

# WOS<sup>®</sup> OBJECT STORAGE

Industry-Leading Performance, Availability, Cost-Effectiveness, and Scale



### DDN WOS Key Advantages:

- Proven at hundreds of billions of objects
- Delivers 20% better disk efficiency and 1.25x faster performance thanks to a no file system (NoFS<sup>®</sup>) architecture
- Offers the most flexible data protection models in order to tune availability, reliability and performance to the needs of the application
- Gives faster access to data based on built in latency mapping
- Starts small (1 4U system) and can scale 1 node at a time
- Offers unmatched metadata customization and search
- Provides End2End data management with a single federated namespace across high performance file storage and high capacity object storage

Storage doesn't need to be complicated to scale and maintain.

Organizations continue to be insatiable consumers of storage capacity, and only a simplified cost effective storage model will allow them to keep up with demand. DDN's WOS enables organizations to build highly reliable, infinitely scalable, cost-efficient storage pools for all their unstructured data needs.

DDN has experience helping their customers scale WOS from a few 100 terabytes to systems with 100s of Billions of objects and 100s of petabytes under management, seamlessly and simply. Whether deploying Storage as a Service for a wide variety of use cases, or as a targeted solution to the cost of expensive storage system or the unwieldy nature of tape, WOS can be tuned to the unique challenges and requirements of your IT team.

Available as software or delivered as a density optimized appliance, WOS is a comprehensive and purpose-built object storage solution that meets all of your unstructured data needs. WOS offers multiple user configuration settings to make it the ideal solution for applications ranging from web origins and collaborative workflows to content delivery, data protection, and active archives.



#### LIFE SCIENCES

Scale: Readily handles 1TB/week data growth

Access: Easily integrated interface to custom workflow

Reliability: Maintains data integrity and offsite replication



#### CLOUD STORAGE

Efficiency: Increased performance, reduced data center footprint and achieved cost savings simultaneously

Reliability: Increased data durability and protection, complying with international funding bodies' policies

Accessibility: Collaborative platform accelerates time-to-discovery



#### MOBILE DEVICE & CLOUD DATA SHARING

Efficiency: Distributed environment managed as single, high density entity, lowering IT, power and cooling costs

Reliability: Multiple copies of data replicated between sites for disaster recovery and low latency access

Accessibility: Files uploaded from PC by teachers and students; and, research equipment/sensors from S3 applications to shared WOS Cloud



#### STORAGE-AS-A-SERVICE (SAAS) CLOUD SOLUTIONS

Efficiency: Securely and cost-effectively managing petabytes of unstructured big data

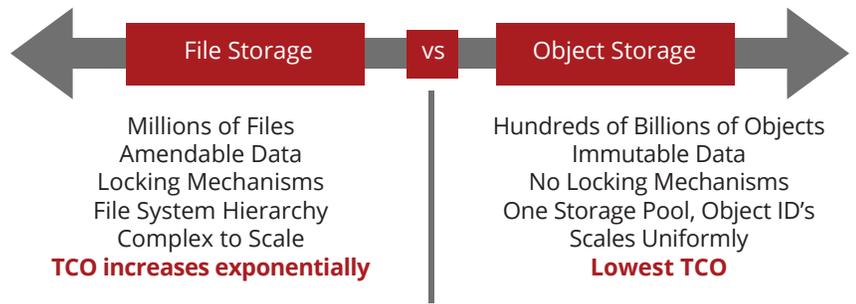
Scalability: Optimized data growth and management in a minimal footprint

Accessibility: Able to store billions of objects on the same platform accessible via a single federated global namespace

# FILE STORAGE VS. OBJECT STORAGE

Object Storage was designed as a more scalable alternative to file storage solutions for simplified storage needs. File storage was designed for files that need to be modified or changed frequently. As such, file storage is complex to scale because of file system hierarchies and locking mechanisms, which were created to enable file modifications. This overhead drives up the management cost exponentially.

DDN is the only storage provider that fully embraces the fact that most unstructured data (80+%) is never modified. The performance, efficiency and scalability of WOS are beyond compare, leading to a TCO that actually decreases per storage unit as the platform is scaled out. WOS stores objects in one scalable namespace.



## WOS FEATURES

### TRUE OBJECT STORAGE

WOS is enabled through DDN's underlying NoFS (no underlying file system) architecture, which minimizes disk operations with as little as a single-disk-operation for reads, and two for writes. (This sharply contrasts with the 8-10 I/O operations that POSIX file systems require, resulting in additional performance and network overhead). Further, the infinitely variable data buckets or "sector" sizes used in WOS carefully balance performance and platter utilization, while keeping system overhead very low.

