Western Digital.

REFERENCE ARCHITECTURE

# Virtual Tape Storage Solution Using Arcserve® UDP and QUADStor VTL on the Ultrastar® Data60 Hybrid Storage Platform

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No warranty for Arcserve or Quadstor is expressed or implied.



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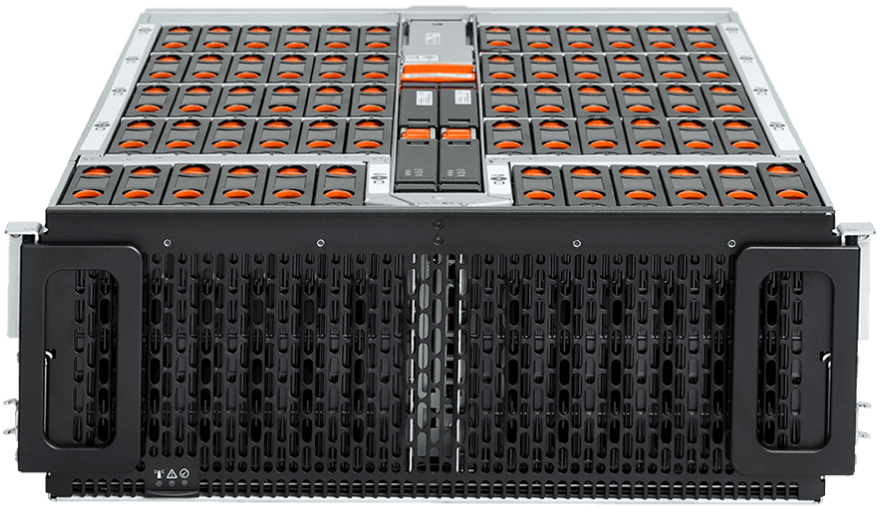
| | Px = Review Cycle | |

# Arcserve® UDP Software with QUADStor VTL on the Ultrastar® Data60 Hybrid Storage Platform

## REFERENCE ARCHITECTURE



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# 1.0 Executive Summary

## 1.1 General Description

The digital transformation results in a huge amount of data, which becomes more and more valuable to organizations. To protect the business-critical data organizations have to think of a multi-tier data protection strategy. Besides snapshot, replication, disk and cloud backup tape remains as the most cost-effective storage tier for long-term retention and the optimal media against malware attacks. IT organizations view tape as an and technology rather than an or technology in their data protection strategies, especially when looking at a multi-tier data protection.

As demand for data continues to skyrocket, high capacity storage mediums like magnetic tape are seeing a resurgence in value to IT. Modern approaches to data protection that enable fast failover and RPO and RTO in seconds demand a more responsive medium, but for many other business applications that require longevity and durability of backup media, tape still has a valid role to play in the architecture.

Many organizations are choosing to replace their physical tape systems with a virtual tape library (VTL). A virtual tape library is a disk storage system that emulates a tape library. VTL provides the simplest replacement for tape and eliminates many of the issues associated with tape medium, such as tape cartridges jams which can cause backup or restore operations to fail. VTL delivers the speed and reliability of disk without changing any applications expecting to work with tape. VTLs delivers high speed backup and restore operations and are flexible, easy to manage, reliable and allow the integration of newer data encryption techniques. They also provide scalability, verification and reduce the time spent on management, operation and maintenance.

With the combination of Arcserve Unified Data Protection (UDP) software with QUADStor VTL on Western Digital's Ultrastar Data60 Hybrid Storage Platform we are offering an end-to-end comprehensive portfolio of tape storage solution which enables IT with an individual, scalable data protection architecture and brings the benefits of current and future Linear Tape Open (LTO) generations to companies of all sizes. The LTO tape libraries optimally enhance the storage and data protection appliances as second-tier backup, archiving or long-term retention backend storage. While cloud storage and SAN snapshots have their advantages in random and partial restores, tape backup solutions are faster, more efficient, and far more affordable, especially when it comes to long-term storage of cold data.

We believe that data protection: shouldn't have a size limitation, that the cost per gigabyte should be low, and that data should be stored in the most indestructible manner possible. This is why we are providing an integrated solution using tape backup.

# 2.0 Solution Highlights

Western Digital, a pioneer in reliable, high-density industry-standard hardware for software-defined storage projects, is partnering with QUADStor and Arcserve to provide verified tape backup solutions for your data. The following sections of this paper provides an overview of this solution.

## 2.1 Ultrastar Data60 Hybrid Storage Platform

The Ultrastar Data60 is a key element of next generation disaggregated storage and software-defined storage (SDS) systems, delivering high density and the flexibility to balance performance with cost. The Ultrastar Data60 provides up to 1.2PB of raw storage using our forthcoming 20TB SMR HDDs in a compact and efficient form factor. Western Digital HelioSeal® drives ensure cool running, quiet operation and high reliability. A high-performance data tier can be set up for demanding applications by using SSDs in up to 24 of the drive slots, enabling the ability to serve both fast data and big data from a single platform.

## 2.2 QUADStor

QUADStor Virtual Tape Library (VTL) software is a high performance VTL solution emulating tape libraries and drives from leading hardware vendors. It enables global data deduplication, enterprise wide replication and tape export to cloud storage without requiring changes to the existing environment.

## 2.3 Arcserve

Arcserve unified data protection (UDP) is a single, unified data protection solution that provides the flexibility to support a wide variety physical, virtual, and cloud IT platforms, a diverse range of application RPO and RTO requirements, and an array of backup media, including tape. Arcserve UDP integrates disk to disk backup, tape backup, replication, high availability, and global deduplication in a highly scalable, single architecture.

By combining Arcserve UDP software with QUADStor VTL solution on Western Digital's Ultrastar Data60 Hybrid Storage Platform organizations can build an end-to-end tape backup solution which enables:

- Data protection
- Low TCO
- Data backup and recovery on the go
- Simplified access of data
- Ease of management
- Multiple platform support

# 3.0 TECHNOLOGY OVERVIEW

The Western Digital's Ultrastar Data60 Hybrid Storage Platform provides a number of core capabilities and advantages in on-premises cloud storage environments.

