NetVault Backup Client and Server Sizing Guide 2.1

Recommended hardware and storage configurations for NetVault Backup 10.x and 11.x

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1. Abstract

This document is designed to aid customers in choosing the appropriate machine configuration for their NetVault Backup server and client machines. The configurations outlined in this guide are designed to provide NetVault with the resources it needs to perform properly in a given environment.

2. Introduction

To get the most out of NetVault Backup (NetVault), it is essential that NetVault is installed on hardware that is capable of supporting the NetVault server and it various plug-ins. While no two NetVault environments are exactly the same, there are general guidelines to ensure the optimal performance of NetVault. It is important to remember that the guidelines provided in this document are recommendations, and that some environments may fall outside of these recommendations and require a custom configuration.

3. Storage Considerations

NetVault is an enterprise backup application, supporting many different storage locations for backups. Backups can be stored on local storage, Quest DR Series Deduplication Appliances (DR appliance), Direct Attached Storage (DAS), Network Attached Storage (NAS), and much more.

When deciding where to store NetVault backup data, the DR appliances should be considered first as they offer the highest level of space savings, fastest backup speeds and a great degree of flexibility and integration. Using the DR appliances can yield backups speeds up 29TB/hr and deduplication rates of up to 93%.

NetVault has tightly integrated with the DR appliance by implementing the DR appliance Rapid Data Access (RDA) technology. RDA provides fast and efficient client slide deduplication. Another option when writing to the DR appliance is writing to a DR VTL container which allows for the direct write of NDMP backups to the DR appliance. Virtual tape libraries (VTL Containers) on a DR appliance can be used to replace or complement a physical tape library as the primary storage target.

Using a combination of a DR appliance for a primary backup-storage target and existing tape infrastructure for secondary backups provides a reliable, high-performance solution to meet legal obligations or business requirements for offsite storage, archiving, and disaster recovery.

RDA integration also allows for easy site-to-site replication between appliances, offloading the work to the DR appliance and not the NetVault server. Furthermore replication data selection and retention policy is all controlled from within the NetVault console, allowing granular and flexible polices to be applied. When using a DR appliance, replication can be one-to-one or many-to-one.

An alternative to using a DR appliance is using Direct Attached Disks on a server (SAS connected) or storage presented via a high speed storage area network (iSCSI or Fibre). When using this type of storage either a NetVault Virtual Tape Library (VTL) or NetVault SmartDisk can be used. The NetVault VTL will pose a 1-to-1 storage requirement, requiring 1TB of storage space for every 1TB of data backed up (e.g. in an environment using a small sized NetVault sever and protecting 5TB of data, a 5TB MD array will be required if using a VTL).

NetVault SmartDisk can provide up to 90% storage savings utilizing target side (post-process) deduplication. It is a software based deduplication storage engine and is required to be installed on a dedicated physical server. NetVault SmartDisk also provides the ability to replicate from one NetVault SmartDisk instance to another NetVault SmartDisk instance.

If using NetVault SmartDisk with deduplication, a dedicated sever with a capable DAS will be required in addition to the NetVault server. In this scenario, it is important to note that NetVault SmartDisk cannot be installed on the same server as NetVault, and NetVault SmartDisk has a maximum capacity of 15TB of deduplicated data. This is roughly 150TB of un-deduplicated data assuming a 10:1 deduplication ratio. Please see NetVault SmartDisk Sever Recommendations for proper sizing.

If using NetVault SmartDisk without any deduplication, then SmartDisk can be co-hosted on the NetVault Backup Server and the 15TB capacity limit is not imposed.

4. NetVault Server Sizing Considerations

NetVault is a cross-platform backup and recovery software solution that safeguards your data and applications in both physical and virtual environments. It's scalable and supports multiple server and application platforms across your enterprise.

A single, intuitive web interface requires minimal experience, simplifying your data backup and recovery operations. To properly run a NetVault server an adequate amount of storage, RAM, and CPU must allocated to the server. The recommendations provided are a general "rule of thumb" approach that has been determined through internal testing and external feedback from partners and customers.

4.1. Database Size Recommendations

NetVault version 10 and greater utilizes a scalable database to store system information, configuration files, job details and backup indexes on the NetVault server. The database continues to grow in size as various data protection operations are performed in the NetVault system. NetVault operations can stop if the database cannot be updated due to lack of disk space. For this reason it is imperative that the NetVault database be provided with adequate space.

