

Quest® vRanger® 7.8.6

**Integration Guide for Quest® NetVault
SmartDisk®**



© 2024 Quest Software Inc.

ALL RIGHTS RESERVED.

This guide contains proprietary information protected by copyright. The software described in this guide is furnished under a software license or nondisclosure agreement. This software may be used or copied only in accordance with the terms of the applicable agreement. No part of this guide may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording for any purpose other than the purchaser's personal use without the written permission of Quest Software Inc.

The information in this document is provided in connection with Quest Software products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Quest Software products. EXCEPT AS SET FORTH IN THE TERMS AND CONDITIONS AS SPECIFIED IN THE LICENSE AGREEMENT FOR THIS PRODUCT, QUEST SOFTWARE ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL QUEST SOFTWARE BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF QUEST SOFTWARE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Quest Software makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Quest Software does not make any commitment to update the information contained in this document.

If you have any questions regarding your potential use of this material, contact:

Quest Software Inc.
Attn: LEGAL Dept.
4 Polaris Way
Aliso Viejo, CA 92656

Refer to our website (<https://www.quest.com>) for regional and international office information.

Patents

Quest Software is proud of our advanced technology. Patents and pending patents may apply to this product. For the most current information about applicable patents for this product, please visit our website at <https://www.quest.com/legal>.

Trademarks

Quest, the Quest logo, Foglight, NetVault, vRanger, and Join the Innovation are trademarks and registered trademarks of Quest Software Inc. vCenter, vSphere, vMotion, VMware, and ESXi are registered trademarks or trademarks of VMware, Inc. in the United States and/or other jurisdictions. Active Directory, Hyper-V, SharePoint, SQL Server, Windows, and Windows Server are registered trademarks of Microsoft Corporation in the United States and/or other countries. Data Domain and DD Boost are trademarks or registered trademarks of EMC Corporation in the United States and other countries. For a complete list of Quest marks, visit <https://www.quest.com/legal/trademark-information.aspx>. All other trademarks and registered trademarks are property of their respective owners.

Legend

-  **WARNING:** A WARNING icon indicates a potential for property damage, personal injury, or death.

-  **CAUTION:** A CAUTION icon indicates potential damage to hardware or loss of data if instructions are not followed.

-  **IMPORTANT NOTE, NOTE, TIP, MOBILE, or VIDEO:** An information icon indicates supporting information.

vRanger Integration Guide for Quest® NetVault SmartDisk®
Updated - November 2024
Software Version - 7.8.6

Contents

Getting started	6
vRanger and NetVault SmartDisk: an integration quick start	6
Product overviews	7
What is vRanger?	7
NetVault SmartDisk overview	7
Downloading the software	8
Understanding NetVault SmartDisk	9
NetVault SmartDisk architecture: an overview	9
Components	9
NetVault SmartDisk Instance	10
NetVault SmartDisk Storage Pools	10
Manifests	10
Processes	11
Deduplicated backup process	12
Deduplicated restore process	13
Garbage Collection process	14
Planning your NetVault SmartDisk deployment	15
NetVault SmartDisk deployment strategy: an overview	15
Defining which data to deduplicate	15
Identifying the ideal targets for deduplication	15
Understanding the cost of restoring deduplicated data	16
Deduplicating similar data together	16
Determining the number of deduplicated NetVault SmartDisk Instances	16
Unique Data Size > OS Bit Limit	17
Ingest Rate > Network Bandwidth	17
Deduplication Rate < Ingest Rate	18
Determining the required number of NetVault SmartDisk Instances	18
Determining the required disk space for NetVault SmartDisk Instances	19
Staging Store size	19
Calculating Chunk Store size	19
Choosing a deployment location for a NetVault SmartDisk Instance	20
Reviewing deployment options for NetVault SmartDisk Deduplicated Instances	20
Defining a NetVault SmartDisk Storage Pool strategy	20
Understanding space allocation for NetVault SmartDisk Storage Pools	20
Understanding the optimal performance strategy	21
Installing vRanger	23
vRanger system requirements	23
Installation requirements	23
Minimum hardware requirements	23
Supported operating systems for installation	24
Installing vRanger	25

Configuring vRanger	25
Adding a NetVault SmartDisk repository	26
Checking the NetVault SmartDisk repository	27
Installing NetVault SmartDisk	28
Installing NetVault SmartDisk: an overview	28
System requirements	28
Software requirements	28
Hardware requirements	29
Authentication requirements	29
Installing the NetVault SmartDisk software	30
Important considerations	30
Installing on Windows	31
Completing the installation process	32
Installing a license key	32
Updating the Storage Pool directory structure	33
Protecting the NetVault SmartDisk unique identity	33
Uninstalling NetVault SmartDisk	33
Preserving data before removing NetVault SmartDisk	34
Removing NetVault SmartDisk	34
Reinstalling NetVault SmartDisk	34
Reinstalling NetVault SmartDisk: an overview	34
Prerequisites for reinstalling NetVault SmartDisk	35
Reinstalling NetVault SmartDisk if identity.cfg is available	35
Reinstalling NetVault SmartDisk if identity.cfg is not available	36
Configuring NetVault SmartDisk	37
Configuring NetVault SmartDisk ports for communication with your software	37
Modifying the data port	37
Enabling or updating authentication for WebDAV access	38
Verifying that the client ports are open	39
NetVault SmartDisk CLI: an overview	39
Accessing command help	40
Processing basic shell commands	40
Determining the status of NetVault SmartDisk Services	41
Starting NetVault SmartDisk Services	41
Stopping NetVault SmartDisk Services	41
Restarting NetVault SmartDisk Services	41
Viewing NetVault SmartDisk Log files	42
Configuring NetVault SmartDisk by using the command line	42
Using the config command options	42
Extending NetVault SmartDisk Storage Pools	44
Examples	45
Monitoring NetVault SmartDisk	47
NetVault SmartDisk performance monitoring: an overview	47
Viewing NetVault SmartDisk statistics	47
Viewing NetVault SmartDisk statistics in a terminal session or command prompt	47

Viewing NetVault SmartDisk statistics in a browser	47
Reviewing the list of NetVault SmartDisk statistics	48
Calculating the Deduplication Ratio	51
Calculating the reduction in the storage footprint	51
About us	52
We are more than just a name	52
Our brand, our vision. Together.	52
Contacting Quest	52
Technical support resources	52

Getting started

- [vRanger and NetVault SmartDisk: an integration quick start](#)
- [Product overviews](#)
- [Downloading the software](#)

vRanger and NetVault SmartDisk: an integration quick start

i | **NOTE:** The information in this topic is intended only to provide an overview of the steps required to configure vRanger and NetVault SmartDisk. Review all applicable documentation before implementing this solution.

Integrating NetVault SmartDisk with vRanger is achieved by adding the NetVault SmartDisk Instance to vRanger as a repository. Backups written to that repository are deduplicated according to your configuration. The following steps describe the integration process at a high level, and provide links to the remaining topics for more exploration. Before implementing this solution in a production environment, read this documentation thoroughly.

- 1 **Install NetVault SmartDisk:** Using the NetVault SmartDisk installer, install NetVault SmartDisk on a Windows[®] machine meeting the [System requirements](#). During the installation process, you must configure:
 - **Non-Admin credentials:** NetVault SmartDisk uses these credentials for most operations. The Install Wizard can create the account for you, or you can select an existing account.
 - **Staging Path Location:** When backup data is streamed to the NetVault SmartDisk server, it is staged in the Staging directory until the data is deduplicated. The Staging directory can be local or remote and is configured in the Install Wizard. For more information, see [NetVault SmartDisk Storage Pools](#) and [Defining a NetVault SmartDisk Storage Pool strategy](#).
 - **Store Path Location:** After deduplication, the unique data is stored in the Store directory. The Store directory can be local or remote and is configured in the Install Wizard. For more information, see [NetVault SmartDisk Storage Pools](#) and [Defining a NetVault SmartDisk Storage Pool strategy](#).
 - **WebDAV credentials:** vRanger requires WebDAV credentials to communicate with NetVault SmartDisk. You must configure WebDAV authentication to integrate with vRanger effectively. You can configure these credentials during the installation process, or by using the NetVault SmartDisk command line, as described in [Enabling or updating authentication for WebDAV access](#).
- 2 **Configure NetVault SmartDisk:** While the defaults may be acceptable for testing, you may want to change two key configurations to fine-tune performance:
 - **Deduplication window:** By default, deduplication is set to “anytime” which means that deduplication runs whenever backups are available in the Staging path. Configuring a deduplication window outside of your backup window may improve performance of both deduplication and backups. For more information on configuring NetVault SmartDisk and the deduplication window, see [Using the config command options](#).
 - **Garbage Collection window:** When backups are retired to do retention policies, the unique data is not automatically deleted from the Store directory. The NetVault SmartDisk Garbage Collection process removes these chunks and reclaims disk space. By default, garbage collection runs at 1:00

PM and 7:00 PM, Monday through Thursday. For more information on configuring NetVault SmartDisk and the garbage collection schedule, see [Using the config command options](#).

- 3 **Install vRanger:** Using the vRanger installer, install vRanger on a machine meeting the [vRanger system requirements](#). For a high-level overview of the vRanger installation process, see [Installing vRanger](#). For more information, see the *Quest vRanger Installation/Upgrade Guide*.
- 4 **Create NetVault SmartDisk Repository:** After vRanger is installed, add the NetVault SmartDisk Instance to vRanger as a repository. Any backup written to this repository is deduplicated according to your NetVault SmartDisk configuration. For more information, see [Adding a NetVault SmartDisk repository](#).

Product overviews

The following topics provide an overview of vRanger and NetVault SmartDisk, and important information about the licensing required to integrate the two products.

What is vRanger?

vRanger is the next step in the evolution of the leading backup solution designed exclusively for the virtual infrastructure. vRanger captures the complete source image—including the operating system, patches, and applications—and transfers the archive—full, incremental, or differential—to a configured data repository. These image-level backups can be restored in a matter of minutes rather than the hours required by legacy file-level solutions.

vRanger versions 5.3 and later support the use of a NetVault SmartDisk server as a repository. Simply by adding a configured NetVault SmartDisk server to vRanger as a repository, backups written to that repository is automatically de-duplicated.

vRanger licensing

Each physical CPU socket on a licensed VMware® ESXi™ host requires one CPU License. vRanger can restore and replicate to a host for which you have not configured a vRanger license. Every ESXi host for which vRanger is expected to provide protection must be properly licensed, both by VMware® and in the vRanger Host Licensing tab.

i | **IMPORTANT:** A Quest vRanger license is required for integration with NetVault SmartDisk. vRanger Standard Edition (SE) and vReplicator are not supported by NetVault SmartDisk. This documentation uses “vRanger” for simplicity, but only vRanger Backup & Replication is supported for use with NetVault SmartDisk.

NetVault SmartDisk overview

The NetVault SmartDisk disk-based data-deduplication option reduces storage costs with its powerful byte-level, variable-block-based software deduplication, which packs up to 12 times more protected data into the same storage area for up to a 90% reduction in storage footprint. Hardware costs are reduced by using existing storage infrastructure instead of requiring specific drives or appliances. Seamless integration with vRanger speeds deployment while simplified ease-of-use reduces the level of storage expertise required to perform deduplicated disk-based backups.

To shrink backup windows with no additional affect on hosts or protected servers, you can schedule the NetVault SmartDisk post-process deduplication option outside the backup window.

For more information, see [Understanding NetVault SmartDisk](#).

NetVault SmartDisk licensing

The NetVault SmartDisk - vRanger Edition is licensed on a per-instance basis. An “instance” is defined as an individual server installation of NetVault SmartDisk. Each NetVault SmartDisk Instance requires its own permanent license key, which is tied to a NetVault SmartDisk Machine ID that is unique to each NetVault SmartDisk Instance. You may configure multiple repositories per instance.

i | IMPORTANT: NetVault SmartDisk is only supported when used with Quest vRanger.

Size limits on NetVault SmartDisk Instances

Each instance is limited in the amount of deduplicated data that it can support:

- If you use a 32-bit platform, you are limited to a Chunk Store of 5 TB of unique data.
- If you use a 64-bit platform, you are limited to a Chunk Store of 15 TB of unique data.

For more information, see [Unique Data Size > OS Bit Limit](#).

Downloading the software

Evaluation versions of vRanger and NetVault SmartDisk are available from the vRanger page on the Quest website. Evaluation versions are full applications limited only by licensing.

To download an evaluation copy of vRanger:

- 1 From an internet-connected PC, access <http://quest.com/products/vranger/>.
- 2 Click **Download Free Trial**.
- 3 Register or log in as appropriate.
- 4 Accept the **License Agreement**, and click **Submit**.
- 5 Select **vRanger**, and save the file to the desired location.

To download an evaluation copy of NetVault SmartDisk:

- 1 From an internet-connected PC, access <http://quest.com/products/netvault-backup/>.
- 2 Click **Download Free Trial**.
- 3 Register or log in as appropriate.
- 4 Accept the **License Agreement**, and click **Submit**.
- 5 Select **NetVault SmartDisk**, and save the file to the desired location.