## 3.1 Designed for High Density and Flexibility

The Ultrastar Data60 is a key element of next generation disaggregated storage and software-defined storage (SDS) systems, delivering high density and the flexibility to balance performance with cost. The Ultrastar Data60 provides up to 1.2PB of raw storage[1] using our forthcoming 20TB SMR HDDs in a compact and efficient form factor. Western Digital HelioSeal® drives ensure cool running, quiet operation and high reliability. A high-performance data tier can be set up for demanding applications by using SSDs in up to 24 of the drive slots, enabling the ability to serve both fast data and big data from a single platform.

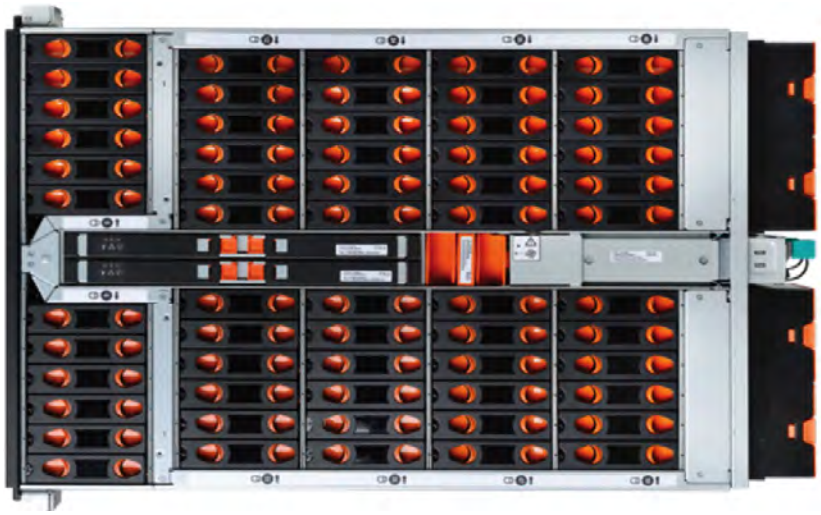
*Figure 3-1. Ultrastar Data60 Hybrid Storage Platform Overview*

[1] One terabyte (TB) is equal to one trillion bytes and one petabyte (PB) is equal to one quadrillion bytes. Actual user capacity may be less due to operating environment.

## 3.2 Designed for Enterprise and the Cloud

This platform addresses the demanding storage needs of large enterprise customers, storage OEMs, cloud service providers and resellers/integrators that require dense, shared HDD or hybrid storage. The Ultrastar Data60 provides the flexibility to specify the HDD and SSD combinations to balance capacity, performance and cost.

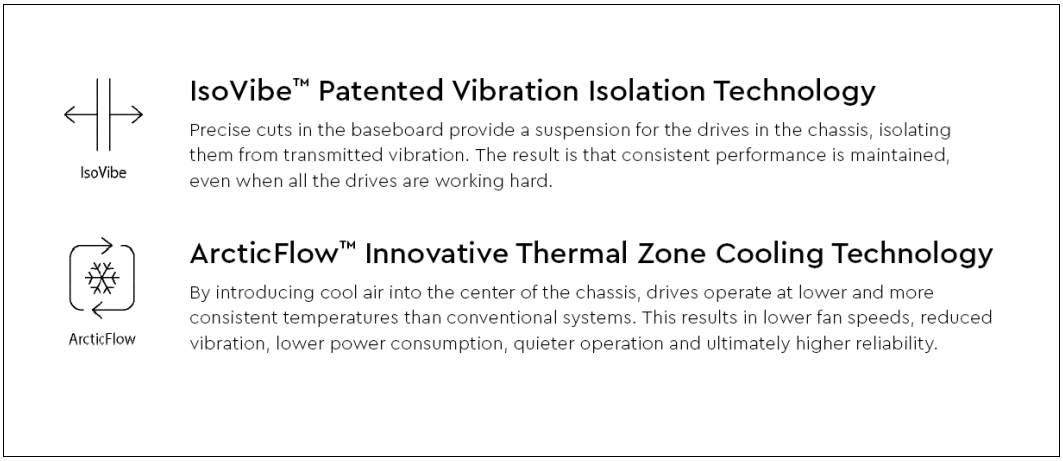
*Figure 3-2. Ultrastar Data60 Hybrid Storage Platform*



## 3.3 IsoVibe™ Patented Vibration Isolation Technology

Precise cuts in the baseboard provide a suspension for the drives in the chassis, isolating them from transmitted vibration. The result is that consistent performance is maintained, even when all the drives are working hard.

*Figure 3-3. IsoVibe Patented Vibration Technology*



## 3.4 ArcticFlow™ Innovative Thermal Zone Cooling Technology

By introducing cool air into the center of the chassis, drives operate at lower and more consistent temperatures than conventional systems. This results in lower fan speeds, reduced vibration, lower power consumption, quieter operation and ultimately higher reliability.

Building on 40+ years of storage design experience conventional dense disk shelves frequently suffer from performance degradation due to induced vibration from adjacent drives. Traditional platforms also have cooling challenges as the cooling air passes over successive rows of drives, losing effectiveness as it gets heated up along the airflow path. Developing storage devices and platforms side-by-side, we address these challenges through silicon to systems design, a set of technologies developed based on a holistic view of devices, platform, and their interactions. The first two of these innovative technologies are IsoVibe and ArcticFlow. IsoVibe reduces vibration-induced performance degradation, while ArcticFlow overcomes the cooling issues by introducing cool air into the middle of the platform. Both these technologies contribute to long-term reliability, enabling our five year limited warranty on the entire platform.

For more details, visit the *Ultrastar Data60 Hybrid Storage Platform* product page.

