IBM

IBM Virtualization Engine TS7510

Tape Virtualization for Open Systems Servers

- Facilitate data sharing and resource virtualization
- Improve operational efficiencies and management
- Reduce backup windows and restore times

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Preface

IBM® Virtualization Engine™ TS7510 offers a new architecture for backup of open systems. The storage industry refers to the IBM Virtualization Engine TS7510 as a *virtual tape library*. A virtual tape library provides high performance backup and restore by using disk arrays and virtualization software.

This IBM Redbook introduces you to this new architecture, walking you through the process of sizing and rearchitecting your data backup environments. It explains how you can take advantage of your tape architecture by coupling it with virtual tape. It helps you to understand how tape and tape virtualization can enhance the backup process. It presents considerations for IBM Tivoli® Storage Manager. And it explains the different types of reports and monitoring aspects offered by the IBM Virtualization Engine TS7510.

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1

IBM Virtualization Engine TS7510

In this chapter, we introduce new approaches for performing open systems backups with the latest in IBM tape technologies, the IBM Virtualization Engine TS7510 (Figure 1-1). We also discuss how you can integrate this product into your current infrastructure to facilitate data backup and restore.

Figure 1-1 IBM Virtualization Engine TS7510

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1.1 The history of open systems backup

The history of open systems backup begins with the need to back up a couple of servers. With the purchase of the server, you received an internal tape device. This tape device normally held enough data to back up the base operating system and some additional small files. This support was satisfactory until the need arose to back up the growing amount of data on the server. For years, engineers swapped out tapes *multiple times* to perform the backup. Then they requested management to upgrade the tape device to something with more capacity and speed. They may have even requested an autoloader to alleviate the multiple nightly media swaps.

Whenever a group of servers was purchased, an autoloader, such as the IBM 3570 Autoloader (Figure 1-2), was purchased with it. For open systems backup, the autoloader alleviated an immediate need and became the standard in data centers. This process normally continued until the engineer reached a point where it took an entire work day to swap out tape magazines, because the tape magazines were distributed throughout the data center.

Figure 1-2 3570 Autoloader

As a result, the data center engineers developed a plan to build a consolidated infrastructure. The consolidated infrastructure usually began with a backup network on 100Base-T, which was rapidly upgraded to a gigabit network, storage area network (SAN), or both with the purchase of new servers and disk storage. The new network infrastructure allowed engineers to back up data to fewer autoloaders. It also helped to speed up backups by integrating Fibre Channel disk storage onto the SAN until the amount of data exceeded what the autoloaders can handle.

The engineers then did more research, this time looking into a tape library, such as the IBM 3584 Tape Library (Figure 1-3). The decision to use a tape library was a major one. It required extensive research to ensure that this method handled all of the current data backup needs and simplified migration from the old process to the new one. After the decision was made and the library was deployed, the engineers were again at ease. Backups were handled by a robot, and the daily ritual of swapping out tapes was reduced substantially, but not for long.

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Figure 1-3 3584 Tape Library

Then the amount of data being backed up grew exponentially, and different types of data required different backup and recovery methods. Bandwidth utilization became more of an issue with the use of super drives, such as IBM Linear Tape-Open 2 (LTO-2), LTO-3, and IBM 3592. These super drives rely on the ability to stream large blocks of data.

Some data requires a long-term archive, while other data is needed immediately upon request. The tape library remains the long-term archive device to safely and inexpensively move data both on-site and off-site. With ever growing security concerns, such capabilities as encryption and Write Once Read Many (WORM) have become more prevalent in tape drives.

With the need becoming more popular for having off-site tapes and restoring data immediately, the trend has changed to staging data to disk before sending it to tape. IBM has been implementing this concept for some time with the IBM Tivoli line of backup products. We recommend that you always stage data temporarily on disk. With the data staged on disk, you can stream it in large block sizes to the tape library that houses the super drives for intermediate storage or archive.

And now, new approaches have arisen for performing backup of open systems as explained in the following section.

1.2 New approaches for open systems backup

In this section, we present two approaches to backing up open systems. The approaches are the *disk to disk* (D2D) and *disk to disk to tape* (D2D2T) backup. As you'll see, we recommend the disk to disk to tape approach.