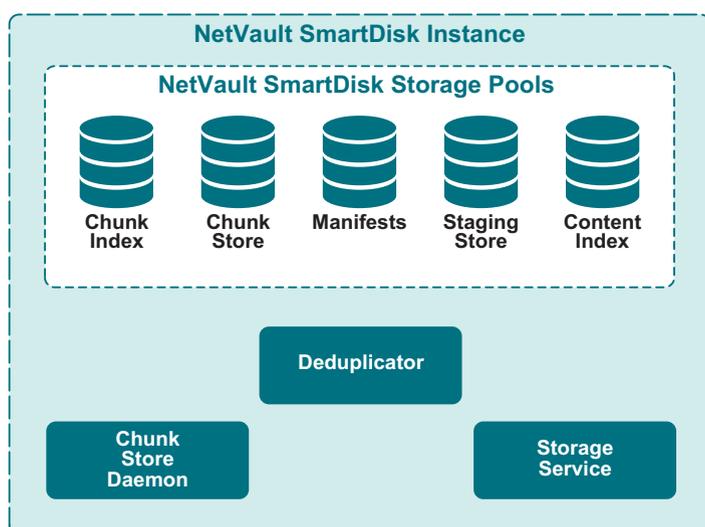
Understanding NetVault SmartDisk

- [NetVault SmartDisk architecture: an overview](#)
- [Components](#)
- [Deduplicated backup process](#)
- [Deduplicated restore process](#)
- [Garbage Collection process](#)

NetVault SmartDisk architecture: an overview

The basic components of a NetVault SmartDisk Instance are shown in the following image, and described in the topics that follow.

Figure 1. Components



Components

- [NetVault SmartDisk Instance](#)
- [NetVault SmartDisk Storage Pools](#)
- [Manifests](#)
- [Processes](#)

NetVault SmartDisk Instance

A **NetVault SmartDisk Instance** includes one or more Storage Pools and a set of processes that perform byte-level, variable-block software deduplication. You can deploy a single **NetVault SmartDisk Instance** on a dedicated server, or a different server or client, and it can accept data streams from heterogeneous platforms. In addition, you can deploy multiple **NetVault SmartDisk Instances** to distribute network, disk, and deduplication resources, which improves load balancing and performance. When multiple NetVault SmartDisk Instances are deployed, Storage Pools and processes are not shared across the multiple NetVault SmartDisk Instances. Data written to a NetVault SmartDisk Instance is deduplicated globally, regardless of the data's source. For example, if you have two vRanger instances writing to the same NetVault SmartDisk Instance, the data is treated as if it came from a single source.

NetVault SmartDisk Storage Pools

A **NetVault SmartDisk Storage Pool** includes one or more file-system volumes, which you can easily extend by adding additional file-system paths. Each Storage Pool is associated with **roles** that it can perform. When configuring the Storage Pool, you can specify the preferred roles or the roles not allowed. Available roles include the **Content Index** (also called Disk Index), **Staging Store** (also called Staging), **Chunk Index**, and **Chunk Store** (also called Storage). For example, Storage Pool A is used for the **Content Index** and the **Chunk Index** while Storage Pool B is only used for the **Staging Store** and **Chunk Store**. Storage Pool A can include fault-tolerant disks with good random-access performance, while Storage Pool B includes fault-tolerant disks with good streaming performance. When NetVault SmartDisk is analyzing the available Storage Pools, it chooses the optimal Storage Pool to use based on available space, the defined roles, and other current activity in the NetVault SmartDisk Instance.

Storage-Pool roles

- **Content Index:** The **NetVault SmartDisk Content Index** role is the index where the NetVault SmartDisk Instance tracks the data it is protecting and whether it is stored in the **Staging Store** or the **Chunk Store**. The Content Index is relatively small and should reside in a Storage Pool made of fault-tolerant disks with good random-access performance.
- **Staging Store:** The **NetVault SmartDisk Staging Store** role is where all nondeduplicated data streams are stored, whether they are awaiting post-processing deduplication or were not selected for deduplication. Data streams that were selected for deduplication are deleted from the **Staging Store** after the post-processing deduplication is completed. The **Staging Store** should reside in a Storage Pool made of fault-tolerant disks with good streaming performance.
- **Chunk Index:** The **NetVault SmartDisk Chunk Index** role is a list of the unique Chunks and where each Chunk is stored in the **Chunk Store**. There is one **Chunk Index** per NetVault SmartDisk Instance. The **Chunk Index** should reside in a Storage Pool made of fault-tolerant disks with good random-access performance.
- **Chunk Store:** The **NetVault SmartDisk Chunk Store** role is where the unique Chunks are stored. The **Chunk Store** should reside in a Storage Pool made of fault-tolerant disks.

Manifests

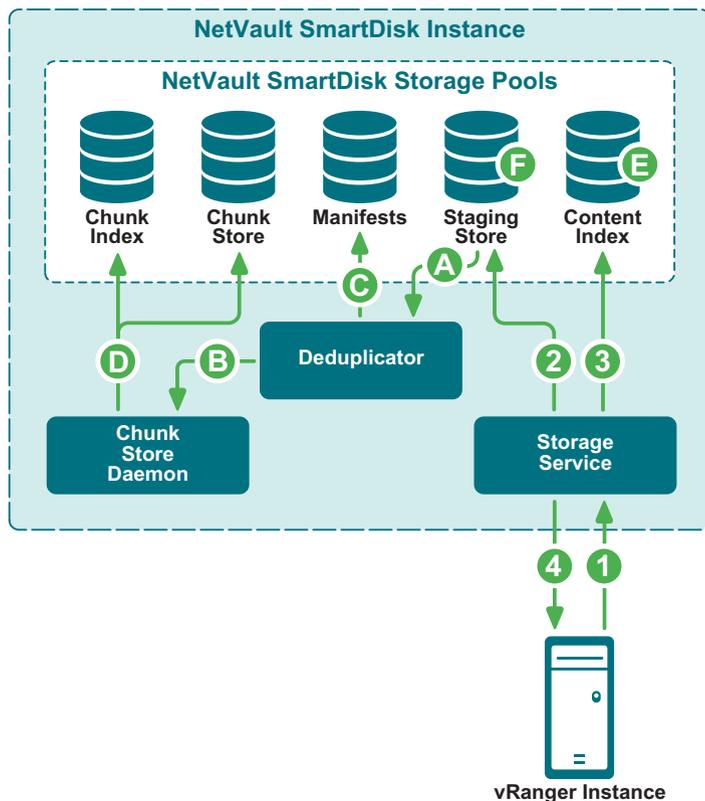
Stored in a NetVault SmartDisk Storage Pool, a **NetVault SmartDisk Manifest** is an ordered list of the Chunks that make up the data stream. It is used during the reconstruction of the data stream to ensure that the Chunks are reconstructed in the correct order. There is one Manifest per data stream.

Processes

- **Storage Service:** The **NetVault SmartDisk Storage Service** listens on a user-defined port for data flowing to and from NetVault SmartDisk. There is one Storage Server process per data stream.
- **Deduplicator:** The **NetVault SmartDisk Deduplicator** performs byte-level, variable-block software-based deduplication by breaking the data streams into unique Chunks. The Deduplicator uses the **Chunk Store Daemon (CSD)** to query the **Chunk Index** to determine if the Chunk is unique. When a Chunk is found in the Chunk Index, the **Chunk Store Daemon** stores the unique Chunk in the **Chunk Store**. There is one Deduplicator process per data stream.
- **Chunk Store Daemon:** The **NetVault SmartDisk Chunk Store Daemon** is the only process that writes to the **Chunk Index** and **Chunk Store**. There is only one CSD per **NetVault SmartDisk Instance**. The CSD also manages the Garbage Collection process.
- **percolatormonitor:** The **percolatormonitor** is a privileged process that launches and monitors other NetVault SmartDisk Processes.
- **percolatorslave:** The **percolatorslave** is responsible for communication routing. It routes messages between NetVault SmartDisk Processes on the local machine and between NetVault SmartDisk and other remote servers.
- **logd:** The **logd** is the logging daemon that creates the NetVault SmartDisk logs and stores them in an internal database. It also sends them to the applicable system location, such as the Application log in the Windows® Event Viewer.
- **resourcemanager:** The **resourcemanager** manages the combined number and size of all trace files by periodically deleting inactive files, that is, those files that are not associated with any running processes, starting with the oldest files first.
- **superserver:** The **superserver** is the high-level manager of all other processes. It coordinates operations, balances the load between file systems, and schedules deduplication and Garbage Collection.
- **winservicerunner:** On Windows, the **winservicerunner** runs the Windows Service and starts the **percolatormonitor**.

Deduplicated backup process

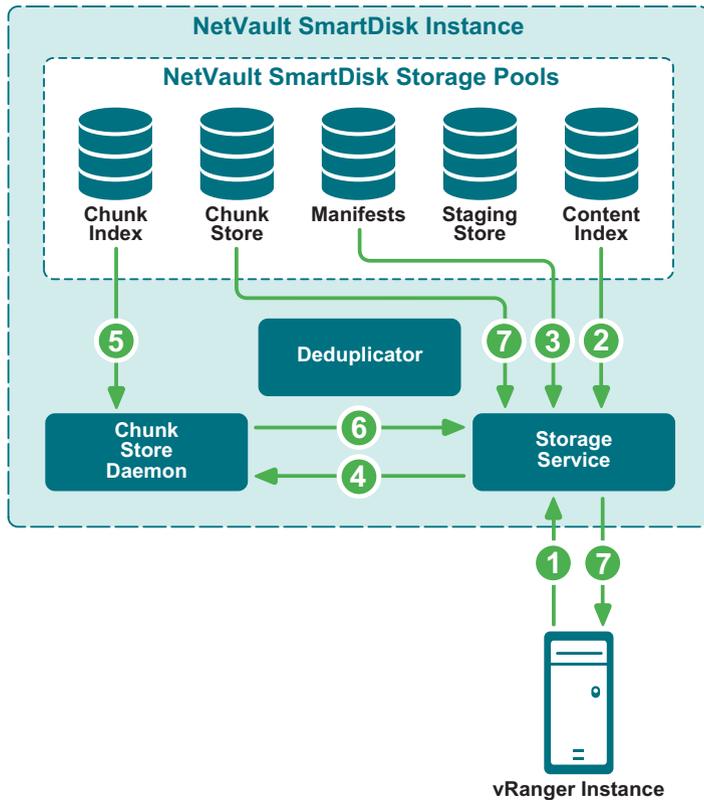
Figure 2. Back up data and deduplicate it



- 1 After the user initiates a backup job targeted to the NetVault SmartDisk repository, vRanger streams data on the user-defined port to the **Storage Service**.
 - 2 The **Storage Service** stores the backup stream from vRanger in the **Staging Store**.
 - 3 The **Storage Service** updates the **Content Index** to indicate where the backup is stored in the **Staging Store**.
 - 4 The **Storage Service** updates vRanger to indicate that the backup stream has been successfully stored.
-
- A During the user-defined deduplication window, backup data is retrieved from the **Staging Store** and sent to the **Deduplicator**.
 - B The **Deduplicator** performs byte-level, variable-block software-based deduplication by breaking data streams into unique Chunks and sending them to the **Chunk Store Daemon**.
 - C The **Deduplicator** creates a backup-specific **Manifest**, which is an ordered list of Chunks that make up the backup.
 - D The **Chunk Store Daemon** sends the unique Chunks to the **Chunk Store** for storage and updates the **Chunk Index** to indicate where each Chunk is stored in the **Chunk Store**.
 - E The **Content Index** is updated to indicate that the backup is stored in the **Chunk Store**.
 - F The backup data stream is removed from the **Staging Store**.

Deduplicated restore process

Figure 3. Restore data that was deduplicated



- 1 After the user initiates a restore of a deduplicated backup that is stored on the NetVault SmartDisk repository, vRanger requests the data on the user-defined port from the **Storage Service**.
- 2 The **Storage Service** queries the **Content Index** to determine whether the backup is stored in the **Staging Store** for nonduplicated backups or the **Chunk Store** for deduplicated backups.
- 3 The **Storage Service** queries the backup's Manifest for the first or next batch of Chunk Names in the backup.
- 4 The **Storage Service** queries the **Chunk Store Daemon** for the location of the Chunks in the **Chunk Store**.
- 5 Using Chunk Names from the **Manifest**, the **Chunk Store Daemon** queries the **Chunk Index** for pointers to the Chunks in the **Chunk Store**.
- 6 The **Chunk Store Daemon** provides the **Storage Service** with the location of the Chunks in the **Chunk Store**.
- 7 The **Storage Service** retrieves the Chunks from the **Chunk Store** and streams the Chunk to vRanger.

Step 4 through Step 7 repeat for each batch of Chunk Names in the **Manifest**.

On completion of restoring all Chunk Names in Manifest, vRanger returns a **Restore Completed** job status.

Garbage Collection process

When backups targeted to NetVault SmartDisk are retired, the data is removed from the backup database; however, the unique Chunks are not automatically removed from the **Chunk Store**. The NetVault SmartDisk Garbage Collection process is designed to remove orphaned Chunks from the **Chunk Store** and reclaim disk space. To do so, Garbage Collection maintains reference counts of added and deleted Chunks, and it deletes or rewrites partially used Chunk pages.

Garbage Collection cannot run at the same time as deduplication, because deduplication needs to write to the Chunk Store. During the configured Garbage Collection window, data waiting for deduplication is queued until Garbage Collection has completed. By default, the Garbage Collection window is from 18:00 through 06:00 on every night; however, you can revise this setting—for more information, see [Configuring NetVault SmartDisk](#). Outside the Garbage Collection window, Garbage Collection is only started if no data is being deduplicated or is queued for deduplication. If data becomes available for deduplication outside the Garbage Collection window and Garbage Collection is active, Garbage Collection is stopped and deduplication proceeds.

Quest also recommends scheduling regular Garbage Collection to avoid delays associated with collecting large amounts of data.