## 3.5 Platform Features

*Table 3-1. Platform Features*

| | |
|---|---|
| Maximum Drives | - 60 x 3.5 inch drive bays<br>- Up to 24 can be SAS or SATA SSD |
| Drive Interface | - 12Gb/s SAS<br>- 6Gb/s SATA |
| Available Drive Capacities | - HDD up to 18TB CMR, or up to 20TB SMR (forthcoming)<br>- SSD up to 15.36TB |
| Host Interface | - Dual redundant I/O modules (IOM)<br>- 6 Mini-SAS HD ports per IOM |
| Cooling | - 4 main enclosure fans, front-to-rear system cooling with zero-loss backflow prevention<br>- 1 IO module fan<br>- Dual PSUs with built-in fans |
| Power | - Dual 1600W, 80+ Platinum<br>- 200-240V AC input, auto ranging, 50-60Hz |
| Serviceability | - Cable-free hot-swappable IOM, power supply, fans and drives |

## 3.6 QUADStor Overview

QUADStor Virtual Tape Library (VTL) software is a high performance VTL solution emulating tape libraries and drives from leading hardware vendors. It enables global data de-duplication, enterprise wide replication and tape export to cloud storage without requiring changes to the existing environment.

A VTL is a disk based backup system which appears to the backup host as a real tape library system. Backup streams sent to the virtual tape drives are however written to and restored from disk. The biggest advantage of a VTL over other disk based backup solutions is its seamless integration into an existing tape backup infrastructure. Backup applications, policies, licenses etc need not change due to a VTL emulating an existing tape library system.

*Table 3-2. QUADStor Features*

| **Physical Specifications** |
|---|
| Windows, Unix, Solaris Linux®, IBM, iSeries OS/400 and AIX |
| Fiber Channel (FC), iSCSI, InfiniBand and Local SCSI Access |
| Dynamic Storage Allocation |
| Data Deduplication |
| VTL to VTL Replication |
| T10 Logical Block Protection |
| Physical Tape Import/export |
| Easy Storage Management with Storage Pools |
| Simple and Intuitive Browser Based Management |

*Table 3-3. Benefits of a Virtual Tape Library (VTL) System*

| **Physical Specifications** |
|---|
| Improved Backup and Restore Times |
| Reduced Tape Media Handling |
| Easy Integration and Interoperability |
| Multiple VTL Instances |
| Dynamic Disk Allocation |
| Data Deduplication |
| Data Compression |
| Disaster Recovery |
| Tape Import/export |

For more details, visit the *QUADStor* homepage.

## 3.7 Arcserve Overview

Arcserve Unified Data Protection (UDP) is a single, unified data protection solution that provides the flexibility to support a wide variety physical, virtual, and cloud IT platforms, a diverse range of application RPO and RTO requirements, and an array of backup media, including tape.

Arcserve UDP integrates disk to disk backup, tape backup, replication, high availability, and global deduplication in a highly scalable, single architecture. Arcserve Backup is a comprehensive storage solution for applications, databases, distributed servers, and file systems. It provides backup and restore capabilities for databases, business-critical applications, and network clients. Among many of the backup options Arcserve Backup offers is the Arcserve Backup tape library option.

The option includes support for tape libraries. The option supports and provides advanced device and media management for multiple-drive tape libraries. With this option, Arcserve Backup can send simultaneous streams of data to each drive to optimize throughput on any multiple-drive tape library. The option adds tape capabilities to Arcserve Backup. All of the standard backup and restore functionality which Arcserve Backup provides are applied to the tape devices.

### 3.7.1 Multiple Drive Support

The option provides support for libraries with multiple drives and with single drives. **Note**: Arcserve Backup tape library option license is required for multiple drive libraries only.

### 3.7.2 Multiple Library Support

These options support multiple libraries. The number of libraries that can be installed at one computer is limited only by the computer's available resources and system performance.

### 3.7.3 Concurrent Drive Initialization

The device manager allows you to track the initialization process. For multiple drive libraries, the tape engine uses all of the drives for the initialization process.

### 3.7.4 Multiple, Concurrent, Device Management Functions

Includes storage drive cleaning from any specified slot. These options use available drives as needed on a library and perform device management functions concurrently (when multiple drives are available). The following library device management functions can be performed concurrently: – quick inventory – format slot range – erase slot range (both quick erase and long erase) –importing and exporting – clean library drive.

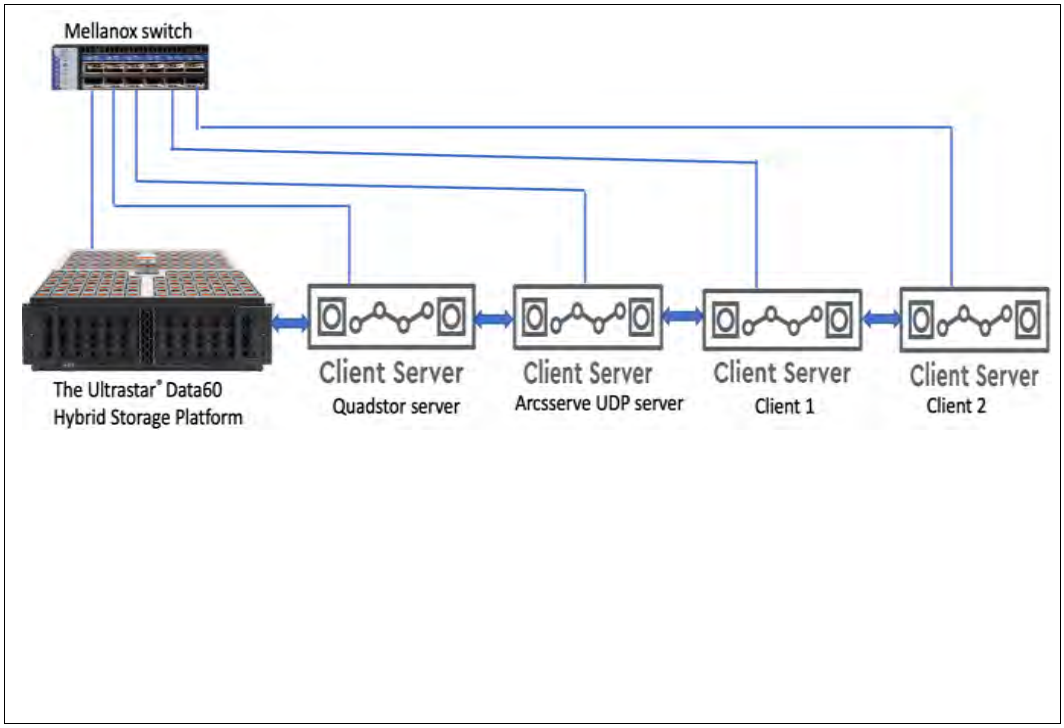
For more details, visit the *Arcserve* homepage.