1.2.1 Disk-to-disk backup

A new approach to open systems backup and restore is to use the D2D backup schema. This method allows you to complete your backups and restores faster. It gives you the sense that your data has been backed up, since the data is backed up to a separate disk subsystem from the server in which it resides. In essence, it is a mirrored copy of the primary disk. However,

this can be complicated to configure with backup products. Such configuration usually requires purchasing additional options for the product and is costly in most cases.

D2D does not meet most off-site compliance guidelines, nor does it give you the ability to place data into an inexpensive WORM-type format. D2D backups are prone to disk corruption or array failure, which can cause a complete data loss.

1.2.2 Disk-to-disk-to-tape backup

A second approach, which is the one that we recommend, is the D2D2T backup architecture. The D2D2T method combines multiple tiers of storage and completes your backups and restores faster. It accomplishes this by mirroring the primary backup server's data to a separate disk subsystem. It gives you the option of moving the physical data to tape either immediately or at some point in time in the future.

Using both disk and tape in your backup architectures gives you high performance backup and restore and off-site compliance with either LTO or 3592 Tape media. In the remainder of this redbook, we discuss the D2D2T backup architecture further as it relates to the IBM Virtualization Engine TS7510.

1.3 Positioning IBM Virtualization Engine TS7510

The storage industry refers to the IBM Virtualization Engine TS7510 as a *virtual tape library*. A virtual tape library provides high performance backup and restore by using disk arrays and virtualization software. The TS7510 is just that. IBM has taken an IBM @server xSeries® 346 server running Linux® and attached it to an IBM TotalStorage® DS4000 disk subsystem, running tape virtualization software.

A virtual tape library is a unique blend of several storage tiers. The life cycle of data from its creation at the server level migrates by backup software to a virtual tape library. Since the virtual tape library is a combination of high performance SAN-attached disk and high performance servers running Linux emulating a tape storage device, there is no better place for the data to be. At this level, you have many options for the data. For example, the data can remain on the virtual tape library indefinitely, as long as there is enough space, or it can be migrated it to tape for off-site storage, archive, or both.

Who needs a virtual tape library? The answer is any business that has a need for high performance backup and restore. Instant access backups and restores are capabilities that only the disk storage tier can provide. Not all backup software has the ability to back up to disk directly, which is why the virtual tape library is necessary. All backup software products were designed to back up to tape drives and libraries, and as mentioned earlier, virtual tape library emulates tape. Customers who have many small or large LAN free clients can go directly to a virtual tape library and have their backups completed quickly.

Virtual tape libraries fill a void in the backup infrastructure for data that needs to be restored at a moment's notice. Most restores that need to occur happen often within six weeks of the data being backed up. Service-level agreements can now be designed to take advantage of data staged on disk. Backup software can be configured to back up data to a virtual tape library, and then create a virtual tape-to-tape copy for off-site deployment. No longer is it necessary to call the tapes back from off-site, unless data is required from years past. The IBM Virtualization Engine TS7510 is the virtual tape library that has been designed specifically to provide this solution.

2

Architecture

In this chapter, we examine the IBM Virtualization Engine TS7510 hardware components, model numbers, and functional aspects of the entire solution. We also cover the Virtualization Engine software that emulates an IBM 3584 Tape Library.

- Hardware components
  - IBM Virtualization Engine TS7510 (3954 Model CV5)
  - IBM Virtualization Engine TS7510 Cache Controller (3955 Model SV5)
  - IBM Virtualization Engine TS7510 Cache Module (3955 Model SX5)
  - IBM System Storage™ 3952 Tape Frame (3952 Model F05)
- IBM Virtualization Engine TS7510 Software Version 1 Release 1 (5639-CC7)

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2.1 IBM Virtualization Engine TS7510 Model CV5

The 3954 Model CV5 is a member of the xSeries family of servers. The Peripheral Component Interconnect (PCI) slots 1 through 4, shown in Figure 2-1, contain the dual ported Qlogic (QLA2342) Fibre Channel adapters with Lucent Connectors (LC). The 3954 Model CV5 is a modified xSeries 346, 8840-A5U, with the following features:

- 2 GB memory
- Two 3.0 GHz processors
- Four 2 Gb dual port QLogic Fibre Channel adapters
  - Two initiator ports for backup servers or clients
  - Two interchangeable ports for physical tape, initiators, or both
  - Four ports dedicated to disk arrays
- Dual AC Power units
- Zero SCSI hard disk drive (HDD, boots from 3955-SV5)
- DVD/CD, FDD
- Light Path Diagnostic panel
- 2 Gigabit Ethernet ports
- Remote Supervisor Adapter (RSA)
- RS485 Ports 1 and 2 unused in this configuration

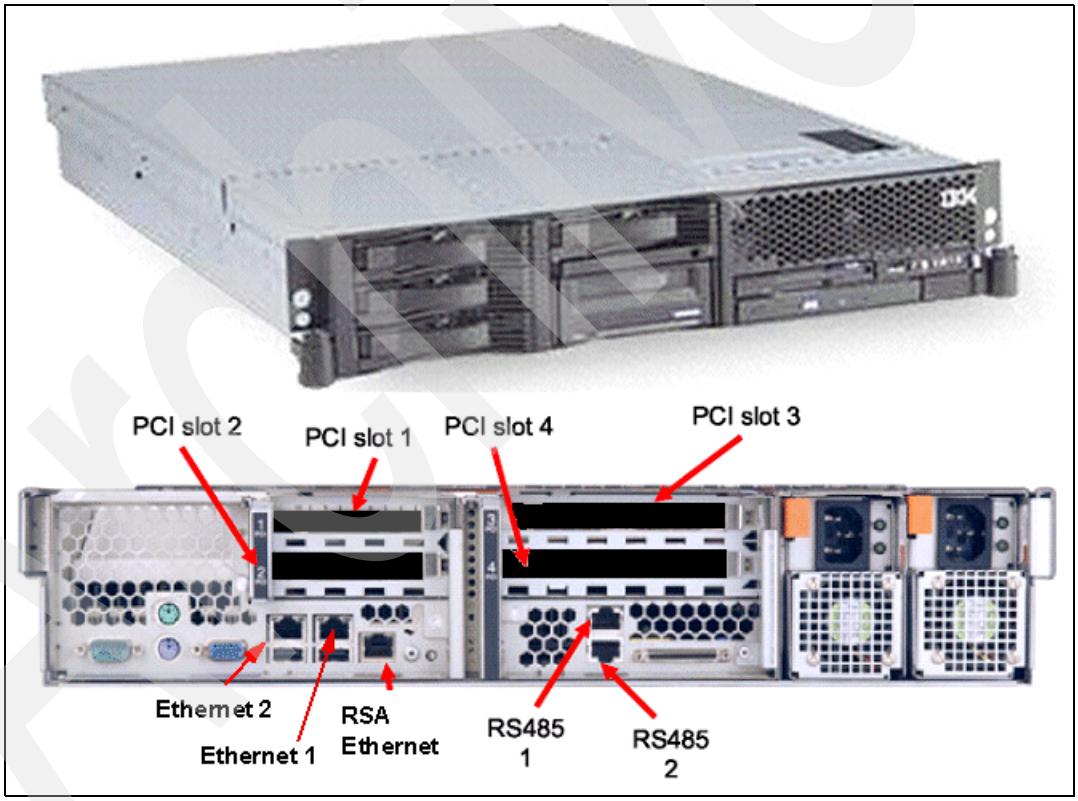

Figure 2-1 IBM 3954 Model CV5

Attention: The server and disk components of the IBM Virtualization Engine TS7510 have been heavily modified and tuned to provide this integrated solution. IBM does not support any attempts to exchange the TS7510 components with other xSeries servers or IBM TotalStorage DS4000 disk family products. Such attempts which will cause the configuration to fail.

2.2 IBM Virtualization Engine TS7510 disk architecture

The disk architecture of the TS7510 consists of the IBM 3955 Model SV5 and the IBM 3955 Model SX5, both of which we describe in this section.

2.2.1 Disk terminology

Serial Advanced Technology Attachment (SATA) disk drives are the physical disk drives housed within the IBM Virtualization Engine TS7510. The SATA interface specification offers increased data rate performance over Parallel Advanced Technology Attachment (PATA). Developed by a group of leading technology vendors, SATA was designed to overcome the performance barriers of PATA technologies, while maintaining the benefits and cost efficiency of PATA technology. The SATA Working Group introduced the first SATA specification, Serial ATA 1.0, in 2001 with plans for future versions.