- i** | **NOTE:** If a backup job that uses deduplication is canceled, the Chunk Store space used by segments that have already been deduplicated is not reclaimed until the next Garbage Collection occurs. Space used by the Staging Store and license enforcement is reclaimed immediately.

Planning your NetVault SmartDisk deployment

- [NetVault SmartDisk deployment strategy: an overview](#)
- [Defining which data to deduplicate](#)
- [Determining the number of deduplicated NetVault SmartDisk Instances](#)
- [Determining the required disk space for NetVault SmartDisk Instances](#)
- [Choosing a deployment location for a NetVault SmartDisk Instance](#)
- [Defining a NetVault SmartDisk Storage Pool strategy](#)

NetVault SmartDisk deployment strategy: an overview

A NetVault SmartDisk deployment strategy includes multiple components, which you define before installing NetVault SmartDisk. To ensure a successful deployment, complete the following steps, which are described in detail in subsequent topics:

- Define the data that you want to deduplicate.
- Calculate the size of your NetVault SmartDisk Deployment.
- Define the deployment location of the NetVault SmartDisk Instance.
- Define a strategy for the NetVault SmartDisk Storage Pools.

Defining which data to deduplicate

The first step in defining your NetVault SmartDisk Deployment Strategy is determining which data to deduplicate. Not **all** data benefits from deduplication; therefore, it is important to determine which data is targeted to use the NetVault SmartDisk Deduplication Option to reduce its storage footprint.

Additionally, the longer the data is retained in vRanger, the better the deduplication ratios. The deduplication ratios improve because more duplicate Chunks are found thus enabling the ability to pack more data into the same storage footprint. This ability enables even more protected data to be available through disk-based media. To obtain the most ideal deduplication ratios, Quest recommends a retention period of 12 weeks or more.

Identifying the ideal targets for deduplication

High deduplication ratios are achieved when multiple generations of the same data are targeted for the same NetVault SmartDisk Instance. Data that is an ideal target for deduplication includes the following:

- Structured databases, such as Oracle® and SQL Server® databases.
- Source servers using the same operating system and similar applications, such as those protected by vRanger.
- Email servers, such as Exchange and Domino® systems.

i | **NOTE:** While email is an ideal target for deduplication, Single Instance Store (SIS), such as storage provided by Exchange, reduces deduplicated data; therefore, the deduplication ratio for the email server is not as high as other types of data.

Understanding the cost of restoring deduplicated data

While data deduplication reduces storage costs by reducing the storage footprint, there is a cost incurred during the restore processes. During the restoration of a deduplicated backup, NetVault SmartDisk has to reassemble the Chunks as it restores the data. This reassembly process, also called **rehydration**, lengthens the time to restore the data. Therefore, if the Recovery Time Objective (RTO) is important for a specific database, email, or file system, consider the trade-off between reducing storage costs and increasing RTO when you identify which data to deduplicate.

Deduplicating similar data together

You can increase deduplication ratios by targeting backups from the same database, file system, or application to the same NetVault SmartDisk Instance. When a backup is deduplicated and a previous backup from the same database, file system, or application has already been deduplicated by the NetVault SmartDisk Instance, only the unique or new Chunks that did not exist in the previous backup have to be stored in the **Chunk Store**. If a previously deduplicated backup does not exist in the NetVault SmartDisk Instance, most of the backup is considered unique data; this issue increases the number of unique Chunks that have to be stored in the **Chunk Store**.

When targeting backups to NetVault SmartDisk Instances, deduplication ratios decline if backups are targeted to random NetVault SmartDisk Instances. Quest recommends that you target backups from the same database, file system, or application to the same NetVault SmartDisk Instance.

Determining the number of deduplicated NetVault SmartDisk Instances

Three factors determine the number of NetVault SmartDisk Instances required. If any of these factors are true, you must deploy multiple NetVault SmartDisk Instances. To determine the total number of NetVault SmartDisk Instances required, perform the following calculations:

- Unique Data Size > 15 TB for 64-bit OS and > 5 TB for 32-bit OS
- Ingest Rate > Maximum Sustained Network Bandwidth
- Deduplication Rate < Ingest Rate

The maximum result for the three calculations determines the number of NetVault SmartDisk Instances that must be deployed. For example, if the Unique Data Size calculation and the Deduplication Rate indicates that only one NetVault SmartDisk Instance is required, but the Ingest Rate calculation indicates that two NetVault SmartDisk Instances are required, you must deploy two NetVault SmartDisk Instances.

Unique Data Size > OS Bit Limit

The Unique Data Size is the amount of unique data that is stored inside the NetVault SmartDisk Instance. An additional NetVault SmartDisk Instance must be deployed for every 15 TB of unique data on a 64-bit operating system (OS) and for every 5 TB of unique data on a 32-bit operating system. Use the following calculation to determine the number of NetVault SmartDisk Instances based on the Unique Data Size:

```
Size of Weekly Full Backups + ((Size of Weekly Full Backups * Weekly Change Rate)
* Weekly Full Backup Retention Period)
+ (Size of Daily Backups * (Number of Daily Backups between Weekly Full Backups
* Daily Backup Retention Period))
```

Example:

100 GB = Size of Weekly Full Backups

10% = Weekly Change Rate

12 = Weekly Full Backup Retention Period in Weeks

10 GB = Size of Daily Backups

4 = Daily Backup Retention Period in Weeks

6 = Number of Daily Backups between Full Backups

```
100 + ((100 * 0.1) * 12) + (10 * (6*4)) =
100 + ((10) * 12) + (10 * (24)) =
100 + (120) + (240) = 460 GB
```

- If the operating system is 64-bit:

$460/15360 = .029$

Rounded Up to Next Whole Number = **1 NetVault SmartDisk Instance**

- If the operating system is 32-bit:

$460/5120 = .089$

Rounded Up to Next Whole Number = **1 NetVault SmartDisk Instance**

Ingest Rate > Network Bandwidth

The NetVault SmartDisk Ingest Rate is the rate at which data can be streamed into NetVault SmartDisk. Because data streams into the NetVault SmartDisk Instance through a user-defined port, the network bandwidth limits the speed at which data can be streamed. To ensure that all backups targeted to a NetVault SmartDisk Instance can complete during the backup window, divide the required ingest rate by the Maximum Sustained Network Bandwidth to determine the number of required NetVault SmartDisk Instances. Use the following calculation to determine the number of NetVault SmartDisk Instances based on the NetVault SmartDisk Ingest Rate and Network Bandwidth:

```
((Size of Weekly Full Backups * 1024) / (Number of Hours in Backup Window* 60 * 60))
/ Maximum Sustained Network Bandwidth
```

Example:

100 GB = Size of Weekly Full Backups

8 = Number of Hours in Backup Window

100 = Maximum Sustained Network Bandwidth (MB/Sec)

```
((100 *1024) / (8 * 60* 60)) / 100 =
((102400) / (28,800)) / 100 =
3.55 / 100 = .035
```

Rounded Up to Next Whole Number = **1 NetVault SmartDisk Instance**

Deduplication Rate < Ingest Rate

The NetVault SmartDisk Deduplication Rate is the rate at which NetVault SmartDisk deduplicates data. If NetVault SmartDisk deduplication is configured to run during the backup, the NetVault SmartDisk Deduplication Rate must be greater than or equal to the Ingest Rate to ensure that the deduplication process completes before the next weekly backup window begins.

Use the following to estimate the Deduplication Rates:

- 1 Determine the Single Core Deduplication Rate:

Hardware	Speed
24 to 36 Month Old Intel Core 1, AMD Athlon or Intel Celeron	10 to 20 MB/sec
12 to 24 Month Old Core 2 Duo, AMD Quad Core Opteron or Dual Core Xeon	20 to 40 MB/sec
0 to 12 Month Old Desktop or Server Core 2 Duo, Quad Core Xeon or Quad Core AMD	40 MB/sec or more

- 2 Multiply the Single Core Deduplication Rate by the number of Cores.

Use the following calculation to determine the number of NetVault SmartDisk Instances based on the Deduplication Rate and Ingest Rate:

```
((Size of Weekly Full Backups) + (Size of Daily Backups * Number of Daily Backups between Weekly Full Backups)) * 1024 / (Number of Seconds in Deduplication Window for 6 Days) / Deduplication Rate
```

Example:

100 GB = Size of Weekly Full Backups

10% = Weekly Full Backup Growth Rate

10 GB = Size of Daily Backups

6 = Number of Daily Backups between Full Backups

24 = Number of Hours in Daily Deduplication Window

50 = Deduplication Rate (MB/Sec)

```
((100) + (10 * 6)) * 1024 / (24 * 6 * 60 * 60) / 50 =  
((100) + (60)) * 1024 / (518400) / 50 =  
(160*1024)/518400/50 =  
(163840/518400)/50 = .0063
```

Rounded Up to Next Whole Number = **1 NetVault SmartDisk Instance**

Determining the required number of NetVault SmartDisk Instances

The maximum result for the following three calculations determines the number of NetVault SmartDisk Instances that must be deployed:

- Unique Data Size > 15 TB for 64-bit OS and > 5 TB for 32-bit OS
- Ingest Rate > Maximum Sustained Network Bandwidth
- Deduplication Rate < Ingest Rate

Example:

- Unique Data Size > OS Bit Limit = 1 NetVault SmartDisk Instance
- Ingest Rate > Network Bandwidth = 1 NetVault SmartDisk Instance
- Deduplication Rate < Ingest Rate = 1 NetVault SmartDisk Instance

The maximum result is one NetVault SmartDisk Instance; therefore, only one NetVault SmartDisk Instance is required in this example.

Determining the required disk space for NetVault SmartDisk Instances

The Total Required Disk Space is divided into the **Staging Store** and the **Chunk Store**. If you intend to use different file systems or disks for the **Staging Store** and the **Chunk Store**, it is important to know how much of the Total Required Disk Space is allocated to the **Staging Store** versus the **Chunk Store**. Use the following calculations to determine this amount.

During the NetVault SmartDisk Deduplicated Backup process, backups are initially streamed to the **Staging Store** where they remain until the deduplication process is finished. The **Staging Store** must be large enough to hold all the backups while they await deduplication.

If the deduplication window overlaps the backup window, deduplication and backups occur at the same time. Each backup starts deduplicating after the backup job is finished. Also, large backups are broken into 400 GB segments. Each segment starts to deduplicate after it is received, even if the backup stream is still being streamed to the **Staging Store**. Therefore, the **Staging Store** only requires space to hold some portion of the total backup size. If the **Staging Store** runs out of space, vRanger backups fail.

Staging Store size

The maximum disk space required for the **Staging Store** is equal to the Size of the Weekly Full Backups.

Calculating Chunk Store size

The amount of physical disk space required for the **Chunk Store** is equal to the Unique Data Size. To calculate the Unique Data Size or the size of the **Chunk Store**, use the following formula:

```
Size of Weekly Full Backups + ((Size of Weekly Full Backups * Weekly Change Rate)
* Weekly Full Backup Retention Period)
+ (Size of Daily Backups * (Number of Daily Backups between Weekly Full Backups
* Daily Backup Retention Period))
```

Example:

100 GB = Size of Weekly Full Backups

12 = Weekly Full Backup Retention Period in Weeks

10 GB = Size of Daily Backups

4 = Daily Backup Retention Period in Weeks

6 = Number of Daily Backups between Full Backups

```
100 + ((100 * 0.1) * 12) + (10 * (6*4)) =
100 + ((10) * 12) + (10 * (24)) =
100 + (120) + (240) = 460 GB
```

Choosing a deployment location for a NetVault SmartDisk Instance

The third step in defining your NetVault SmartDisk Deployment Strategy is deciding where you want to deploy your NetVault SmartDisk Instances. Whether the NetVault SmartDisk Instance is enabled for deduplication dictates the available deployment options.

Reviewing deployment options for NetVault SmartDisk Deduplicated Instances

Multiple vRanger servers cannot target the same repository. For this reason, in environments with one or more vRanger servers, you must deploy a NetVault SmartDisk Instance for each vRanger server.

i | **NOTE:** You *cannot* deploy multiple NetVault SmartDisk Instances on the same machine.

Defining a NetVault SmartDisk Storage Pool strategy

The fourth step in defining your NetVault SmartDisk Deployment Strategy is defining your strategy for the NetVault SmartDisk Storage Pools.