# 4.0 Solution Architecture

QUADStor software is designed to create a high performance VTL solution emulating tape libraries and drives from leading hardware vendors, which can be deployed on any OS platforms and we can expose the Ultrastar® Data60 60-Bay Hybrid Storage Platform's drives to act as the VTL storage.

The figure below illustrates a verified deployment topology with Ultrastar® Data60 Hybrid Storage Platform.

*Figure 4-1. Verified Deployment of Ultrastar Data60 Hybrid Storage Platform*



# 5.0 QUADStor Deployment and Configuration

A functional verification of QUADStor with Arcserve was undertaken by Western Digital. One high-density Digital Ultrastar Data60 Hybrid Storage Platform and four clients were used for this configuration. The Ultrastar Data60 Hybrid Storage Platform acting as the tape storage end, which is hosting all the data which is backed up using Arcserve software to the QUADStor VTLs.

*Table 5-1. QUADStor Configuration*

| Type | Description |
|---|---|
| Storage Platform | 4U storage platform with 60 x 3.5" drive bays, up to 24 can be SAS or SATA SSD, Dual 1600W AC redundant power supplies |
| Host Operating System | CentOS Linux release 7.6.1810 (Core) |
| Kernel | 3.10.0-1127.18.2.el7.x86_64 |
| Interface | Networking 1 x (1EX2107) Mellanox® connectX®-5 EN MCX516A-CCAT 100Gb network interface card was installed in each server. All servers' nodes connected to a Mellanox top-of-rack switch with 100GbE interfaces to provide end-to-end 100Gb link speed. |
| Software Version | 3.0.48 |
| UDP Version | 7.0.4455 |
| Build | Update 2 Build 634 |
| Backup Version | 18.0 (Build 8209) |

You need to set the pre-requisite before initiating the QUADStor installation on the server.

For more information on installation and pre-requisites, refer to the *QUADStor Installation of Prerequisite Packages* page.

## 5.1 Installation and Configuration

QUADStor is an open source Virtual Tape Library (VTL), it is a disk-based backup system which appears to the backup host as a real tape library system. Backup streams are however written to and restored from disk. Let's understand the pre-requisites of the product and step by step installation procedure.

### 5.1.1 System Requirement

*Table 5-2. System Requirement*

| | |
|---|---|
| **System** | |
| | Multicore/Multi CPU Intel/AMD processor system |
| | 8 GiB RAM/ 64 GiB or more recommended for data deduplication |
| | RHEL/CentOS/SLES or Debian OS |
| | QLogic 4Gb/s or above HBA(s) for Fiber channel connectivity |
| | 1/10 Gb ethernet ports for iSCSI connectivity |
| **Software** | |
| | httpd |
| | gcc |
| | perl |
| | kernel-devel |
| | sg3_utils |
| | kernel version should match with kernel-devel version |
| | QUADStor rpm package |
| ***Other Pre-requistes:*** Allow Port 80, and Allow ISCSI ports 3260. | |

### 5.1.2 Installation of Virtual Tape Library

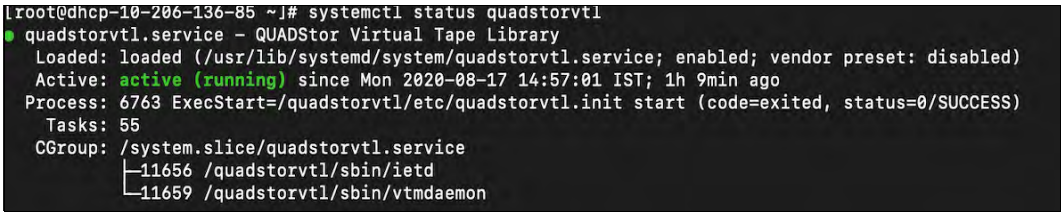
1. Login to the target system as root.
2. Install the following software prerequisites using yum. Open terminal and run the command listed below:
   - yum install httpd
3. Repeat the same process for the rest of the listed prerequisites:
   - yum install gcc
   - yum install perl
   - yum install kernel-devel
   - yum install sg3_utils
4. Check the kernel version of CentOS and check the kernel-devel version for both kernel. Both kernel version has to be same.
   - rpm -qa | grep kernel-devel
5. Update CentOS kernel if the kernel version is different using the command below. You need to reboot the operating system for upgrading kernel.
   - yum upgrade kernel
6. Repeat step 4 (above) to verify the kernel version.
7. Transfer/copy/download the QUADStor rpm package to CentOS operating system.
8. Install the rpm package on the RHEL/CentOS/SLES system.

- sh# rpm -vh quadstore-tl-ex-xxx.rpm
- sh# rpm -e quadstore-xxxx
- sh# rpm -qa | grep quadstor

9. Add the appach2/httpd and QUADStor services to system start up.
   - /sbin/chkconfig --add httpd (RHEL/CentOS)(httpd services added to system startup)
   - /sbin/chkconfig --del quadstorvtl (QUADStor service added to system startup)
10. Start the httpd and quadstorvtl service.
    service httpd status/systemctl status httpd find the httpd service status)
    service httpd start/systemctl start httpd (start the httpd service)
    /etc/rc.d/init.d/quadstorvtl status (find the quadstorevtl status)
    /etc/rc.d/init.d/quadstorvtl start (start the quadstorvtl service)