To learn more about the SATA specification, see *Introducing IBM TotalStorage FAStT EXP100 with SATA Disks*, REDP-3794. Also refer to the Serial ATA Web site at:

http://www.serialata.org

Redundant Array of Independent Disks

IBM Virtualization Engine TS7510 uses Redundant Array of Independent Disks (RAID). RAID is a collection of techniques that treats multiple disks as combined units (arrays) and allows various levels of fault tolerance to be implemented in the disk subsystem. It is a strategy created to bridge the gap between computer input/output (I/O) requirements and the latency and throughput restrictions of single disk drives, while also allowing for greater degrees of fault tolerance.

RAID is the technology of grouping several physical drives in a computer into an array that can be defined as one or more logical drives. Each logical drive appears to the operating system as a single drive. This grouping technique greatly enhances logical drive capacity and performance. Refer to *The IBM TotalStorage Solutions Handbook*, SG24-5250, for more details about different levels of RAID.

The IBM Virtualization Engine TS7510 specifically uses RAID levels to protect its data. The disk arrays reside in a RAID-5 stripe, with parity and hot spares referred to as *RAID 5+P+S*. The Virtualization Engine repository is stored within a software mirror on the RAID-5 array. The software mirror is extra protection for the repository. Within a RAID array, partitions are referred to as logical unit numbers (LUNs).

Archived

2.2.2 IBM 3955 Model SV5

The 3955 Model SV5 (shown in Figure 2-2) is a modified IBM TotalStorage DS4100 Controller. The dual controller model is what IBM has configured with the SV5, providing 14 internal 250 GB disk drives inside every controller. The SV5 can provide ample yet scalable storage for the IBM Virtualization Engine TS7510. There are four 2-gigabit Fibre Channel ports to attach to the CV5 on dual controllers. Two 3955 Model SV5s are built into every IBM Virtualization Engine TS7510 configuration.

The 3955 Model SV5, shown in Figure 2-2, consists of the following components:

- IBM TotalStorage DS4100
- Fourteen 250 GB SATA HDDs
- Dual array controllers
- Dual AC Power
- Fibre Channel host ports 1 and 2 connected to CV5
- Fibre Channel expansion ports connected to SX5