The NetVault database cannot reside on a network mount point (for example, network share, mapped drive, NFS, or JFS-mounted device). For installing the NetVault database, you must select a directory on a local drive or volume[1].

The backup indexes take up the majority of the space. Indexes are list of the filenames contained in a backup job and are used for searching for files during a restore process. For example, if you are backing up a large Windows file server, in the NetVault File System plug-in options you can choose to enable indexing. With indexing enabled, during the backup each file name is captured and stored inside a file in the NetVault "db" directory. Later if a restore request comes through for a deleted file or directory, you can search for the file/directory in the NetVault console under the restore section. This searches online backup index files and displays all the occurrences of the search string in the available backup sets.

This functionality is commonly used in the File System and VMware Plug-ins, if you do not require this search functionality, consider disabling the index functionality, it will cut down on the disk space requirements and the size of NetVault database backups. Additionally, to further manage database size, you can delete the online indexes. There are a number of different methods to accomplish this. Refer to the "Managing online backup indexes" section of the [NetVault Backup Administrator's Guide](#) for more details.

There are two techniques for calculating a NetVault database size. The first is a general "rule of thumb" approach. This is the simplest way to define the amount of storage a NetVault database will require. The "rule of thumb" approach is based on numbers gained from internal and external feedback and experience.

- A typical large (400 to 1000 clients) NetVault server environment will require 1TB of storage for the NetVault database.
- A typical small (1 to 400 clients) NetVault server environment will require 500GB of storage for the NetVault database

When in doubt, it is best to provide 1TB or more of storage for NetVault database. For some installations this may be an excessive amount of storage, but it will help to ensure and trouble free product experience and provide room for unexpected growth.

If the NetVault server is virtual, then it is possible to create a smaller volume and extend this when required. In this scenario, always use thick-provisioning (VMware) or fixed VHDs (Microsoft Hyper-V).

The second sizing technique is to calculate the amount of storage a NetVault database will need using known variables. By default, backups have an infinite life. Most systems cannot handle this amount of storage requirement, so the NetVault backup administrator must ensure that a suitable retirement is set for each backup.

Database size calculation variables:

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[1] Do not accept the default installation drive of C:

- **Approximate number of files and directories backed up per machine: NFD**

  Each file or directory that is included in a backup requires an average number of bytes for an index entry in the NetVault database. This average is based on a formula of 71 bytes plus the average number of characters contained in the filenames of the files that make up a target file system.

- **Approximate number of generations retained: NGR**

  Each generation is a separate instance of a file or directory backup. For example, if the same file is backed up seven times using the default backup settings, there are seven generations of the file stored on the media and indexed in the NetVault database.

- **Number of Machines backed up**: **NMB**
- **Average filename length**: **AFL**

Database size calculation formula: **NFD** x **NGR** x **NMB** x (71 bytes + **AFL**)

4.2. RAID and disk performance

Failure to provide enough disk I/O throughput will result in NetVault performance degradation which will be exhibited by a slow and unresponsive user interface (UI), high disk latency and long queue depths.

In order to achieve optimal NetVault database performance, it should be placed on disk storage capable of high IOPS (Input/output per second). For example, a RAID 5 array, with a minimum of 4 spindles, SAS 6/12 GPPS 15K RPM, and minimum size of 200GB. Aim for a sustained sequential write speed of 250 MBytes/sec and sustained IO write (single block) of 500 writes/sec. When building a storage array for the NetVault database be sure to utilize a minimum of 6 spindle drives.

The NetVault database must support a very good sustained read and write capability as it can be performing many simultaneous operations.   If the sustained writes meets 250 Mbytes/sec described above, then typically the read rates are as good if not better. IOPS read/write (4K blocks) must also be very high.   Third party tools can be used to establish these factors[2]. This is essential for good database operations and to ensure that the user experience is not downgraded due to system performance issues.   Typical read and writes IOPS must be in excess of 350 (approximately 50 Mbytes/sec with 4KiB blocks). RAID styles also affect these performance values so it is recommended to always have a 1-2 GB cache on the RAID controller. No cache will degrade read performance significantly.

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[2] One such tool can be found here: https://crystalmark.info/software/CrystalDiskMark/index-e.html

For NetVault servers with less than 400 clients, RAID 6 with 7200 rpm disk will provide adequate performance. However, it is still encouraged to follow the same guidelines for the 400+ clients in the following circumstances:

- You are just below protecting 400 clients
- You expect to protect 400 or more clients in the future
- You plan to utilize resource intensive features such as verify after backup, VMware backup or Hyper-V backup on the NetVault Server

4.3. RAM and CPU Recommendations

The amount of RAM and CPU that a NetVault sever will require can vary, based on multiple factors. With many possible plug-ins and configurations, it is very difficult to know every possible combination to provide exact resource consumption numbers for a NetVault server.