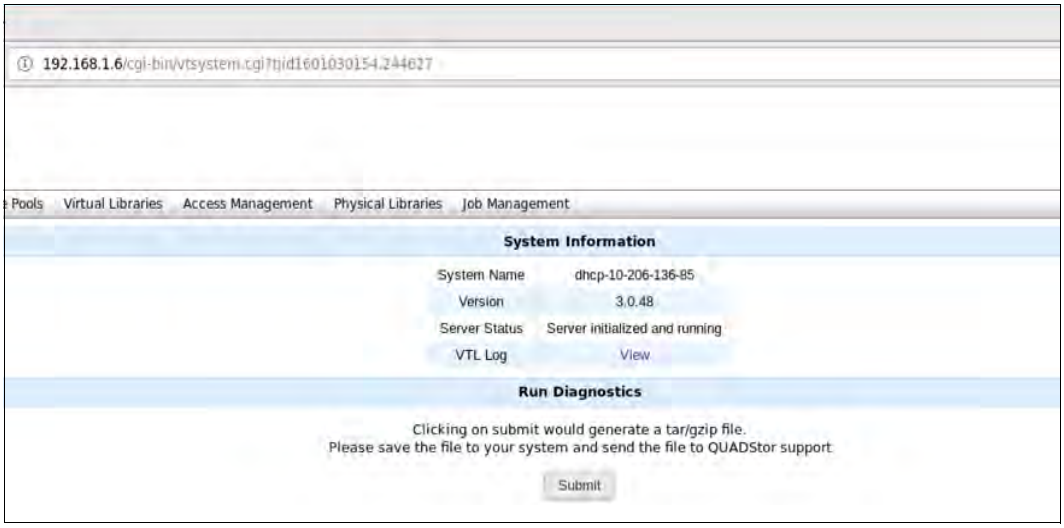
    Check the QUADStor service status after successful installation.

*Figure 5-1. Installation (Screen 1)*




11. Open firewall settings in CentOS and enable the firewall ports.
12. Open the web browser and enter the IP address of the system. You should see the screen below.

*Figure 5-2. Installation (Screen 2)*



### 5.1.3 Pool Configuration

In order to access the QUADStor console open a web browser and type the address of the QUADStor VTL system. Ensure that java script is enabled in your browser. All the RAID volumes will get auto discovered under **Physical Storage**. (Use software RAID tool or LSI Megastore CLI tool to create RAID volumes using the drives.

Use the add button to add the RAID volumes to the **Default Pool**. Else using the **Storage Pools** button new pools can be created and the RAID volumes can be added to the new pools using the **Physical Storage** -> Add button.

For more information, visit the *QUADStor Creating a New Storage Pool* page.

*Figure 5-3. Configuration (Screen 1)*

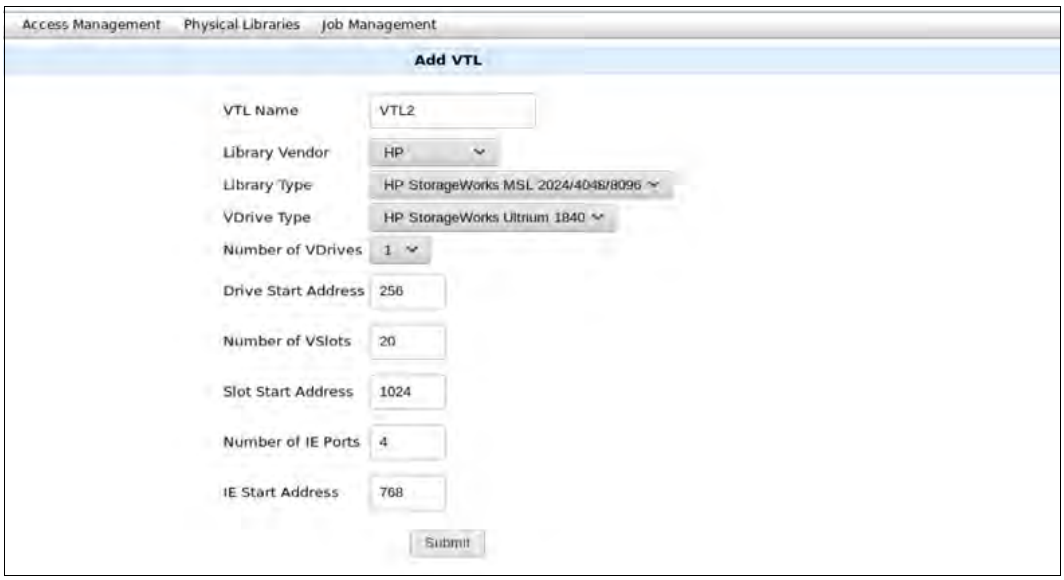
### 5.1.4 VTL Configuration

Click on the **Virtual Libraries** menu to get a list of the currently configured VTLs as shown in the figure below.

Click on the **View** link to view the configuration of a specific VTL.

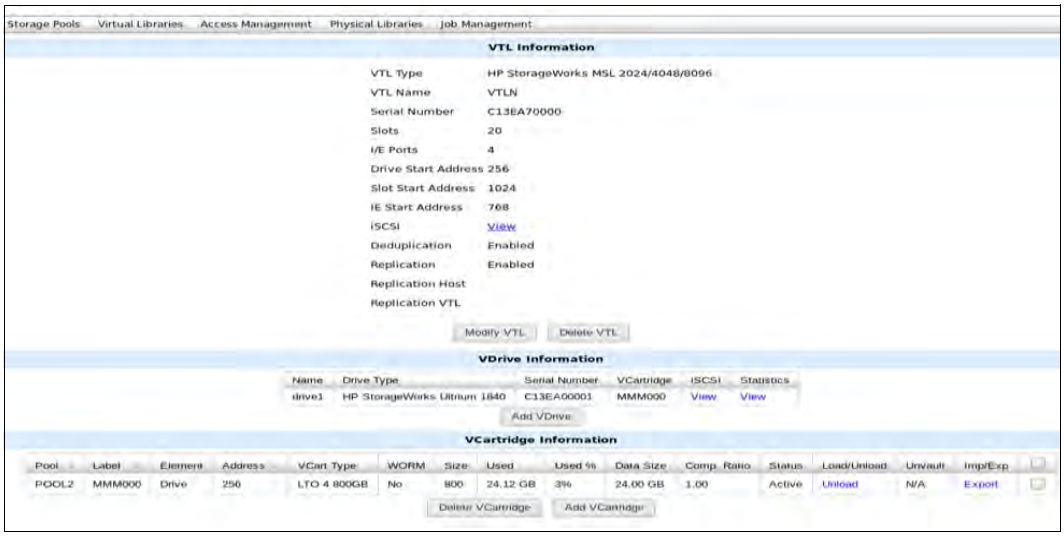
Click on the **Add VTL** button to add a new VTL. A form is displayed as shown in the figure below. For more details, visit the *QUADStor VTL Configuration* page.