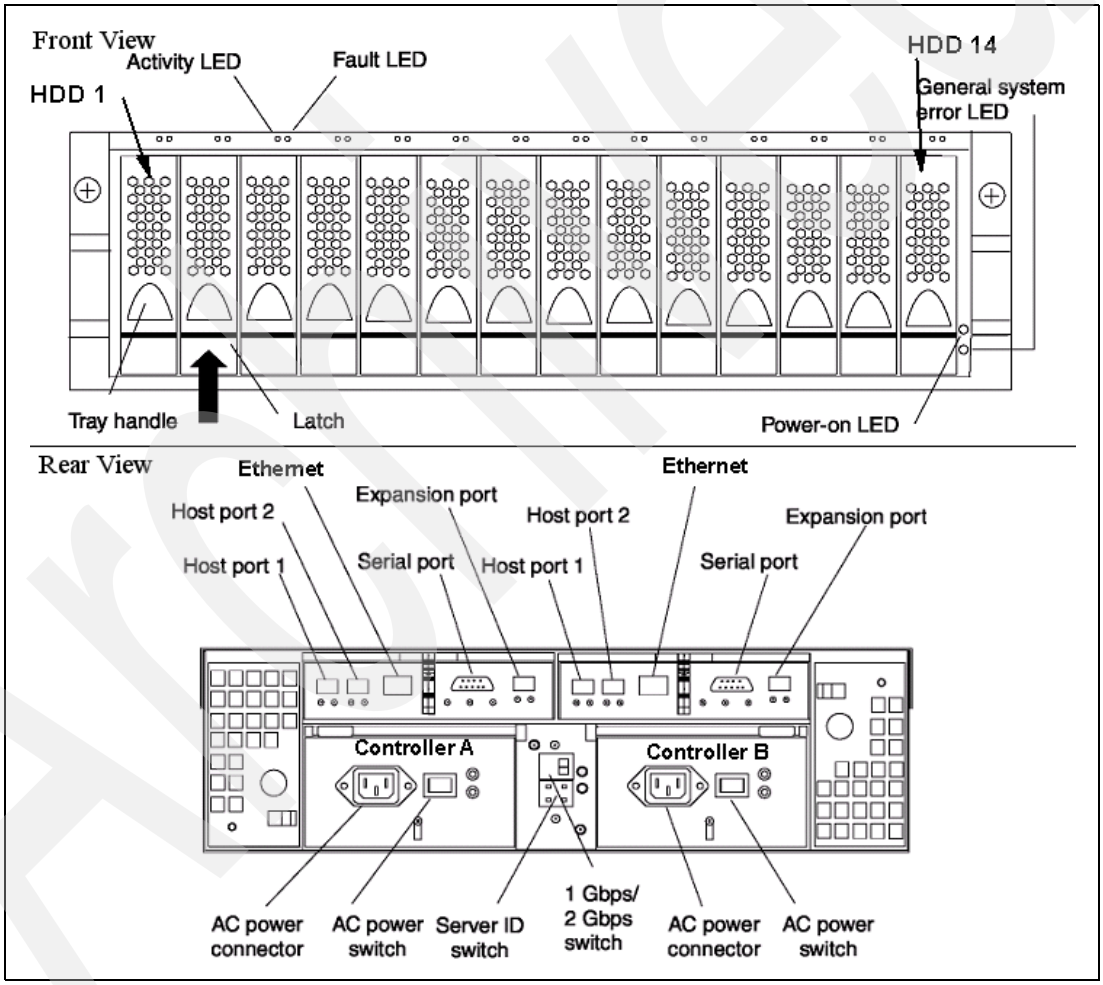

Figure 2-2 The 3955 Model SV5

The 3955-SV5 provides RAID-5 with *five data*, plus *one parity*, plus *one spare* (5+P+S). It is managed in-band from the IBM 3954 Model CV5. Ethernet and serial ports are not used.

2.2.3 IBM 3955 Model SX5

The 3955 Model SX5 is the disk expansion drawer associated with the 3955 Model SV5. It is an IBM TotalStorage DS4000 EXP 100 disk array.

The new 3955 Model SX5 is a rack-mountable enclosure configured with fourteen 250 GB SATA disk drive modules, offering up to 3.5 terabytes (TB) of raw capacity per enclosure. The IBM Virtualization Engine TS7510 configured capacity of each SX5 drawer is 3.0 TB usable. The 3955 Model SX5 consists of the following components:

- IBM TotalStorage DS4000
- Fourteen 250 GB SATA HDDs
- Dual Enclosure Service Modules
- Dual AC Power

The SX5 connects to an existing SX5 or SV5 as shown in Figure 2-3.