The goal of this section is to provide general guidelines and estimates for NetVault server resource consumption based tested configurations.

The minimum requirements for a physical or virtual NetVault server are as listed in Table 1 below.

These recommendations are based on tested configurations by Quest Software. While the base NetVault server configuration supports the local installation of multiple plug-ins it is not a recommended configuration as users start to scale past 400 clients. Plug-ins such as VMware, Oracle, SharePoint, and Hyper-V add additional load when installed on the NetVault server. Additional resource usage on the NetVault server can cause symptoms like slow NetVault WebUI refresh rates or slow NetVault job allocation and scheduling.

When possible install NetVault plug-ins on a NetVault client that is specifically allocated for providing application backup.

TABLE 1

Number of Clients	Base NetVault Server	NetVault Server with RDA enabled plug-in installed
Up to 50	Minimum Requirements: RAM - 12GB CPU – 2.5Ghz Dual-socket, 4 Core	If the VMware or Hyper-V plug-in is installed on the NetVault server then: • Add an additional 4GB to 12GB of RAM to the server. • Use caution when installing the VMware/Hyper-VM plug-in and the Bare Metal Recovery plug-ins on the NetVault server in larger environments. • In some configurations the backup data will flow via the server that the plug-in is installed on. It is better to use multiple SmartClients/Clients on dedicated servers to distribute the backup load.
Up to 200	Minimum Requirements: RAM – 24GB CPU – 2.5Ghz Dual-socket, 4 Core Suggested Requirements: CPU – 3.0Ghz, Dual-socket, 8 Core	
Up to 400	Minimum Requirements: RAM - 32GB CPU – 2.5Ghz Dual-socket, 4 Core Suggested Requirements: CPU – 3.2Ghz, Dual-socket, 10 Core	
Up to 700	Minimum Requirements: RAM - 48GB CPU – 2.5Ghz Dual-socket, 4 Core	
Up to 1000	Minimum Requirements: RAM - 64GB CPU – 2.5Ghz Dual-socket, 4 Core Suggested Requirements: CPU – fastest available, Dual-socket maximum, disk IOPs is most critical. SSD should be considered.	

4.4.   NetVault *Verify After Backup* Feature

The *Verify After Backup* feature allows users to run a verification process to check the validity of a backup at the end of data transfer. NetVault uses the built-in Verify plug-in to perform the verification phase. The Verify plug-in verifies the stream length written to the media and ensures that no blocks were dropped during backup. While the actual backup runs as Phase 1, backup verification runs as Phase 2 of the backup job.

Use of the *Verify After Backup* feature is recommended on an as needed basis for mission critical systems. Using *Verify After Backup* for every job places extra load on the NetVault server which could be problematic if the server is not properly sized. When the *Verify After Backup* job is run it performs a block-by-block check to confirm that data written is correct.

4.5.   NetVault RDA Client Resources

Rapid Data Access (RDA) optimizes deduplication between the software and target appliance. NetVault with RDA and the DR appliance can ingest at up to 29TB/hr. The

combination enables source-side dedupe with NetVault to reduce the amount of data moved over the network to the appliance. The higher the rate of change the more RAM is used.

In NetVault the amount of RAM/CPU used by RDA is determined by the number of streams a single job is defined to use. As an example, if four jobs all defined to use one stream will use the same amount of resources that one job defined to use four streams.

The minimum requirements required to use RDA source side deduplication on a client is 2GB of RAM and a 4 core CPU and a 64 bit OS. For more detailed information, see the DR Series Interoperability guide. Failure to provide the minimum amount of RAM will result in RDA operating in pass-through mode. In this mode, deduplication will occur at the DR appliance. This applies to both VM's backing up via RDA and physical machines.

For every 100MB/s of RDA backup throughput desired from a NetVault client, provide 1 CPU. Keep in mind that after CPU, disk and networking can become a bottleneck for backup throughput.

At the time of writing RDA is supported on Windows, Linux and Solaris clients.

4.6. Example NetVault Server Configuration

Below is a general recommendation for all NetVault servers if you are uncertain of the exact work load. The speed of storage where the NetVault database resides needs to be high speed, so consider SSD or 15K RPM SAS disks for this purpose. The operating system should be placed on the RAID group and not on its own mirror pair as this will slow the OS down.