*Figure 5-4. Configuration (Screen 2)*




On a successful addition the VTL configuration of the newly added VTL is displayed as shown in the figure below. Click on the **Add VDrives(s)** button to add additional virtual drives as per below image.

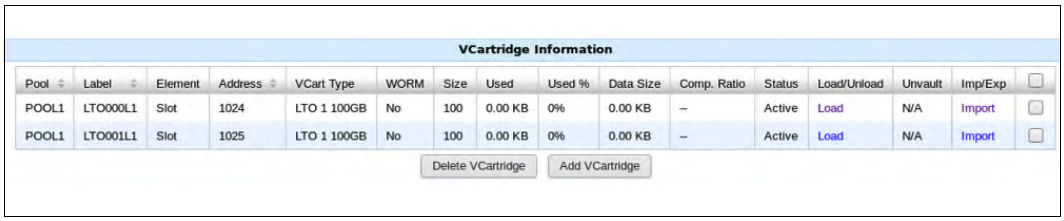
*Figure 5-5. VTL Configuration*



### 5.1.5 Configuring Virtual Cartridges

To add a vcartridge click on the **Add VCartrige** button. Click on submit to add the specified number of vcartridges. The specified number of vcartridges will be created as shown below.

*Figure 5-6. Add VCartrige*



## 5.2 Arcserve Configuration

Arcserve Backup is a comprehensive storage solution for applications, databases, distributed servers, and file systems. It provides backup and restore capabilities for databases, business-critical applications, and network clients. Among many of the backup options Arcserve Backup offers the Arcserve Backup Tape Library option.

Before initiating backup using Arcserve UDP software; Arcserve UDP server and client agents needs to be installed and configured on all the system. Visit the *Arcserve* page to download and install the latest software version.

Install and configure the Arcserve Unified Data Protection (UDP) software. Use the UDP console or Arcserve Backup console to initiate backup. For the complete configuration detail, visit the *Arcserve Administration Guide*.

### 5.2.1 Backup Operation Details

1. Use the configuration wizard to **Add Plans** for the backup servers, **Add Nodes** to protect, **Add Recovery Point Servers**, **Add Backup Servers**, and **Add Tasks**, **Create Schedules** to backup data using Arcserve.
2. To back up to tape device using Arcserve, VTL device needs to be connected and mounted to the Arcserve system. For the complete configuration details, visit the *How to Optimize Tape Usage* page.

*Figure 5-7. Arcserve UDP Console View*

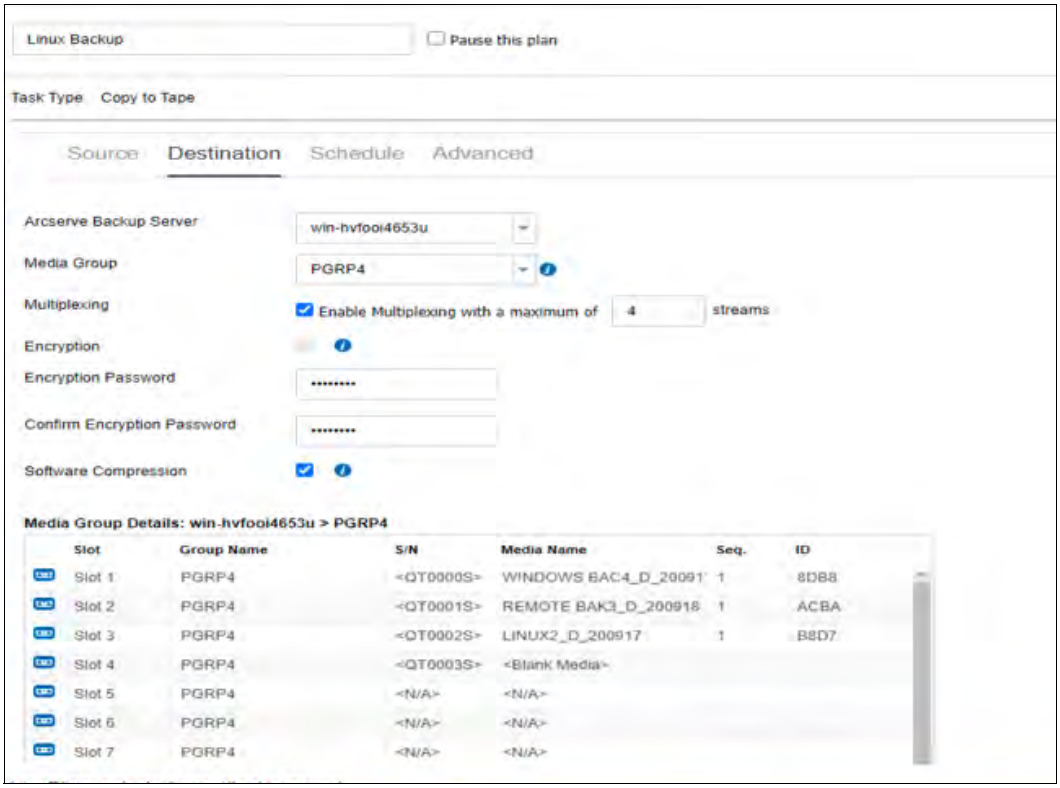
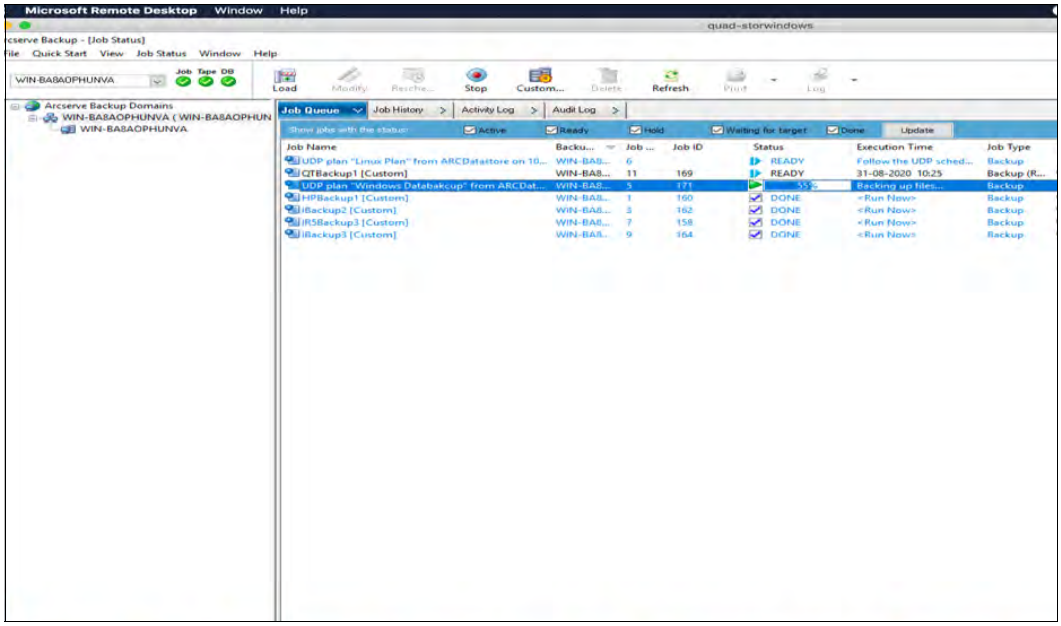