Understanding space allocation for NetVault SmartDisk Storage Pools

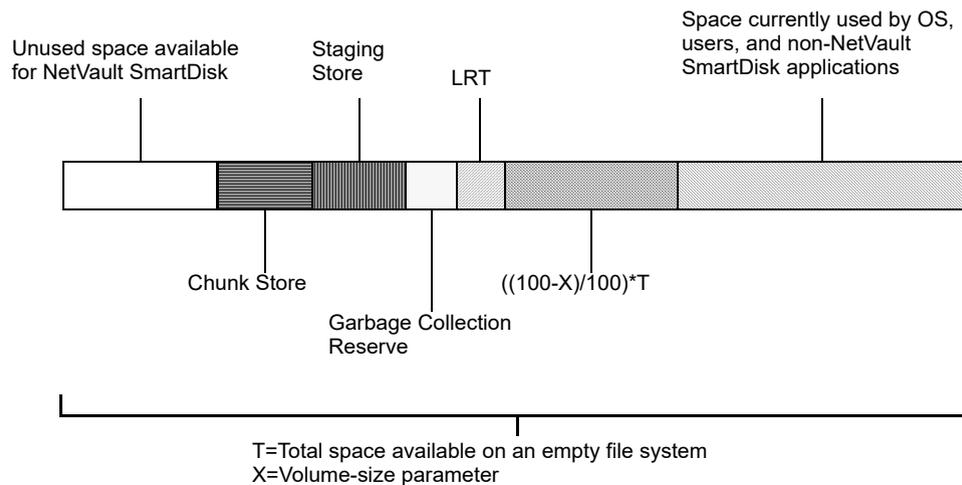
Before choosing a strategy for your NetVault SmartDisk Storage Pools, consider the following regarding how NetVault SmartDisk allocates space in the NetVault SmartDisk Storage Pools:

- You can add an unlimited number of Storage Pools to NetVault SmartDisk.
- You can add an unlimited number of volumes to each NetVault SmartDisk Storage Pool.
- Each NetVault SmartDisk Storage Pool is associated with roles that it can perform.
- When configuring a NetVault SmartDisk Storage Pool, you can identify it as a favorite for specific roles (**favour**), and you can indicate that it should never be used for specific roles (**deny**).
- There is no quota specified per-volume of the absolute amount of space NetVault SmartDisk can use; that is, you cannot say “use exactly 100 GB.” However, you can specify an amount of physical disk-storage that you want to set aside that NetVault SmartDisk cannot use. This option simplifies the NetVault SmartDisk internal space-allocation policies so that Staging Store and Chunk Store processes can efficiently share volumes. Each role independently implements and honors the configured thresholds, which allows efficient parallel-processing without a requiring a single, centralized space allocator.
- Using the **volume-size** parameter, you can set aside a portion of the volume so that it cannot be used for NetVault SmartDisk. After the volume is full with NetVault SmartDisk or non-NetVault SmartDisk data, NetVault SmartDisk does not store anything else on the volume until space is made available.
- NetVault SmartDisk uses storage space in each volume up to a threshold amount that includes space directly set aside using the **volume-size** parameter, and the **Last Resort Threshold (LRT)** amount set by NetVault SmartDisk internally.

- NetVault SmartDisk first uses a volume for its intended role, for example, Chunk Store or Staging Store, but it also uses it for other purposes if necessary. Even if you supply a threshold, NetVault SmartDisk implements an **LRT** that stops NetVault SmartDisk from using a volume after there is less than a certain amount of space available and thus prevents the disk from becoming full. The **LRT** is calculated to include both a fixed amount of space (1 GB) and the space that would be required to make Garbage Collection possible, that is, the **gc_reserve_bytes** parameter. This process means that the figure varies in size depending on the amount of data held in the Chunk Store; typically, you can expect the **gc_reserve_bytes** parameter to be at least 1.7 GB.
- If the **LRT** is large enough, NetVault SmartDisk properly allocates space when multiple Staging Store and Chunk Store processes are both writing to a volume that becomes too full. NetVault SmartDisk maintains an overall idea of how much space is used both by the Staging Store and the Chunk Store. This allows it to enforce the licensed amount of capacity and to enforce the **LRT** and the **volume-size** limits.
- User thresholds and the NetVault SmartDisk **LRT** do not affect licensing. Licensing measures the amount of data accepted for protection by the NetVault SmartDisk Instance, regardless of whether the data has been deduplicated.

The following figure shows a graphical example of how space is organized in NetVault SmartDisk. This figure assumes that all volumes are mapped to one file system. Also, the space reserved for LRT is reserved on a per-volume basis; if your configuration uses multiple volumes, more LRT space might be allocated.

Figure 1. Space allocation for NetVault SmartDisk



Understanding the optimal performance strategy

Consider the following guidelines when assigning NetVault SmartDisk Storage Pool Roles:

- **Content Index:** Should be small and reside in a Storage Pool made of fault-tolerant disks with good random-access performance.
- **Staging Store:** Should reside in a Storage Pool made of fault-tolerant disks with good streaming performance.
- **Chunk Index:** Should reside in a Storage Pool made of fault-tolerant disks with good random-access performance.
- **Chunk Store:** Should reside in a Storage Pool made of fault-tolerant disks.

If the goal is optimal performance, using additional disks to increase Input/Output Operations per Second (IOPS) and aggregate disk bandwidth improves NetVault SmartDisk performance more than using additional memory.

For example, if you are using a single RAID array, consider configuring four separate RAID 1 volumes, one for each Storage Pool Role. This configuration separates the IO workload for each volume across independent RAID volumes. You can tune performance further by restricting the number of independent disk operations—reads, writes, and deletes—allowed per volume to two operations, which avoids disk thrashing. In addition, configure the RAID array to support more bandwidth in and out of **Staging Store**.

This strategy is appropriate for NetVault SmartDisk Instances where staging, deduplication, and restores might occur simultaneously.

i | **NOTE:** RAID recommendations also apply to Storage Area Network (SAN) and Network Attached Storage (NAS).

On Windows® platforms, you can disable the New Technology File System (NTFS) **Last Access Update** feature, which can reduce disk accesses and increase performance. For instructions on disabling this feature, see the documentation for your specific operating system.

Optimizing performance while protecting against data loss during power failures

Although enabling disk-write caches improves NetVault SmartDisk performance, power failures that occur before modified disk-cache contents have been written to non-volatile magnetic storage can potentially cause data loss in NetVault SmartDisk. Because of this risk, it is critical that you understand how your underlying disk technology caches writes to disk. You can turn off disk-write caching, but due to the improvement in performance that write-caching offers, it is increasingly used despite the risk, and the risk is mitigated by using additional technology. A common mitigation technique is ensuring that power does not go off. In high-end server environments, with their uninterruptible power supplies (UPSs) and redundant power supplies, having unfilled cached writes is less of an issue.

Also, drives that employ write-caching have a write-flush feature that instructs the drive to send pending writes from the cache to the disk immediately. This command is sent before UPS batteries run out—if the system detects a power interruption—or just before the system is shut down for any other reason.

Finally, most disk array systems use non-volatile random access memory (NVRAM) to protect data written to disk if there is a power failure. Quest recommends that you review your server and storage vendor's product documentation to understand what steps are taken to ensure that disk writes are written to non-volatile magnetic storage if there is a power failure.

Installing vRanger

- [vRanger system requirements](#)
- [Installing vRanger](#)
- [Configuring vRanger](#)

vRanger system requirements

Before installing vRanger and NetVault SmartDisk, ensure that you read and understand the requirements and limitations of both products. The system requirements for vRanger are summarized in the following topics.

For vRanger and NetVault SmartDisk to integrate, you must use the following versions:

- vRanger 7.6.5 or later
- NetVault SmartDisk 11.4.5 or later

i | **NOTE:** The following information is a summary only. Before implementing vRanger, review the *Quest vRanger Installation/Upgrade Guide*.

Installation requirements

The hardware requirements to run vRanger can vary widely based on several factors. Therefore, you should not do a large-scale implementation without first completing a scoping and sizing exercise.

Minimum hardware requirements

The minimum hardware requirements to run vRanger can vary widely based on several factors. Therefore, you should not do a large-scale implementation without first completing a scoping and sizing exercise.

vRanger: physical machine

The following describes the hardware recommendations for the vRanger physical machine:

Table 1. Requirements for a installing vRanger on a physical machine

CPU	Any combination equaling four cores of CPUs are recommended. Example one quad-core CPU; two dual-core CPUs.
RAM	4 GB RAM is required.
Storage	At least 4 GB free hard disk space on the vRanger machine.
HBA	For LAN-free, Quest recommends that you use two HBAs—one for read operations and one for writing.

vRanger: virtual machine (VM)

The following describes the hardware recommendations for using vRanger in a VM:

Table 2. Requirements for a installing vRanger on a virtual machine

CPU	Four vCPUs.
RAM	4 GB RAM is recommended.
Storage	At least 4 GB free hard disk space on the vRanger machine.

Requirements for physical backup and restore

When backing up from and restoring to a physical server, vRanger uses a client run on that server to perform backup and restore operations. To process the backup workload effectively, the physical server must meet the following requirements:

Table 3. Requirements for physical backup and restore

CPU	Any combination equaling four cores of CPUs are recommended. Example one quad-core CPU; two dual-core CPUs.
RAM	2 GB RAM is required.

Supported operating systems for installation

The following operating systems are supported for installation of vRanger.

Table 4. Supported operating systems

Operating system	Service pack level	Bit level
Windows Server 2012 ^b	All service packs	x64
Windows Server 2012 R2 ^{ba}	All service packs	x64
Windows Server 2016 ^b	All service packs	x64
Windows Server 2019 ^b	All service packs	x64
Windows Server 2022 ^b	All service packs	x64

a. Before installing vRanger on Windows Server 2012 R2, the updates listed in [Additional required software](#) must be installed.

Additional required software

In addition to a supported version of Windows[®] and a supported VMware[®] Infrastructure, you may need some additional software components, depending on your configuration.

- **Microsoft[®] .NET Framework:** vRanger requires the .NET Framework 4.5. The vRanger installer installs it if not detected.
- **SQL Server:** [Optional] vRanger utilizes two SQL Server[®] databases for application functionality. vRanger can install a local version of SQL Express 2014 SP3 or you can choose to install the vRanger databases on your own SQL instance.
- **Windows PowerShell 3 or above.** If you are installing vRanger on Windows 2008 R2 SP1, you will need to install Windows PowerShell 3 or above before installing vRanger
- **vRanger virtual appliance (VA):** The vRanger VA is a small, pre-packaged Linux[®] distribution that serves as a platform for vRanger operations away from the vRanger server. vRanger uses the VA for the following functions:

- Replication to and from VMware® ESXi™ hosts.
- File-level restore (FLR) from Linux machines.
- Optionally for backups and restores.
- **Updates for Windows Server 2012 R2:** Before installing vRanger on Windows Server 2012 R2, ensure that the Windows updates listed below are installed:
 - KB2939087
 - KB2975061
 - KB2919355
 - KB2999226

Installing vRanger

The following topic describes the high-level steps for installing vRanger. For more information, see the *Quest vRanger Installation/Upgrade Guide*.

NOTE: NetVault SmartDisk and vRanger cannot be installed on the same machine.

The installation of vRanger has several options. Unless you have a valid reason not to, accept the defaults wherever possible. The installation follows this sequence:

- 1 Launch the installer, and accept the vRanger license.

The install process does not continue until the license is accepted.
- 2 Enter the credentials under which the vRanger services should run.

The credentials used need to have local administrator privileges on the vRanger machine.
- 3 Choose an installation directory.
- 4 Select the vRanger database.

You may choose to install vRanger with a new instance of SQL Server® Express or on an existing SQL Server.
- 5 Configure the runtime credentials for the vRanger Database.
- 6 [Optional] Install the vRanger Catalog Service.

The installation completes.

Configuring vRanger

vRanger requires some basic configuration before data protection can begin. The bulk of this configuration is driven by the Startup Wizard which starts the first time the application is opened. For more information on configuring vRanger, see the *Quest vRanger Installation/Upgrade Guide*.

The following topics describe the primary configurations you need to make.

- **Add source servers:** Before you can begin backups, you must add one or more source objects to the vRanger inventory. Source objects can include VMware® vCenter® or VMware® ESXi™ hosts, Hyper-V® Clusters or hosts, or physical machines.
- **Add repositories:** Repositories are where vRanger stores the savepoints created by each backup job. For the purposes of this integration, a NetVault SmartDisk repository should be used.

The NetVault SmartDisk server must be fully configured and running before adding it as a vRanger Repository. For procedures on how to add a NetVault SmartDisk server as a repository, see [Adding a NetVault SmartDisk repository](#).

Adding a NetVault SmartDisk repository

The following process describes how to add a Quest NetVault SmartDisk repository.

To add a NetVault SmartDisk repository:

- 1 In the **My Repositories** pane, right-click anywhere, and click **Add > NetVault SmartDisk (NVSD)**.
- 2 In the **Add NVSD Repository** dialog box, complete the following fields:
 - **Repository Name:** Enter a descriptive name for the repository.
 - **Description:** [Optional] Enter a long-form description for the repository.
 - **DNS Name or IP:** Enter the IP or FQDN for the NetVault SmartDisk server.
 - **User name and Password:** Enter the credentials for the account that vRanger should use to connect to the repository.
 - **NOTE:** If you have enabled WebDav authentication on your NetVault SmartDisk server, use those credentials here. If you have not enabled WebDav authentication, no credentials are required. For more information, see the *Quest NetVault SmartDisk Administrator's Guide*.
 - **Target Directory:** This value is a logical identifier for the repository on the NetVault SmartDisk Instance, rather than a specific directory on the NetVault SmartDisk server. If you have previously created one or more repositories on the target NetVault SmartDisk Instance, the existing target directories are available in a drop-down menu.

To create a repository, enter a name for your repository.
 - **Port:** Enter the port that vRanger should use to connect to the NetVault SmartDisk server—the default is 37453.
 - **Timeout:** Enter a value that determines how long to wait before terminating an idle connection.
 - **NOTE:** Encryption is not supported for NetVault SmartDisk repositories.
- 3 Click **OK**.

The connection to the repository is tested and the repository is added to the **My Repositories** pane and the **Repository Information** dialog box.

vRanger checks the configured repository location for existing manifest data to identify existing savepoints.
- 4 If vRanger finds existing savepoints, click the applicable button:
 - **Import as Read-Only:** To import all savepoint data into the vRanger database, but only for restores, click this button. You cannot back up data to this repository.
 - **Import:** To import all savepoint data into the vRanger database, click this button. vRanger is able to use the repository for backups and restores. vRanger requires read and write access to the directory.
 - **Overwrite:** To retain the savepoint data on the disk and not import it into vRanger, click this button. vRanger ignores the existence of the existing savepoint data and treats the repository as new.