- **NetVault Server OS**: Windows Server 2012R2 Standard, Windows Server 2016
- **CPU** – 2.5Ghz Dual Socket, 8 Cores
- **Memory** – 64GB RAM
- **RAID controller:** High specification model – for example a Dell H730p[3].
- **Internal Disk:** (where the NetVault database will reside) 4x300Gb 15K SAS RAID 5
- **Network:** 4x 1GbE or 2x 10GbE
- **External Controller (**Tape library connectivity**):** SAS SAS 6Gbps HBA External Controller and/or Fibre Channel HBA
- **Backup Storage:** DR appliance (recommended) or Direct Attached Storage for use with a NetVault Virtual Tape Library.

5. NetVault SmartDisk Server Recommendations

If you require deduplication in either a small or large environment a DR appliance should be considered first. Deep integration with NetVault backup and the DR appliance via RDA

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[3] A RAID example NOT to use is Dell H730mini as this has no cache.

provides performance advantages over NetVault SmartDisk. Visit Resources at https://www.quest.com/products/netvault-backup/ for more information.

When using NetVault SmartDisk instead of a DR appliance or NetVault VTL you will need a dedicated sever in addition to a properly sized NetVault server with the specifications listed below.

When architecting a NetVault SmartDisk server, it is vital that the OS, Chunk index, staging area and storage area are all on different partitions and drives/LUN. This is to ensure that the proper amount of I/O is given to each function, allowing SmartDisk to deliver acceptable levels of performance.

Chunk index LUN also requires high read and write IO, so consider placing this on RAID 10 or SSD RAID 1 configuration. A caution with RAID 1 SSD is if the wrong controller is used, as this makes no difference and IOPS can still be poor.

Refer to the SmartDisk Installation and Configuration Guides for more information.

5.1.   Example NetVault SmartDisk Server Recommendation

NetVault SmartDisk Server OS: 64bit Linux or Windows OS
Recommended for up to 15TB of deduplicated data:

- **Minimum RAM:** 12GB RAM
- **Minimum CPU:** 2.5Ghz Dual Socket, 8 Cores
- **Drives for OS:** 2x 300GB 10K RPM SAS (RAID 1)[4]
- **Drives for Chunk Index Store:** 4x 300GB 15K RPM SAS (RAID 10)
- **Storage Pool A:** 8x 300GB 15K RPM SAS 12Gbps 2.5" drives
- **RAID controller:** High specification model – for example a Dell H730p.
- **External Controller:** SAS 6Gbps HBA External Controller
- **Storage Pool B:** External SAS connected Direct Attached Storage
- **Network interface card:** 10Gb

Note; Chunk Index Store needs to be high speed disks with a high quality RAID controller. Consider SSD disks for this purpose.

6. NetVault Client Recommendations

Generally the overhead of the client is small for the target server. The installation of the NetVault client into a server operating takes up less than 100Mb of disk space. The backup index is also temporarily held on the client while a job is running. A really large backup index

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[4] A wider RAID is preferred. It will deliver better IOPS as SmartDisk can be installed as D:\SD or /user/sd

is still only likely to be up to a small number of GB's. It is therefore recommended that you allow 3GB of free disk space for the NetVault client to operate effectively.

When backing up to a DR appliance via RDA (which provides source side deduplication for Windows, Linux and Solaris clients) the minimum requirements for the client are:

- 2GB of RAM
- 4 core CPU
- 64 bit OS

Failure to provide the minimum amount of RAM will result in RDA operating in pass-through mode. In this mode deduplication will occur at the DR appliance.

7. NetVault Compatibility Documents

All NetVault documentation can be found online at https://support.quest.com/

The NetVault Backup Compatibility Guide contains the following information;

- Supported Applications
- Supported Operating Systems
- Supported NAS\NDMP Devices

The NetVault Backup Supported VTLs, Libraries, Tape, and Optical Drives provides information of what devices are compatible with NetVault.

8. Resources

- For more guides like this visit the Resources tab at: quest.com/products/netvault-backup/

- For NetVault technical documentation visit: https://support.quest.com/netvault-backup/11.4/technical-documents

- For information about the DR appliances visit: https://www.quest.com/products/dr6300-disk-backup-appliance/

- NetVault Knowledge Base – https://support.quest.com/netvault-backup/kb

- NetVault Video Tutorials - https://support.quest.com/netvault-backup/kb/video-articles