*Figure 5-8. Arcserve Windows Backup Application View*




To check the back up and resource job statistic and performance details check the Arcserve Dashboard.

*Figure 5-9. Arcserve Windows Backup Application View*

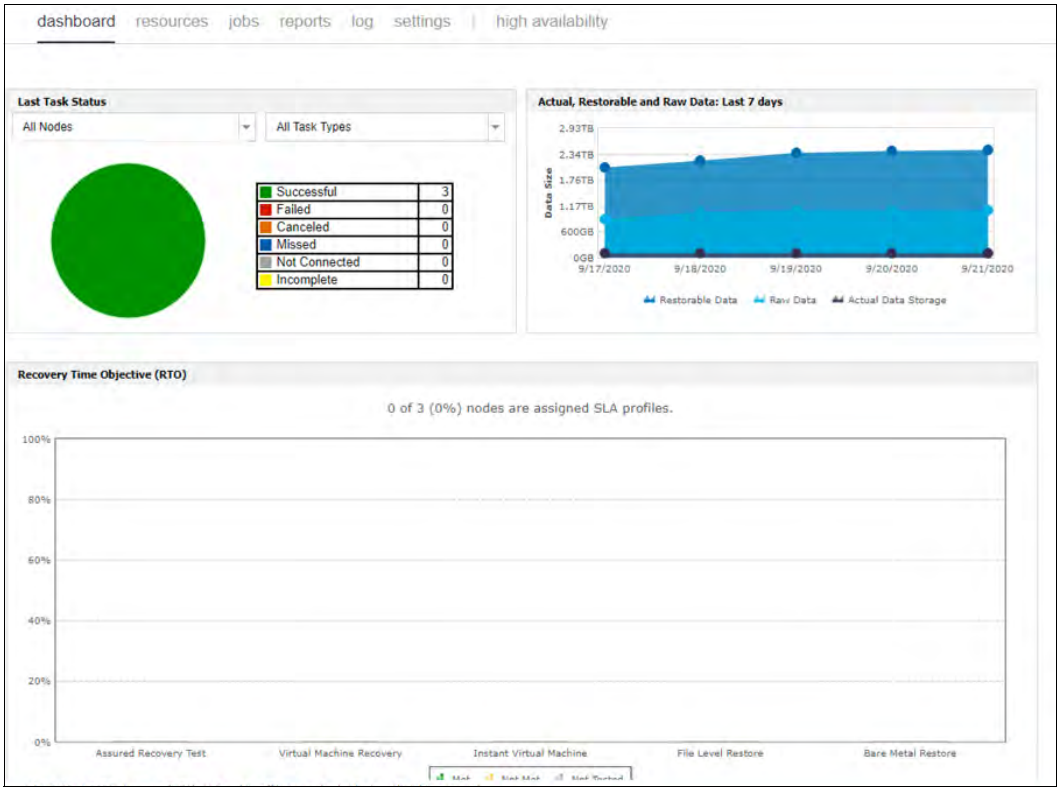
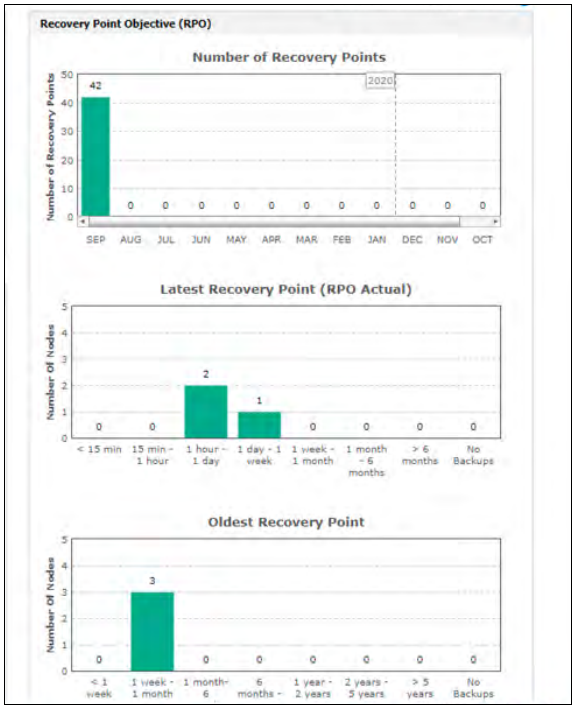


*Figure 5-10. Arcserve Windows Backup Application View*



## 5.3 Backup Performance

We have tested multiple backup operations using different configurations supported by Arcserve software and confirmed the following performance data details.

