provides the utmost data protection, reliability and users can access content seamlessly through either site. If multi-site replication is not an option, then the following two options (Spectra ColdPair and Spectra HotPair) ensure content availability at a single site.

Spectra ColdPair

The ColdPair option lets users quickly and economically recover from a master node failure. This involves storing a spare master node onsite. In the case of a master node failure, the customer can rapidly bring the system back up using the spare master node by following a few simple steps: Powering off the original system, moving all cables and data drives to the spare node, then powering up the system and ensuring all keys are installed. The system will automatically read all configuration data, bringing the system to its original operational state. All bands and associated data will come online in less than 30 minutes.

Spectra HotPair

Similar to how ColdPair works, HotPair is an automated way for system to recover in a minimal amount of time, having both nodes powered on at all times. HotPair set up is configured with two BlackPearl master nodes and one or more expansion nodes. The master nodes do not contain data drives, but instead operate as (disk) controllers. Both master nodes connect to all expansion nodes via SAS cables. One master node is active, and the other is in standby mode. The standby node monitors the active master node utilizing a 'heartbeat' signal. Heartbeat is over both a direct serial cable connection and over the Ethernet network. In the unlikely event the active master node fails, the standby master node takes over. While data access is affected during the recovery, the system does recover and return to serving data with no administrator intervention.



Conclusion

BlackPearl Object Storage Disk is a modern disk-based storage system that scales as needed, allowing media and entertainment organizations to manage their vast repositories of assets cost effectively and with very low TCO. BlackPearl Object Storage Disk allows the seamless sharing or isolation of content among a host of applications, enabling efficient, innovative workflows. BlackPearl Object Storage Disk's power-down feature gives it a long life of more than seven years, alleviating the need for a typical forklift upgrade common in three to four years, providing great cost savings. BlackPearl Object Storage Disk is easy to manage and can quickly adapt to changing workflows and business needs.

BlackPearl Object Storage Disk is powered by the BlackPearl Converged Storage System delivering a robust object storage system with capabilities to natively replicate files to other sites for high availability and protection. The solution also supports DR functions natively, copying files to tape or public clouds such as Amazon and Azure.

Nearly all media workflows and organizations, such as news organizations, post and production houses, creative groups and sports broadcasters and teams, will greatly benefit from the low-cost and feature-rich BlackPearl Object Storage Disk.

BlackPearl Object Storage Disk Specifications Table

Generation Release	Gen 3	Gen 2
Drive Capacity	16 TB	12TB
Drive Type	Enterprise	Enterprise
Minimum System Capacity	2 Bands	2 Bands
Maximum System Capacity (TB RAW)	15,408	11,556
Idle Time Until Spin Down - Power Down (per Band)	1hr	1hr
Time From idle to Data Access (per Band)	<15 sec	<15 sec
Maximum Node RAW	1,712	1,284
Maximum Node Usable	1,488	1,116
Full Node Price (\$/TB)	\$60/TB	\$120/TB
Number of Bands per Node	6 or more	6 or more
Number of Drives per Band	Any size from 2 to 18	Any size from 2 to 18
Minimum Power per Node (all Bands Idle)	140 watts	140 watts
Maximum Power per Node (all Bands with full I/O)	775 watts	775 watts



About Spectra Logic

Spectra Logic develops data storage and data management solutions that solve the problem of digital preservation for 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
or contact our sales staff at sales@spectralogic.com