- No Linux file I/Os, no fragmentation
- Fully contiguous object read and write operations for maximum disk efficiency

### FEDERATED GLOBAL NAMESPACE

WOS Scales out in clusters of up to 256 nodes, and supports clustering of up to 8,192 nodes across multiple geographies. Combine up to 32 clusters to build out an exabyte namespace, distributed geographically.

### THE LEADER IN DATA PROTECTION FLEXIBILITY

Offering the widest range of data protection options in the industry, WOS can be optimized around various metrics to deliver the availability, performance or data distribution required by individual object. Each WOS node can support combinations of policy, so the various policies can be applied to enable the highest data availability and performance while minimizing overhead.

### SELF-HEALING ARCHITECTURE

ObjectAssure, a unique form of erasure coding, has self-healing capabilities that reduce the management effort. In case of a failed disk, ObjectAssure only reconstructs the actual data that was lost, as opposed to the entire disk. In the event of an object read error, WOS automatically recreates the object from a replica or parity to fulfill the request and then replaces the object to restore compliance

with the specified data protection policy. These automatic features dramatically increase data availability and reduce operator intervention. No hard tie between physical disks and data:

- Failed drives are recovered through dispersed data placement
- Rebuilds happen at read, not write, speed
- Rebuild data, not disks

### LATENCY-AWARE ACCESS MANAGER

In distributed environments with replicated data, WOS minimizes the access latency for end users. When a user requests an object, WOS automatically retrieves the object from the geographic node with the lowest latency.

- Lowest Latency Access
- Intelligent selection of geographically distributed nodes based on load and latency

### METADATA SEARCH

WOS avoids scalability bottlenecks by storing metadata in key-value stores, rather than in scale-limiting metadata databases. A highly parallelized backend metadata search allows users to query one or more indexed fields of user-specified metadata across petabytes of objects. Applications can assign their own metadata via object storage API, WOS now also supports simple search of WOS user metadata

### MULTIPLE HARDWARE PLATFORM CHOICES

WOS is available preinstalled on: DDN high-density, high-performance storage appliance with the option of lower cost archive tier, Node configurations; or on an OCP-ready platform appliance for scale-out web applications.

# WOS BENEFITS

## FLEXIBILITY

WOS provides full flexibility to build the right storage infrastructure for any mix of applications. Customers can tune their infrastructure to meet the requirements for their data and application needs.

- Choose data replication, erasure coding or both
- Protect data with smart policies for performance and/or disaster recovery on a perobject basis

## EASIER ACCESSIBILITY

WOS provides the most complete choice of interfaces, including RESTful APIs and file system gateways from S3/Swift and IBM® Spectrum Scale™ to the WOS object store. In addition, interfaces with WOS is offered from third party ISV's and DDN offers a complete WOS Partner development program for users that prefer to do custom integration with their own in-house applications.

## MORE EFFICIENCY

WOS was designed as a single storage solution for all your unstructured data needs, to easily and reliably store petabytes of information at the lowest cost. DDN maximizes storage efficiency through the NoFS architecture, which keeps the solution easy to manage at scale (one infrastructure). It is not unusual to find customers who manage 10s of PB with just one full-time employee. The TCO can be further optimized by leveraging the WOS Capacity nodes and ObjectAssure, which provides the highest durability, with the lowest overhead of any object storage solution on the market.

# WOS USE CASES

WOS use cases are extended with a mix of in-house developed solutions, integrated applications from third party ISV's and reference architectures through the WOS Partner program. With its rich choice of API's and file system gateways, WOS can easily be integrated for Custom Applications as well. WOS currently supports a wide variety of use cases with pre-integrated partner solutions.

## SYNC & SHARE

Automated Sync & Share applications enable users to securely upload documents to the cloud, synchronize files and mobile devices, and easily share information with others. This is one of the more popular applications that utilize WOS, leveraging the latency-aware and data placement capabilities that are unique to the platform. WOS Sync & Share comes as a pre-integrated partner solution, from companies like CTERA® and OwnCloud®.

## COMPLETE RELIABILITY

WOS provides full data protection with a wide choice of user-selected protection schemes. Data protection policies can be selected per object: synchronous and asynchronous replication; local ObjectAssure (Erasure Coding); replicated ObjectAssure, Global ObjectAssure (Hierarchical Erasure Coding) and Extended Object Assure (De-constrained Erasure Coding). This enables customers to design their infrastructure specifically to support their required SLAs. As the only Object storage with an option to perform rebuilds entirely in a single node, only DDN WOS can protect against the huge hit to rebuild times and data risk of rebuilds over the LAN or even the WAN while maintaining extremely low overhead.