*Table 5-3. Performance Data*

| Performance | Compressed Data | Uncompressed Data |
|---|---|---|
| Write | 3.2 GB/sec | 2.0 GB/sec |
| Read | 2.2 GB/sec | 2.9 GB/sec |

- The best write performance for compressed data is 3.2 GB/sec (ZeroWC) and for uncompressed data is 2.0 GB/sec (ZeroW) for 256K Block size.
- The best read performance for compressed data is 2.2 GB/sec (ZeroRC) and for uncompressed data is 2.9 GB/sec (ZeroR) for 256K Block size.

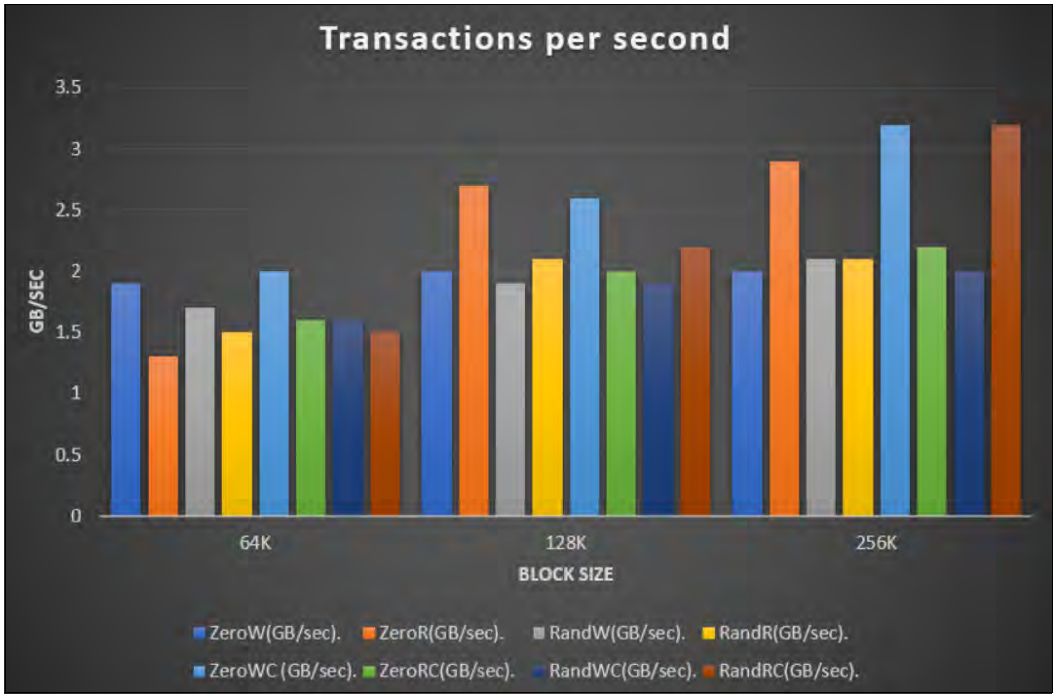
Below are the recommendations to achieve better performance:

- Based on available budget, customer can opt for higher CPU/memory configuration to achieve maximum results.
- Similarly, depending on the data requirements, customers can either go for lower capacity or higher capacity drives.
- Similarly, depending on the data type, customers go for different VTL configuration and back-up and restore policy configuration.

The below graph depicts the backup performance for the VTL where:

- **ZeroW:** Write zeros, data uncompressed when written to disk
- **ZeroWC:** Write zeros data compressed when written to disk
- **ZeroR:** Read zeros uncompressed
- **ZeroRC:** Read zeros compressed
- **RandW, RandR, RandWC, RandRC:** Read/writes from file with random data

*Figure 5-11. Arcserve Windows Backup Application View*



# 6.0 CONCLUSION

As a globally leading IT provider, Western Digital consistently monitors the changing technological, strategic and organizational requirements in the datacenter. Our observations show that as the complexities of IT environments has increased in general, so has the complexities of data protection environments in particular. Efficient data protection scenarios call for infrastructure and management consolidation, with the main goal of ensuring high data availability and quick and fast disaster recoveries, while optimizing backup-to-disk in the process. To meet these requirements, we are offering a consistent data protection strategy with our broad portfolio of storage solutions. By combining QUADStor VTL libraries, Arcserve UDP and Western Digital's Ultrastar Data60 platform, organizations can achieve:

- Lower TCO
- High transaction speed for backup and recovery
- Resilient, high-availability storage
- Linear scalability of backup storage as data volumes grows
- Ease of data management for backup and restore
- Protection against ransomware

*Table 6-1. References*

| **References** |
|---|
| *Ultrastar Data60 Hybrid Storage Platform* |
| *QUADStor Virtual Tape Library* |
| *Arcserve \| Home* |

# 7.0 TECHNICAL SUPPORT

| | |
|---|---|
| *NORTH AMERICA* | |
| **US/Canada** (Central Time) | **800.ASK.4WDC (800.275.4932)** |
| *Monday - Thursday* | 8:00 am - 9:00 pm |
| *Friday - Sunday* | 8:00 am - 7:00 pm |
| *EUROPE* | |
| **Central European Time** (CET) | **00800.27549338 (toll-free where available) or +31.880062100** |
| *Monday - Thursday* | 9:00 am - 7:00 pm |
| *Friday* | 9:00 am - 5:00 pm |

## 7.1 Western Digital Online Services

Western Digital provides a wide variety of technical support services on our Internet site at *http://support.wdc.com.*

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April 2021