Removing a NetVault SmartDisk repository

The process for removing a NetVault SmartDisk repository is the same as removing any other repository type.

To remove a NetVault SmartDisk repository:

- 1 In the **My Repositories** pane, right-click the NetVault SmartDisk repository, and select **Remove**.
The **Remove Repository** dialog box appears, showing the savepoints in the selected repository.
When removing a repository, you have the option of keeping the savepoints on disk or deleting them.
- 2 To remove the savepoints, select **Delete all savepoints in this repository**.

! | **CAUTION:** This step deletes the savepoints from the repository disk, not just the vRanger database. Exercise caution when deleting savepoints.

- 3 If you chose to delete the savepoints, click **OK** when the **Delete Savepoints** dialog box appears.
The savepoints are deleted, along with the repository.

Checking the NetVault SmartDisk repository

Use the vRanger **My Repositories** pane to view information about the NetVault SmartDisk repositories that you have configured. Of particular importance is the amount of remaining free space and the deduplication ratio for that repository.

Installing NetVault SmartDisk

- [Installing NetVault SmartDisk: an overview](#)
- [System requirements](#)
- [Installing the NetVault SmartDisk software](#)
- [Completing the installation process](#)
- [Uninstalling NetVault SmartDisk](#)
- [Reinstalling NetVault SmartDisk](#)

Installing NetVault SmartDisk: an overview

Installing NetVault SmartDisk involves the following main steps:

- Verifying that the system requirements are in place.
- Installing the software.
- Updating the Storage Pool structure, if applicable.
- Adding the NetVault SmartDisk Devices to your backup product.
- Protecting the NetVault SmartDisk identity.
- Installing the license key.

System requirements

Before installing vRanger and NetVault SmartDisk, ensure that you read and understand the requirements and limitations of both products.

For vRanger and NetVault SmartDisk to integrate, you must use the following versions:

- vRanger Backup & Replication 7.6.5 or later
- NetVault SmartDisk 11.4.5 or later.

Software requirements

NetVault SmartDisk has the following software requirements for Windows®:

- **Microsoft Visual C++:** If it is not already installed, NetVault SmartDisk automatically installs the applicable portions of the **Microsoft Visual C++ 2005 SP1 Redistributable Package**. No additional steps are required by you.

- **System-memory requirements:** Verify that your Windows system has at least 2 gigabytes (GB) plus 400 megabytes (MB) for every terabyte (TB) of data that the Chunk Store must address.
 - If you use a 32-bit platform, you are limited to a Chunk Store of 5 TB of unique data.
 - If you use a 64-bit platform, you are limited to a Chunk Store of 15 TB of unique data.

Hardware requirements

The use of NetVault SmartDisk in a production environment is only supported when run on a physical machine.

The NetVault SmartDisk server must meet the following hardware requirements:

- **Processor requirements:** Processor requirements vary based on the required NetVault SmartDisk Deduplication Rate (the rate at which NetVault SmartDisk deduplicates data)—the higher the Deduplication Rate requirements, the higher the CPU requirements for the machine where NetVault SmartDisk software is installed. Generally, the NetVault SmartDisk machine should be equipped with two dual-core processors.

The NetVault SmartDisk Deduplication Rate must be greater than or equal to the Ingest Rate to ensure that the deduplication process completes during the backup window or before the next weekly backup window begins. For more information, see [Deduplication Rate < Ingest Rate](#).

- **Memory requirements:**

Required minimum: 2 GB

Recommended minimum: An extra 400 MB per 1 TB of NetVault SmartDisk-unique data

Example

10 TB of NetVault SmartDisk Unique Data

$2 \text{ GB} + (400 \text{ MB} * 10) = 2 \text{ GB} + 4000 \text{ MB} = \mathbf{6 \text{ GB}}$

- **Network requirement for all NetVault SmartDisk Instances:** TCP/IP name resolution. After the machine that hosts the NetVault SmartDisk software has been identified, verify that the machine can resolve its own host name.
- **Storage Pool requirements:** For Storage Pool requirements based on whether your goal is simplified management or optimal performance, see [Defining a NetVault SmartDisk Storage Pool strategy](#).

Authentication requirements

- **Administrator account for installation:** Administrator credentials are only required for use during the installation process, removal process, and, if necessary, manually restarting the NetVault SmartDisk Services.
- **NetVault SmartDisk Non-privileged Group and User:** Security group with full NetVault SmartDisk configuration and monitoring rights. You are not required to create the non-privileged user before installation. You can enter the applicable information during the installation process. The installer verifies that the account meets all applicable system requirements before continuing with the installation process.
- **UNC path and credentials if using a network share on Windows:** You can specify a path that includes a network share, whether it is mapped or using Universal Naming Convention (UNC). To do so, the parent directory of the target directory must exist—the target directory does not have to exist yet—and you must have the access credentials.

Important notes regarding Windows and the Non-Privileged User

The NetVault SmartDisk installer grants read- and write-access permission to the specified non-privileged user during the installation process. This access, which lets NetVault SmartDisk report Windows® Events, *only* applies to the Application log.

If you change the non-privileged user by using **smartdisk password**, the same rights are granted to the new user. The rights are retained for the original user because the original user might be assigned to multiple services on the same system. For the same reason, this access is also retained if you remove NetVault SmartDisk.

The modified registry key is:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ Eventlog\Application
```

Therefore, if you know that a non-privileged user is not needed for other services, manually update the registry key and user account.

Installing the NetVault SmartDisk software

Throughout this document, an ellipsis (...) represents the path to where you installed NetVault SmartDisk. Replace the ellipsis with the applicable information.

Important considerations

- If you install NetVault SmartDisk on a double-byte Windows® operating system and you do not use the default directories for installation, verify that the new directories are created using single-byte characters; installation fails if you use double-byte characters.
 - You cannot install the NetVault SmartDisk binaries—installation files—on a Network File System (NFS) share.
 - During installation, you are prompted for two volume paths, which must be different. One volume contains the **Staging Store**, and the other contains the **Chunk Index**, **Chunk Store**, and **Content Index**. You can specify any supported file system that is listed in the *Quest NetVault Backup Compatibility Guide* available at <https://support.quest.com>. However, if you intend to use a third-party deduplication appliance, filer, or other form of network-attached storage (NAS) for the NetVault SmartDisk Storage Pools, you must use the network share for the appliance that is exported through Common Internet File System (CIFS) or NFS as the target for the **Staging Store**. You can specify one network share for each path during installation; if you need additional shares for the Storage Pools, you can add them after installation is finished. You can specify one network share for each path during installation; if you need additional shares for the Storage Pools, you can add them after installation is finished. For more information, see [Completing the installation process](#).
- i** | **NOTE:** The Staging Path and Store Path must point to different target directories, for example, **\\Server\share\Stage** and **\\Server\share\Store**. For best performance, they should be on different physical storage devices.
- If installation is interrupted or fails for any reason, for example, due to a power outage, remove the product before attempting to install it again. Manually delete the NetVault SmartDisk-related directory and its contents.

Installing on Windows

- 1 Verify that you have reviewed the authentication requirements and all other critical information.
For more information, see [Authentication requirements](#) and [Important considerations](#).
- 2 Log in as an administrator.
- 3 If you are using the downloaded package, decompress the downloaded file, and navigate to the NetVault SmartDisk directory in which the decompressed files reside.
- 4 To start the installation wizard, double-click the **install.exe** file.
- 5 When the **Installation Language** dialog box appears, select the applicable language, and click **OK**.
- 6 When the **Welcome** dialog box appears, click **Next**.
- 7 When the **License Agreement** dialog box appears, review the license agreement, select **I Agree**, and click **Next**.

i | **NOTE:** Quest requires that you thoroughly review the license agreement before proceeding with the installation.

- 8 In the **Non-Privileged User** dialog box, enter the name and password of the non-privileged user account that you want to use for NetVault SmartDisk (if the account does not exist, the installer creates it for you), the Windows® Domain, if applicable, and click **Next**.

The installer verifies that the specified account meets all applicable system requirements—based on your organization’s policies—before continuing with the installation process. If the requirements are not met, the installer cancels the installation process before installing any NetVault SmartDisk components.

- 9 If the user account that you entered in the previous step does not exist, select **Yes**, and click **Next** when the **Preinstall Warnings** dialog box appears.
- 10 In the **Select Installation Folder** dialog box, change the path if you do not want to use the default.

To use a different directory, type the path in the **Folder** box, or click **Browse** to point to the new location.

To see how much space NetVault SmartDisk requires for the selected installation directory and files, click **Disk Cost**, review the information on the **SmartDisk Disk Space** dialog box, and then click **OK**. The Disk Cost information is calculated only for the NetVault SmartDisk software binaries. It does not include the disk space required for the **Staging Store** or **Chunk Store**. To determine the disk space required for the **Staging Store** or **Chunk Store**, see [Determining the required disk space for NetVault SmartDisk Instances](#).

- 11 Click **Next**.
- 12 In the **Select Staging Path Folder** dialog box, indicate whether you want use a Remote or Local directory, and then click **Next**.

i | **NOTE:** After installation is finished, you can add additional volumes. For more information, see [Updating the Storage Pool directory structure](#).

- 13 Do one of the following:

- If you selected Remote—the default is Local—on the **Select Remote Staging Path Folder** dialog box, specify the path for the **Staging Store**; use the `\\server\share` format. Enter the user name and corresponding password required to access the remote path, and then click **Next**.

i | **CAUTION:** The Staging Path and Store Path must point to different target directories, for example, `\\Server\share\Stage` and `\\Server\share\Store`. For best performance, they should be on different physical storage devices.

- If you selected Local, on the **Select Staging Path Folder** dialog box, specify the file-system path for the **Staging Store**, and then click **Next**.

- 14 In the **Store Path Folder Configuration** dialog box, indicate whether you want to use a **Remote** or **Local** directory, and then click **Next**.

i | **NOTE:** After installation is finished, you can add additional volumes. For more information, see [Updating the Storage Pool directory structure](#).

15 Do one of the following:

- If you selected Remote—the default is Local—on the **Select Remote Store Path Folder** dialog box, specify the path for the **Chunk Store**; use the `\\server\share` format. Enter the user name and corresponding password required to access the remote path, and then click **Next**.

! | **CAUTION:** The Staging Path and Store Path must point to different target directories, for example, `\\Server\share\Stage` and `\\Server\share\Store`. For best performance, they should be on different physical storage devices.

- If you selected Local, on the **Select Store Path Folder** dialog box, specify the file-system path for the **Chunk Store**, and then click **Next**.

16 In the **WebDAV Authentication Configuration** dialog box, select **Yes** to enable WebDAV authentication, and click **Next**.

i | **IMPORTANT:** This feature is required for vRanger.

17 In the **WebDAV Authentication Credentials** dialog box, enter the user name and password for the WebDAV account, and click **Next**.

To update these credentials later, see [Enabling or updating authentication for WebDAV access](#).

i | **NOTE:** These credentials are the ones that you use when configuring this NetVault SmartDisk Instance as a vRanger repository. There are no restrictions for the corresponding password.

18 When the **Confirm Installation** dialog box appears, click **Next**.

19 When the **Installation Complete** dialog box appears, click **Close**.

If necessary, NetVault SmartDisk automatically installs the supporting Microsoft Visual C++ files into the Global Assembly Cache. If these files are currently in use by a different application, the installer prompts you to restart the system. This behavior is standard Windows behavior.

Completing the installation process

- [Installing a license key](#)
- [Updating the Storage Pool directory structure](#)
- [Protecting the NetVault SmartDisk unique identity](#)

Installing a license key

- 1 Log in as an administrator.
- 2 Open a command prompt by clicking **Start > Programs Accessories > Command Prompt**.
- 3 In the **Command Prompt** window, change to the bin directory in the NetVault SmartDisk directory:

```
cd ...foundation\bin
```

- 4 Enter the license key.

For example:

```
smartdisk.bat license -t XX-XXXXX-XXXX-XXXXX
```

i | **NOTE:** To avoid potential errors, Quest recommends that you use copy-and-paste functionality to copy the license key from the email to the command prompt.

The system displays the following message:

```
License installed successfully
```

Updating the Storage Pool directory structure

During the installation of the NetVault SmartDisk software, you specified a directory for the Staging Path and the Store Path. Currently, the following NetVault SmartDisk components are installed in each of the directories that you specified:

- Staging Path (folder)
 - Staging Store
- Store Path (folder)
 - Chunk Index
 - Content Index
 - Chunk Store

The preceding list identifies the default structure. If your NetVault SmartDisk Storage Pool Strategy requires a different structure, update it **before** you add NetVault SmartDisk as a device to your backup product. Examples of other structures that you might use include a third-party deduplication appliance, filer, or other NAS that is mapped or accessible through UNC. You might also want to implement an optimal performance strategy for your NetVault SmartDisk Storage Pools, which might require a different structure.

For more information, see [Defining a NetVault SmartDisk Storage Pool strategy](#)

Protecting the NetVault SmartDisk unique identity

Each NetVault SmartDisk installation of the software binaries creates a unique identity that is referenced in the NetVault SmartDisk Content Index and your backup product. The NetVault SmartDisk unique identity is required in cases where the NetVault SmartDisk software binaries are reinstalled while retaining the data stored in the NetVault SmartDisk Storage Pools. For more information, see [Reinstalling NetVault SmartDisk](#).

To ensure that you can reinstall the NetVault SmartDisk software binaries while retaining the data stored in the NetVault SmartDisk Storage Pools, protect the NetVault SmartDisk unique identity by backing up the following configuration file:

```
...\diskmanager\etc\identity.cfg
```

Uninstalling NetVault SmartDisk

- [Preserving data before removing NetVault SmartDisk](#)
- [Removing NetVault SmartDisk](#)

Preserving data before removing NetVault SmartDisk

When you remove NetVault SmartDisk, the data in the **Staging Store** and the **Chunk Store** is retained after removal of the NetVault SmartDisk software binaries.

If you specified a different file-system path during installation, that is, you did not use the defaults, the data in the **Staging Store** and the **Chunk Store** is retained after removal of the NetVault SmartDisk software binaries.

Removing NetVault SmartDisk

- 1 Access **Control Panel > Add or Remove Programs**.
- 2 In the **Currently installed programs** list, select **NetVault SmartDisk**, and click **Remove**.
- 3 When the confirmation message appears, click **Yes**.
- 4 After the program is removed, delete the directory where NetVault SmartDisk was installed.

Reinstalling NetVault SmartDisk

- [Reinstalling NetVault SmartDisk: an overview](#)
- [Prerequisites for reinstalling NetVault SmartDisk](#)
- [Reinstalling NetVault SmartDisk if identity.cfg is available](#)
- [Reinstalling NetVault SmartDisk if identity.cfg is not available](#)

Reinstalling NetVault SmartDisk: an overview

In a standard NetVault SmartDisk installation, the NetVault SmartDisk software binaries are installed on a volume that is separate from the NetVault SmartDisk Storage Pools. Reinstalling the NetVault SmartDisk software binaries is required in one of the following scenarios:

- NetVault SmartDisk is inoperable because a media failure occurred on the volume where the NetVault SmartDisk software binaries are installed.
- The operating system of the machine where the NetVault SmartDisk Instance is running has become corrupted.
- NetVault SmartDisk was removed. During the uninstall, the software binaries were removed, but the data stored in the NetVault SmartDisk Storage Pools was left intact.

In the preceding scenarios, the data in the NetVault SmartDisk Storage Pools is still intact and can be used by a new installation of the NetVault SmartDisk software binaries. Each NetVault SmartDisk installation of the software binaries creates a unique identity that is referenced in the NetVault SmartDisk Content Index and your backup product; therefore, it is critical that you use the following procedures to ensure that the **new** NetVault SmartDisk installation of the software binaries points to the **original** NetVault SmartDisk Storage Pools. **Failure to follow these steps renders NetVault SmartDisk unable to read or restore from the original NetVault SmartDisk Storage Pools.**

Prerequisites for reinstalling NetVault SmartDisk

Ensure that the following prerequisites are met before reinstalling the NetVault SmartDisk software binaries.

- All the original Storage Pool directories, which include the directories for the Content Index, Staging Store, Chunk Index, and Chunk Store, are available in their entirety and are not corrupted.
- All the original Storage Pool directories have been moved or copied to a different directory by using operating-system commands.
- All the original Storage Pool directories, which are now empty, are available for the new NetVault SmartDisk software binary installation and there is sufficient available disk space to store all the data that originally resided in these directories.
- The original **identity.cfg** configuration file is available. This file is located in the following directory:
...**\diskmanager\etc**
- The same version of the NetVault SmartDisk software is installed that was running on the original NetVault SmartDisk installation.

Reinstalling NetVault SmartDisk if identity.cfg is available

If the original **identity.cfg** configuration file is available, reinstall the NetVault SmartDisk software binaries by performing the following steps:

- 1 Ensure that the NetVault SmartDisk non-privileged user account has full access to the original NetVault SmartDisk Storage Pool directories.

For more information, see [Authentication requirements](#).

- 2 Install the same version of the NetVault SmartDisk software that was originally running.

During installation, enter the *original* values for the following options:

- **Non-privileged User Account**
- **Staging Path Folder or Staging Store Directory**
- **Store Path Folder or Chunk Store Directory**

For more information, see [Installing the NetVault SmartDisk software](#).

- 3 Update the NetVault SmartDisk Configuration to ensure that the directory structure for the Content Index, Staging Store, Chunk Index, and Chunk Store matches the original NetVault SmartDisk installation.

For more information, see [Updating the Storage Pool directory structure](#).

- 4 Stop the NetVault SmartDisk Services.

For more information, see [Stopping NetVault SmartDisk Services](#).

- 5 Replace the **identity.cfg** file with the original file.

This file is located in the following directory:

...**\diskmanager\etc**

- 6 Use operating-system commands to copy the contents of the original Storage Pool directories, which were moved to a different directory, back to the original corresponding directories.

- 7 Start the NetVault SmartDisk Services.

For more information, see [Starting NetVault SmartDisk Services](#).

Reinstalling NetVault SmartDisk if identity.cfg is not available

If the original **identity.cfg** configuration file is not available, reinstall the NetVault SmartDisk software binaries by performing the following steps:

- 1 Ensure that the NetVault SmartDisk non-privileged user account has full access to the original NetVault SmartDisk Storage Pool directories.

For more information, see [Authentication requirements](#).

- 2 Install the same version of the NetVault SmartDisk software that was originally running.

During installation, enter the original values for the following options:

- **Non-privileged User Account**
- **Staging Path Folder or Staging Store Directory**
- **Store Path Folder or Chunk Store Directory**

For more information, see [Authentication requirements](#).

- 3 Update the NetVault SmartDisk Configuration to ensure that the directory structure for the Content Index, Staging Store, Chunk Index, and Chunk Store matches the original NetVault SmartDisk installation.

For more information, see [Updating the Storage Pool directory structure](#).

- 4 Stop the NetVault SmartDisk Services.

For more information, see [Stopping NetVault SmartDisk Services](#).

- 5 Use operating-system commands to copy the contents of the original Storage Pool directories, which were moved to a different directory, back to the original corresponding directories.

- 6 Start the NetVault SmartDisk Services.

For more information, see [Starting NetVault SmartDisk Services](#).

Configuring NetVault SmartDisk

- [Configuring NetVault SmartDisk ports for communication with your software](#)
- [NetVault SmartDisk CLI: an overview](#)
- [Processing basic shell commands](#)
- [Configuring NetVault SmartDisk by using the command line](#)
- [Using the config command options](#)
- [Extending NetVault SmartDisk Storage Pools](#)
- [Examples](#)

Configuring NetVault SmartDisk ports for communication with your software

By default, NetVault SmartDisk uses port **37453** to communicate with vRanger instances that are streaming data to the NetVault SmartDisk Device. It also uses port **37451** for Inter Process Communication (IPC) on the loopback interface, but not for remote connections.

i | **NOTE:** If you intend to use different ports, Quest recommends that you make the applicable change to the port setting on the NetVault SmartDisk Instance before you add the NetVault SmartDisk repository to vRanger. You can update the port that communicates with your software at any time.

Modifying the data port

If you want to use a different port to communicate with the vRanger instances, complete the following steps.

i | **NOTE:** Throughout this documentation, the path to where you installed NetVault SmartDisk is represented by an ellipsis (...). Replace the ellipsis with the applicable information.

i | **IMPORTANT:** You cannot add a port that exists. If you try to add an existing port, you see a “Failed to apply configuration” message. Before attempting to add a port, use the config --show command option to view existing information.

- 1 Open a command prompt, and type:

```
...\foundation\bin\smartdisk.bat config
```

NetVault SmartDisk displays the list of options and parameters that you can use, including the sections for configuring the ports:

```
config --add|--update --webdav <port> [--block-size <bytes>]
  [--preferred-address <address>] [--credentials]
```

You can use **--block-size** to define the block size used to read and write blocks when streaming data to the **Staging Store**. You can use **--preferred-address** to define the primary IP address that clients should use

when communicating with the NetVault SmartDisk Device. You can use **--credentials** to enable authentication and define the authorized user and password.

- 2 If you are modifying port information, complete any of the following:

- To add a port, type:

```
...\foundation\bin\smartdisk.bat config --add --webdav <port#>
```

Replace **<port#>** with the port that you want to use.

- To remove the original port, the following uses the default, type:

```
...\foundation\bin\smartdisk.bat config --delete --webdav 37453
```

- 3 To verify that the new port has been added and the original has been removed, type:

```
...\foundation\bin\smartdisk.bat config --show
```

NetVault SmartDisk displays results similar to the following example:

```
[Interface:Data]
Block Size = <blockSize>
Credentials = <Name:MaskedPassword>
Port = <NewPort#, NewPort#>
Type = WebDAV
```

Enabling or updating authentication for WebDAV access

If you want to enable authentication for WebDAV access of NetVault SmartDisk for the data port, complete the following steps to specify the credentials. NetVault SmartDisk uses digest-access authentication, specifically RFC 2069. You can also use this same procedure to update existing credentials.

- i** | **NOTE:** For the user name in the WebDAV credentials, NetVault SmartDisk currently supports the use of any ASCII characters except the quotation mark ("), comma (,), and colon (:). There are no restrictions for the corresponding password.

- 1 Open a command prompt, and type:

```
...\foundation\bin\smartdisk.bat config
```

NetVault SmartDisk displays the list of options and parameters that you can use, including the section for configuring authentication:

```
config --add|--update --webdav <port> [--block-size <bytes>]
  [--preferred-address <address>] [--credentials]
```

- 2 To define the credentials, type:

```
...\foundation\bin\smartdisk.bat config --update --webdav <port#> --credentials
```

Replace **<port#>** with the port that you are using.

- 3 When the **Username** prompt appears, enter the user name that should be used for access, and press **Enter**.

- 4 When the **Password** prompt appears, enter the password associated with the specified user name, press **Enter**, enter the password again when the **Confirm Password** prompt appears, and press **Enter** again.

NetVault SmartDisk displays results similar to the following example:

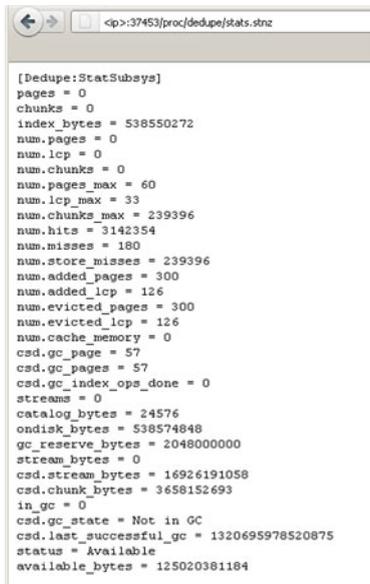
```
./smartdisk.bat config --update --webdav 37453 --credentials
Username: NetVaultSmartDiskuser
Password:
Confirm Password:
Configuration applied
```

- 5 In your backup software, configure the same credentials for backups and restores to the NetVault SmartDisk Instance.

Verifying that the client ports are open

Quest recommends that you verify that the ports are open between the vRanger machine and the NetVault SmartDisk server.

To verify that the ports are open, you can use a web browser or another method of your choice. If the port is open, the command returns the status information for the NetVault SmartDisk server. If the port is not open, you receive a connection error from your browser.



```
[Dedupe:StatSubsys]
pages = 0
chunks = 0
index_bytes = 538550272
num.pages = 0
num.lcp = 0
num.chunks = 0
num.pages_max = 60
num.lcp_max = 33
num.chunks_max = 239396
num.hits = 3142354
num.misses = 180
num.store_misses = 239396
num.added_pages = 300
num.added_lcp = 126
num.evicted_pages = 300
num.evicted_lcp = 126
num.cache_memory = 0
csd.gc_page = 57
csd.gc_pages = 57
csd.gc_index_ops_done = 0
streams = 0
catalog_bytes = 24576
ondisk_bytes = 538574848
gc_reserve_bytes = 2048000000
stream_bytes = 0
csd.stream_bytes = 16926191058
csd.chunk_bytes = 3658152693
in_gc = 0
csd.gc_state = Not in GC
csd.last_successful_gc = 1320695978520875
status = Available
available_bytes = 125020381184
```

In the following examples, replace **<port#>** with the applicable port number, and replace **<hostName>** with the IP address of the machine on which NetVault SmartDisk is installed.

To use a web browser:

- 1 On the system on which NetVault SmartDisk is installed, type:
`http://<localhost>:<port#>/proc/dedupe/stats.stnz`
- 2 On the system on which the backup server or client software is installed, type:
`http://<hostName>:<port#>/proc/dedupe/stats.stnz`

NetVault SmartDisk CLI: an overview

Configuration and administration of NetVault SmartDisk is handled primarily through the NetVault SmartDisk CLI. You can perform basic functions such as configuring, monitoring, starting, and stopping NetVault SmartDisk.

The basic structure is:

```
...\foundation\bin\smartdisk.bat <command>
```

i | **IMPORTANT:** If you are using NetVault SmartDisk on Windows® Vista, or Windows 7, use a **Run as Administrator** command prompt to run the CLI commands. If you use a standard command prompt, you might receive an **Access Denied** message, even if you have administrator privileges.

To use a Run as Administrator command prompt:

- 1 Click **Start > Run**.
- 2 In the **Run** dialog box, type **cmd**, and press **Ctrl+Shift+Enter**.
- 3 If you receive a confirmation prompt, click **Continue**.

The **Administrator Command Prompt** appears.

Accessing command help

- 1 Open a command prompt.
- 2 Type:

```
...\foundation\bin\smartdisk.bat help
```

NetVault SmartDisk displays a list of the available options and an explanation of how to use them.

Processing basic shell commands

The following table lists all the commands in alphabetical order.

Table 1. Available commands

Command	Description
config	Displays and modifies the NetVault SmartDisk configuration. For more information, see Using the config command options .
dump	Places a copy of all relevant files into a compressed file. For more information, see Dumping NetVault SmartDisk-related information to a compressed file .
help	Displays a complete list of the NetVault SmartDisk commands supported on the NetVault SmartDisk platform.
license	Installs a license key. For more information, see Installing a license key .
logs	Displays the NetVault SmartDisk logs, which are used for diagnosis.
password	Lets you change the name or password, or both, of the non-privileged user that was stored when you originally installed NetVault SmartDisk. If you change the non-privileged user name or password after installation, use this command to change it in NetVault SmartDisk as well. NOTE: <ul style="list-style-type: none">• Before changing a user name, you must stop the NetVault SmartDisk Services.• Changing the non-privileged user affects the number of people who have read- and write-access to the Windows® Application log. For more information, see Authentication requirements. The password is case-sensitive.
restart	Stops and restarts the NetVault SmartDisk Services. Must be run by an Administrator User.
start	Starts the NetVault SmartDisk Services. Must be run by an Administrator User.
stats	Displays NetVault SmartDisk statistics that you can use to monitor NetVault SmartDisk performance. For more information, see Viewing NetVault SmartDisk statistics .
status	Indicates whether the NetVault SmartDisk Services are running.
stop	Stops the NetVault SmartDisk Services.
version	Displays the current version of NetVault SmartDisk that is installed.

Determining the status of NetVault SmartDisk Services

1 Open a command prompt.

2 Type:

```
...\foundation\bin\smartdisk.bat status
```

If NetVault SmartDisk services are running, NetVault SmartDisk displays:

```
Percolator slave is listening
```

If NetVault SmartDisk Services are not running, NetVault SmartDisk displays:

```
Failed to connect to percolator slave
```

Starting NetVault SmartDisk Services

1 Open a command prompt.

2 Type:

```
...\foundation\bin\smartdisk.bat start
```

NetVault SmartDisk starts the NetVault SmartDisk Services.