## EXABYTE-SCALE

Storage platforms can be scaled in three dimensions: the total volume of storage; the number of objects; and the number of sites. It is possible to deploy a fully functional storage cloud with just a single WOS appliance, and then scale seamlessly by non-disruptively adding more nodes. A federated WOS namespace has capacity for up to one exabyte and 32 trillion objects.

## HIGHER PERFORMANCE

Storage performance is measured in throughput, IOPS and latency. WOS provides the highest performance results for all three dimensions:

- 20% higher bandwidth for large sequential IO
- Fewer IOPS needed for each read or write (thanks to NoFS)
- Lower latency thanks to unique latency mapping

Multiple clusters can also be combined for even higher performance.

## VIDEO STREAMING

Enable Video on Demand, Cloud DVR or other video streaming services for residential or corporate end users. WOS provides high-throughput, low latency video delivery streaming for geographically distributed viewers. WOS Video Streaming can be deployed as a custom solution (integrated with API's or file system gateways) or as a pre-integrated solution using the technology from partners like Arris®, a global innovator in cable, video and broadband technology.

## CONTENT DELIVERY NETWORK

Leverage WOS to build your own Content Delivery Network for worldwide distribution of massive volumes of data with high throughput and low latency. The unique latency-aware technology in WOS, combined with the flexibility to optimize for small and large file performance, make WOS the perfect CDN storage origin. DDN has engaged with several partners to build CDN architectures that scale to as many as 60 origin storage sites.

## WORLDWIDE COLLABORATION

Store assets in a globally distributed storage cloud to enable collaboration between distributed teams and integrate with your favorite workflow suites or file sync and share clients. WOS is the only platform that enables integration with (and federation of) parallel file systems. Leading research institutions and universities around the world leverage WOS to build global collaboration libraries, enabling more efficient workflows and quicker times to result/discovery.

## ACTIVE ARCHIVES

Many providers have been promoting disk storage solutions as an alternative to tape to build "Active" Archives, but few are able to provide the cost-efficiency that is required to build petabyte-scale repositories. WOS enables customers to monetize their data and build highly reliable, scale-out archive infrastructures, at the lowest TCO. WOS provides instant access to all archived assets and integrates with popular archival platforms, such as: ASG® and iRODS®. DDN is a member of the Active Archive Alliance to continue thought leadership and integration points with object storage to the modern archive applications.

## VIDEO POST-PRODUCTION

WOS enables collaborative editing for distributed teams in video post-production environments. Integrate WOS with your favorite post-production workflow suites, directly integrated through the native REST API or by leveraging the integrated S3, Swift, CIFS, NFS and GPFS file system gateways. WOS can be optimized to replace several tiers of the storage infrastructure with one, scalable and easy to manage storage pool.



WOS Partners Ecosystem

## WOS CLUSTER SPECIFICATIONS

MAXIMUM WOS NODES PER CLUSTER	256
MAXIMUM # OF WOS CLUSTERS PER WOS NAMESPACE	32
MAXIMUM # OF UNIQUE OBJECTS PER CLUSTER	1 Trillion
MAXIMUM TOTAL CLUSTER CAPACITY WITH 10TB HDDs	215PB
MAXIMUM CLUSTER AGGREGATE R/W PERFORMANCE (SAS HDDS)	256M Object Reads; 64MB Object Writes
MAXIMUM NAMESPACE AGGREGATE R/W PERFORMANCE (SAS HDDS)	8M Object Reads; 2M Object Writes
MAXIMUM OBJECT SIZE	5TB
USER-DEFINED METADATA	Up to 64MB
DATA PLACEMENT POLICIES PER CLUSTER	64
DATA PROTECTION	Local ObjectAssure Erasure Coding and/or Sync-Async Replication, Global Object Assure Erasure Coding, Extended Object Assure Erasure Coding

## ABOUT DDN®

DataDirect Networks (DDN) is the world's leading big data storage supplier to data-intensive, global organizations. For more than 18 years, DDN has designed, developed, deployed and optimized systems, software and solutions that enable enterprises, service providers, universities and government agencies to generate more value and to accelerate time to insight from their data and information, on premise and in the cloud. Organizations leverage the power of DDN technology and the deep technical expertise of its team to capture, store, process, analyze, collaborate and distribute data, information and content at largest scale in the most efficient, reliable and cost-effective manner. DDN customers include many of the world's leading financial services firms and banks, healthcare and life science organizations, manufacturing and energy companies, government and research facilities, and web and cloud service providers. For more information, visit our website [www.ddn.com](http://www.ddn.com) or call 1-800-837-2298.