```
Services started ok.
```

i | **NOTE:** You can also start the NetVault SmartDisk Services by clicking Start > Settings > Control Panel > Administrative Tools > Services and starting Foundation Services ID <NetVaultSmartDiskInstanceID>.

Stopping NetVault SmartDisk Services

1 Open a command prompt.

2 Type:

```
...\foundation\bin\smartdisk.bat stop
```

NetVault SmartDisk stops the NetVault SmartDisk Services. You might see the following message.

```
Services stopped ok.
```

i | **NOTE:** You can also stop the NetVault SmartDisk Services by clicking Start > Settings > Control Panel > Administrative Tools > Services and stopping Foundation Services ID <NetVaultSmartDiskInstanceID>.

Restarting NetVault SmartDisk Services

To stop and start the NetVault SmartDisk Services automatically, complete the following steps:

1 Open a command prompt.

2 Type:

```
...\foundation\bin\smartdisk.bat restart
```

NetVault SmartDisk stops and restarts the NetVault SmartDisk Services.

```
Services stopped ok.
```

```
.
```

```
Services started ok.
```

Viewing NetVault SmartDisk Log files

1 Open a command prompt.

2 Type:

```
...\foundation\bin\smartdisk.bat logs
```

NetVault SmartDisk displays the NetVault SmartDisk Logs and all relevant information. When you run **logs** without any options, it displays all NetVault SmartDisk log entries.

3 To display specific information, use one of the following options:

Logs option	Description
<code>--file <pathToFile></code>	Displays the contents of the specified file.
<code>--help</code>	Displays a list of the available options and an explanation of how to use them.
<code>--last-hours <x></code>	Displays the records for the specified number of hours.
<code>--time-interval <yyyy-mm-dd-hhmmss yyyy-mm-dd-hhmmss></code>	Displays the records for the specified time frame.

You can also view logs by using the Windows® **Event Viewer**.

Configuring NetVault SmartDisk by using the command line

You can use the NetVault SmartDisk CLI **config** command to perform tasks such as:

- Enabling deduplication.
- Enabling deduplication compression.
- Configuring the deduplication window.
- Configuring Garbage Collection.
- Extending NetVault SmartDisk Storage Pools by adding additional volumes.

Using the config command options

Before using the NetVault SmartDisk CLI **config** command, note the following:

- All times are displayed in the local time for the machine where the NetVault SmartDisk Instance is installed.
- With the **--volume** and **--pool** options, the *<path>* and *<label>* strings are case-sensitive because they identify a specific NetVault SmartDisk Storage Pool or Volume.
- If a configuration-related command fails and displays a message similar to “Failed to apply configuration,” Quest recommends that you use the **config** command with the **--show** option to display the current configuration. After displaying the configuration, double-check the case of the specified NetVault SmartDisk Storage Pool or Volume to ensure that the strings reflect the case-sensitivity.
- The NetVault SmartDisk Services must be running before you can use the **config** command and most of the options. To view the options that are available, you can use the **--help** option while NetVault SmartDisk Services are offline.

The NetVault SmartDisk CLI **config** command supports the following options:

Table 2. Available options

Config option	Description
<code>--help</code>	Displays a list of the config command options and their syntax.
<code>--show</code>	Displays the current values for the NetVault SmartDisk configuration.
<code>--dedupe-enable</code> <TRUE FALSE>	Enables or disables NetVault SmartDisk Deduplication.
<code>--dedupe-compression</code> <TRUE FALSE>	Enables or disables compression of NetVault SmartDisk-unique chunks. Disabled by default, compressing unique chunks can reduce their storage footprint up to 50%. Compression is performed on the unique chunks that result from the deduplication process. Compressing the initial Full Backup for a data set might take longer than not compressing the unique data because most of the data is considered unique. Subsequent Full Backups have fewer unique chunks and do not experience an increase in the amount of time it takes to complete the deduplication and compression process.
<code>--add --delete --dedupe-window</code> <[Sun Mon Tue Wed Thu Fri Sat-]HH:MM- HH:MM> <Never Anytime>	Sets the NetVault SmartDisk Deduplication Window by specifying the times that deduplication can be performed. By default, the default deduplication window is set to Anytime. Available parameters include: <ul style="list-style-type: none"> • Days of Week: Specifies the days of the week on which the deduplication process runs. You can schedule it to run on multiple days, such as Monday, Wednesday, and Friday. • HH:MM-HH:MM: Using a 24-hour clock, specifies the times of day at which the deduplication process runs. • Never: Disables the deduplication window. Backups enabled for deduplication remain in the Staging Store in a non-deduplicated state until the deduplication window is enabled. • Anytime: Enables the deduplication process to be run at any time. Deduplication for a backup data stream begins after the initial 400 GB has been written to the Staging Store, which can provide nearly inline deduplication performance.
<code>--add --delete --gc-window</code> <[Sun Mon Tue Wed Thu Fri Sat-]HH:MM- HH:MM> <Never Anytime>	Sets the Garbage Collection window by specifying the times that NetVault SmartDisk Garbage Collection has priority over deduplication. By default, the Garbage Collection window is set to 13:00 through 19:00 on Mondays through Thursdays. Available parameters include: <ul style="list-style-type: none"> • Days of Week: Specifies the days of the week on which the Garbage Collection process runs. You can schedule it to run on multiple days, such as Monday, Wednesday, and Friday. • HH:MM-HH:MM: Using a 24-hour clock, specifies the times of day at which the Garbage Collection process runs. • Never: Disables the Garbage Collection window. • Anytime: Enables the Garbage Collection process to be run at any time.
<code>--dedupe-active-limit</code> <Unlimited limit>	Specifies the maximum number of segments that can be deduplicated simultaneously.
<code>--network-capacity</code> <MBps>	Specifies the capacity, in megabytes per second (MBps), of the network between the NetVault SmartDisk Device and the backup clients.
<code>--stream-limit</code> <limit>	Specifies the number of data streams that can be processed simultaneously.
<code>--add --update --volume</code> <path> [Parameters]	Extends NetVault SmartDisk Storage Pools by adding or updating existing volumes in the NetVault SmartDisk Storage Pools. For more information, see Extending NetVault SmartDisk Storage Pools .

Table 2. Available options

Config option	Description
<code>--add --update --webdav <port> [--block-size <bytes>] [--credentials] [--preferred-address <address>]</code>	Modifies the port that the NetVault SmartDisk Device uses to communicate with vRanger. For more information, see Modifying the data port .
<code>--delete --webdav <port> [--credentials]</code>	Used with <code>--add</code> , modifies the port that the NetVault SmartDisk Device uses to communicate with vRanger. For more information, see Modifying the data port .
<code>--update --remote-port <port></code>	Modifies the port that the NetVault SmartDisk Device uses to communicate with the backup software. For more information, see Modifying the data port .
<code>--write-md5 <Always Never BasedOnHTTPHeader></code>	Indicates when to calculate MD5 checksum for data streams written to NetVault SmartDisk.

Extending NetVault SmartDisk Storage Pools

You can extend NetVault SmartDisk physical capacity by adding or updating the volumes specified for the NetVault SmartDisk Storage Pools. Use the **config --add|--update --volume <path>** command to extend the NetVault SmartDisk physical capacity. You can also use the following additional parameters:

- NOTE:** The NetVault SmartDisk Non-privileged User must have access to any volumes that are added to ensure that configuration changes are successfully applied.

Table 3. Available parameters

Config volume parameters	Description
<code>--volume <path></code>	Specifies the path for the file-system path of the volume to be used as a NetVault SmartDisk Storage Pool. You can specify local drives or Universal Naming Convention (UNC) paths for CIFS, NFS, and Storage Area Network (SAN). If the volume is on a mounted file system, verify that the specified path is a valid subdirectory on the mounted file system, and not the mounted directory itself. This step ensures that data is not written to the local directory if the mounted location is unavailable.
<code>[--volume-size <%>]</code>	Specifies the percentage of the volume that NetVault SmartDisk <i>can</i> use; the remainder <i>cannot</i> be used by NetVault SmartDisk. The value of $((100 - X) / 100) * (\text{total volume size})$ is added to the Last Resort Threshold (LRT) . In addition, a small amount of storage is reserved to complete Garbage Collection. These three components of reserved storage determine the total storage set aside that cannot be directly used by NetVault SmartDisk. For example, if volume-size is set to 30 and the volume's size is 100 GB, 70 GB is set aside—in addition to the LRT and Garbage Collection reserve space—and cannot be used by NetVault SmartDisk.
<code>[--dedupe-cap <Unlimited cap>]</code>	Specifies the maximum number of backup segments for the specific volume that can be deduplicated simultaneously. Defaults to 4.
<code>[--pool <label>]</code>	Specifies the Label assigned to the Storage Pool. Defaults to a system-generated numeric label. Specify an existing Storage Pool label to add the volume to an existing Storage Pool, or specify a new name to create a Storage Pool.

Table 3. Available parameters

Config volume parameters	Description
<code>[--reservation-size <bytes>]</code>	Specifies the number of bytes reserved by the processes streaming data into NetVault SmartDisk. A smaller size results in NetVault SmartDisk having to reserve space more frequently; a larger size renders more disk space temporarily unavailable. If the Space.Available —reported through the show option—is less than the reservation-size , the volume is considered FULL.
<code>[--favour <Staging Storage "Chunk Index" "Disk Index" All None>]...</code>	Specifies which Storage Pool Roles the volume is available to perform. To specify multiple roles, list the --favour parameter multiple times. For example: <code>--favour Staging --favour "Disk Index"</code> Use with --deny to dedicate a volume to one or more roles.
<code>[--deny <Staging Storage "Chunk Index" "Disk Index" All None>]...</code>	Specifies which Storage Pool Roles the volume is not available to perform. To specify multiple roles, list the --deny parameter multiple times. For example: <code>--deny Storage --favour "Chunk Index"</code> Use with --favour to dedicate a volume to one or more roles. NOTE: After NetVault SmartDisk uses a volume as a Chunk Index or Content Index, that is, data has been staged or stored, NetVault SmartDisk continues to use the volume for this purpose, even if this parameter is used to deny it.
<code>[--balancing <Space Activity None>]</code>	Instructs NetVault SmartDisk to use the volume with either the most space available or the least activity occurring. If used with --favour and --deny , --balancing is applied last. NOTE: The --balancing parameter provides guidance to NetVault SmartDisk; the NetVault SmartDisk Disk Manager and Deduplicator make the final decision about how to allocate space.
<code>[--account <UNC-path-account>]</code>	Required for Windows® platform when specifying UNC paths. Specifies the user account with read and write permissions to the UNC path.
<code>[--password <UNC-path-password>]</code>	Required for Windows platform when specifying UNC paths. Specifies the password for the user account with read and write permissions to the UNC path. This password is case-sensitive.

Examples

- To add a volume that is used for all roles, enter the following command:

```
... \foundation\bin\smartdisk.bat config --add --volume \mnt
    \<newNetVaultSmartDiskVolume>
```

The NetVault SmartDisk configuration is updated.

Configuration applied

- To add a volume dedicated to the **Chunk Store**, enter the following command:

```
... \foundation\bin\smartdisk.bat config --add --volume
    c:\SDStoragePools2\Store --favour Storage --deny Staging
    --deny "Chunk Index" --deny "Disk Index"
```

The NetVault SmartDisk configuration is updated.

Configuration applied

- To add a CIFS share, enter the following command:

```
...\foundation\bin\smartdisk.bat config --add --volume
  \\<IPAddress>\<NetVaultSmartDiskVolume> --account <nonprivilegedUser>
  --password <nonprivilegedUserPassword>
```

The NetVault SmartDisk configuration is updated.

- To review the NetVault SmartDisk configuration, enter the following command:

```
...\foundation\bin\smartdisk.bat config --show
```

The NetVault SmartDisk configuration is displayed, including the following details on the Storage Pool volumes:

```
[SmartDisk:Volume]
Storage Pool = Store
Location = c:\SDStoragePools2\Store
Disk Manager Index = TRUE
Space.Limit = 100, %
Space.Reservation Size = 1073741824, B
Favour = Storage, Chunk Index, Disk Index
Deny = Staging
Balancing = Activity
Space.OS.Available = 17928032256, B
Space.Available = 15175759872, B
Space.Staging.Status = Not Configured
Space.Staging.Available = 0, B
Space.Staging.Reserved = 0, B
Space.Last Resort = 2752272384, B
Data.Staged = 0, B
Deduplication Activity Cap = 4
Active Operations = 0
```

```
[SmartDisk:Volume]
Storage Pool = Staging Pool
Location = c:\SDStoragePools2\Stage
Disk Manager Index = FALSE
Space.Limit = 100, %
Space.Reservation Size = 1073741824, B
Favour = Staging
Deny = Storage, Chunk Index, Disk Index
Balancing = Activity
Space.OS.Available = 3681370112, B
Space.Available = 2607628288, B
Space.Staging.Status = Available
Space.Staging.Available = 2607628288, B
Space.Staging.Reserved = 0, B
Space.Last Resort = 1073741824, B
Data.Staged = 0, B
Deduplication Activity Cap = 4
Active Operations = 0
```

Monitoring NetVault SmartDisk

- [NetVault SmartDisk performance monitoring: an overview](#)
- [Viewing NetVault SmartDisk statistics](#)
- [Calculating the Deduplication Ratio](#)
- [Calculating the reduction in the storage footprint](#)

NetVault SmartDisk performance monitoring: an overview

NetVault SmartDisk lets you monitor its performance and to calculate the following statistics:

- Deduplication Ratio
- Disk Space Savings

Viewing NetVault SmartDisk statistics

You can view NetVault SmartDisk statistics from a terminal session, command prompt, or browser.

Viewing NetVault SmartDisk statistics in a terminal session or command prompt

- 1 Open a command prompt.
- 2 Type:

```
...\foundation\bin\smartdisk.bat stats
```

NetVault SmartDisk displays the statistics described under [Reviewing the list of NetVault SmartDisk statistics](#).

Viewing NetVault SmartDisk statistics in a browser

i | **NOTE:** Quest recommends that you use one of the following browsers when viewing NetVault SmartDisk statistics: Mozilla®, Safari, or Konqueror. Truncation might occur with Internet Explorer® because it ignores line feeds.

In a browser, enter the following URL:

http://<NetVaultSmartDisk_Instance_Hostname>:<Backup_Software_Client_Port>/proc/stats.stnz

For example: <http://10.1.0.0:37453/proc/stats.stnz>

NetVault SmartDisk displays the statistics in XML format in the browser. For a description of the statistics, see [Reviewing the list of NetVault SmartDisk statistics](#).

Reviewing the list of NetVault SmartDisk statistics

When reviewing the following list of statistics, a backup job is divided into a minimum of two segments: Segments contain either data or metadata and are smaller than 400 GB. For example, if the backup data stream is 1200 GB, the backup job has three data segments. One NetVault SmartDisk element is equivalent to one backup segment.

i | **NOTE:** The status of the **Chunk Store Daemon (CSD)** affects the list of statistics displayed for the Dedupe:StatusSubsys segment.

Table 1. Statistics

Stat entry	Description
[SmartDisk:Deduplication Scheduler]	Statistics for the process that schedules deduplication activity.
Elements.Queued = <No.>	Number of segments awaiting deduplication.
Data.Queued = <No.>, B	Number of bytes awaiting deduplication.
Elements.Deduplicating = <No.>	Number of elements or backup segments currently deduplicating.
Data.Deduplicating = <No.>, B	Total size of elements or backup segments currently deduplicating. After all current deduplication completes, the equivalent amount of data is removed from the Staging Store .
GC Active = FALSE	Indicates whether Garbage Collection is active.
Deduplication Available = TRUE	Displays TRUE or FALSE depending on whether the CSD is available for deduplication tasks.
Deduplication Enabled = TRUE	Displays TRUE or FALSE depending on whether the data-deduplication option is licensed and enabled.
[SmartDisk:RAS Controller]	Statistics for the process that interacts with your backup software.
Availability Score = <No.>	Indicates how available a backup server should consider this NetVault SmartDisk Device to be. The lower the number, the less available the NetVault SmartDisk Device is. Given a choice of two NetVault SmartDisk Devices to target a backup job to, your backup software might choose the one with the higher Availability Score. The score takes the following into account: <ul style="list-style-type: none">• Number of data streams NetVault SmartDisk is receiving in or retrieving from the Staging Store.• Percentage of available network bandwidth that these data streams are using.
Sent MBps = <No.>	Total megabytes per second (MBps) across all streams being sent out from NetVault SmartDisk to your backup software; that is, when a restore job is being performed.

Table 1. Statistics

Stat entry	Description
Received MBps = <No.>	Total MBps across all streams being sent to NetVault SmartDisk; that is, when a backup job is targeted to an NetVault SmartDisk Device.
Machine ID = <3-XXXX-XXX>	Machine ID of the NetVault SmartDisk Instance that is used to obtain a permanent license key.
Soft stream limit = <No.>	Current maximum number of data streams or backups that your backup software can target to this NetVault SmartDisk Device simultaneously.
Version = <NetVaultSmartDiskVersion>	NetVault SmartDisk version
Build Level = <NetVaultSmartDiskBuild>	NetVault SmartDisk build
[SmartDisk:Service Manager]	Statistics for the NetVault SmartDisk Task Manager.
Active = 0	Total number of active NetVault SmartDisk operations.
Active.Read = <No.>	Current number of backup segments being read.
Active.Write = <No.>	Current number of backup segments being written.
Active.Delete = <No.>	Current number of backup segments being deleted.
Active.MkDir = <No.>	Not currently used.
Active.Move = <No.>	Not currently used.
Active.Read Properties= <No.>	Not currently used.
Active.Read Options= <No.>	Not currently used.
Active.Delete Staging= <No.>	Not currently used.
Active.Delete Rollback= <No.>	Not currently used.
Active.Rollback Element= <No.>	Not currently used.
[Dedupe:StatSubsys]	Statistics for the NetVault SmartDisk Deduplication Processes.
pages = <No.>	Current number of chunk pages stored on disk. A chunk page is a storage object or file that contains several chunks. Chunk pages are typically 64 MB.
chunks = <No.>	Total number of unique chunks stored in the Chunk Store of this NetVault SmartDisk Device.
index_bytes = <No.>	Total number of bytes on disk used by the Chunk Index .
num.pages = <No.> num.lcp = <No.> num.chunks = <No.> num.pages_max = <No.> num.lcp_max = <No.> num.chunks_max = <No.> num.hits = <No.> num.misses = <No.> num.store_misses = <No.> num.added_pages = <No.> num.added_lcp = <No.> num.evicted_pages = <No.> num.evicted_lcp = <No.> num.cache_memory = <No.>	For use by Quest Support, if necessary.
streams = <No.>	Total number of elements or backup segments that have been deduplicated.
catalog_bytes = <No.>	Total number of bytes used by a volume's catalog.

Table 1. Statistics

Stat entry	Description
<code>ondisk_bytes = <No.></code>	Total number of bytes on disk used by deduplicated data. Includes the bytes consumed by the Chunk Store , Chunk Index , and Manifests .
<code>gc_reserve_bytes = <No.></code>	Number of bytes that NetVault SmartDisk must keep available on a file system to guarantee that Garbage Collection can take place. Increases as the size of the Chunk Store increases.
<code>stream_bytes = <No.></code>	Total number of bytes submitted for deduplication.
<code>csd.stream_bytes = <No.></code>	Total number of bytes submitted for deduplication since the NetVault SmartDisk Services were started. When a backup is retired, the size of the backups is not deleted from <code>csd.stream_bytes</code> .
<code>csd.chunk_bytes = <No.></code>	Total number of bytes of unique chunks stored since the NetVault SmartDisk Services were started.
<code>in_gc = <No.></code>	Indicates whether Garbage Collection is happening.
<code>csd.gc_state = Not in GC</code>	The phase of Garbage Collection that is occurring.
<code>csd.last_successful_gc = <No.></code>	Time stamp that indicates when Garbage Collection was last completed successfully.
<code>status = <currentStatus></code>	Status reported by the CSD; includes Available, Unavailable, and NotConfigured. Used to determine whether the CSD is available for deduplication tasks and whether space is available.
<code>available_bytes = <No.></code>	Total number of bytes available for storage of deduplicated data.
[SmartDisk:Disk Storage]	Statistics for NetVault SmartDisk Disk Storage.
<code>Index.Location = <.../store></code>	Location of the Staging Store volume used for the Content Index.
<code>Index.Fixed = TRUE</code>	Displays TRUE or FALSE depending on whether the location is fixed (TRUE) or can be moved to another location (FALSE) by using the --favour and --deny options. For more information on the favour and deny options, see Extending NetVault SmartDisk Storage Pools .
<code>Elements = <No.></code>	Number of elements or backup segments currently residing in the Storage Pools.
<code>Data = <No.>, B</code>	Amount of data, in bytes, currently residing in the Storage Pools.
<code>Data.Committed = <No.>, B</code>	Amount of data, in bytes, that has completed the write-to-disk process.
<code>Space.Licensed = Unlimited</code>	Number of GB that NetVault SmartDisk is licensed to protect.
<code>Space.OS.Available = <No.>, B</code>	Number of bytes available across all configured NetVault SmartDisk Storage Pools; reported by the operating system.
<code>Space.Available = <No.>, B</code>	Number of bytes available across all configured NetVault SmartDisk Storage Pools.
<code>Space.Staging.Status = <CurrentStatus></code>	Status of NetVault SmartDisk Staging Store ; includes Available, Full, Unlicensed, and License Exceeded.
<code>Space.Staging.Available = <No.>, B</code>	Number of bytes available for Staging Store across all configured NetVault SmartDisk Storage Pools.
<code>Elements.Staged = <No.></code>	Number of elements or backup segments currently residing in the Staging Store .

Table 1. Statistics

Stat entry	Description
Data.Staged = <No.>, B	Amount of data, in bytes, currently residing in the Staging Store .
Elements.Accumulative = <No.>	Number of elements or backup segments processed by NetVault SmartDisk since its implementation.
Data.Accumulative = <No.>, B	Total amount of data, in bytes, processed by NetVault SmartDisk since NetVault SmartDisk was installed.
Data.Committed.Accumulative = <No.>, B	Total amount of data, in bytes, that has completed the NetVault SmartDisk write-to-disk process since NetVault SmartDisk was installed.

Calculating the Deduplication Ratio

Use the following calculation to determine the NetVault SmartDisk Deduplication Ratio for the data that has been protected by NetVault SmartDisk:

```
stream_bytes / ondisk_bytes = NetVault SmartDisk Deduplication Ratio
```

Use the following calculation to determine the NetVault SmartDisk Deduplication Ratio for the data that has been protected by NetVault SmartDisk since the NetVault SmartDisk Services were started:

```
csd.stream_bytes / csd.chunk_bytes = NetVault SmartDisk Deduplication Ratio since NetVault SmartDisk were started
```

For information on viewing NetVault SmartDisk statistics in your backup software, see the documentation that came with your product.

Calculating the reduction in the storage footprint

The NetVault SmartDisk Deduplication Option reduces the storage footprint required to store the protected data. To calculate the reduction in the storage footprint that NetVault SmartDisk is providing for protected data, use the following calculation:

```
(ondisk.bytes / stream.bytes) * 100 = NetVault SmartDisk Reduction in Storage Footprint
```

We are more than just a name

We are on a quest to make your information technology work harder for you. That is why we build community-driven software solutions that help you spend less time on IT administration and more time on business innovation. We help you modernize your data center, get you to the cloud quicker and provide the expertise, security and accessibility you need to grow your data-driven business. Combined with Quest's invitation to the global community to be a part of its innovation, and our firm commitment to ensuring customer satisfaction, we continue to deliver solutions that have a real impact on our customers today and leave a legacy we are proud of. We are challenging the status quo by transforming into a new software company. And as your partner, we work tirelessly to make sure your information technology is designed for you and by you. This is our mission, and we are in this together. Welcome to a new Quest. You are invited to Join the Innovation™.

Our brand, our vision. Together.

Our logo reflects our story: innovation, community and support. An important part of this story begins with the letter Q. It is a perfect circle, representing our commitment to technological precision and strength. The space in the Q itself symbolizes our need to add the missing piece—you—to the community, to the new Quest.

Contacting Quest

For sales or other inquiries, visit <https://www.quest.com/company/contact-us.aspx> or call +1-949-754-8000.

Technical support resources

Technical support is available to Quest customers with a valid maintenance contract and customers who have trial versions. You can access the Quest Support Portal at <https://support.quest.com>.

The Support Portal provides self-help tools you can use to solve problems quickly and independently, 24 hours a day, 365 days a year. The Support Portal enables you to:

- Submit and manage a Service Request.
- View Knowledge Base articles.
- Sign up for product notifications.
- Download software and technical documentation.
- View how-to-videos.
- Engage in community discussions.
- Chat with support engineers online.
- View services to assist you with your product.