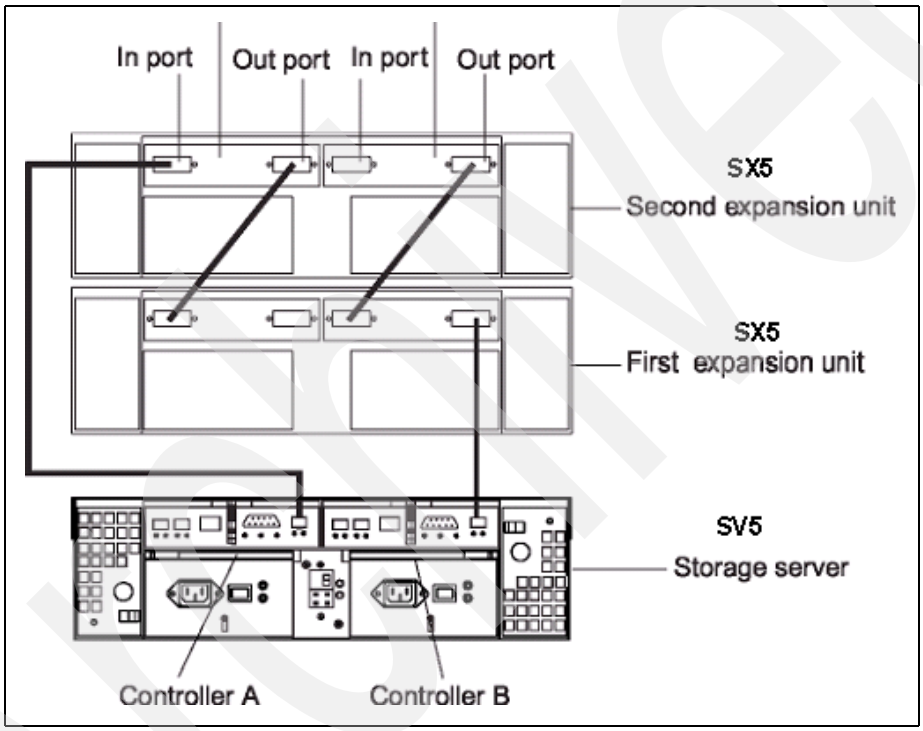

Figure 2-3 The 3955 Model SX5 attaching to the 3955 Model SV5

The Model SX5 provides RAID-5 (six data, plus one parity). The fourth drawer, which is the first drawer in the expansion frame, provides RAID-5 (5+P+S).

Attention: The server and disk components of IBM Virtualization Engine TS7510 have been heavily modified and tuned to provide this integrated solution. IBM does not support attempts to exchange the TS7510 components with other xSeries servers or IBM TotalStorage DS4000 disk family products. Such attempts which will cause the configuration to fail.

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2.2.4 LUN configuration for the CV5

The LUN configurations presented in the following sections are for the IBM Virtualization Engine TS7510 software and database repositories. The LUNS are preconfigured by IBM service support representatives (SSRs), so there is no need to change them.

LUN allocation: Stand-alone 3954-CV5 configuration

The primary 3954 CV5 server on disk has the following LUN allocations:

- Boot LUN: LUN 0, at 8 GB, is connected to port 4 on the CV5.
- Repository LUNs: Fibre Channel LUNs 1 and 2 are used for the repository (LUN1) and mirror of repository (LUN2). The repository LUN size is 2 GB.
- Data LUNs: All other Fibre Channel LUNs are virtualized and used for data.

LUN allocation: High availability dual 3954-CV5 configuration

The secondary 3954 CV5 server on disk has the following LUN allocations:

- Boot LUN: LUN 0, at 8 GB, is connected to Port 4 on both CV5s.
- Repositories LUNs: Fibre Channel LUNs 1 and 2 are used for the repository (LUN1) and mirror of the repository (LUN2). The repository LUN size is 2 GB.
- Data LUNs: All other Fibre Channel LUNs are virtualized and used for data: half for CV5-1 and half for CV5-2.

Note: In each case, all LUNs are initialized and ready for use upon system installation.

2.3 IBM 3952 Model F05 Frame

The 3952-F05 Frame is the 19-inch rack in which all of the components reside and is required for the configuration. The rack comes standard with one Power Distribution Unit (PDU), although we recommend that you purchase a second PDU for the initial installation.

Tip: *IBM Virtualization Engine TS7510 Introduction and Planning Guide*, GC26-7767, is a good place to find information about the all of the physical site planning for the TS7510.

2.4 IBM Virtualization Engine TS7510 software

The IBM Virtualization Engine TS7510 application software provides tape library and tape drive emulation including virtual volumes. It includes the following features and functions, which are explained next:

- Backup and Network compression
- Import and Export including Automatic Archive
- Network Replication including Encryption

2.4.1 Software emulation

Software emulation of the IBM Virtualization Engine TS7510 is what makes the Virtualization Engine so powerful. We describe all of the features and functions of the software in this section.

Tape library emulation

The IBM Virtualization Engine TS7510 has been designed to create a virtual copy of the IBM 3584 Tape Library. You can configure the TS7510 to act exactly like the 3584 with any slot configuration you see fit for the virtual unit. The TS7510 will look like a 3584 and act like a 3584 to all the backup software, from independent software vendors (ISVs), that attaches to it. Each backup client, from an ISV, can attach to the tape library across the storage area network (SAN) the same way it did to an actual library without needing additional software.

Tape drive emulation

You can configure the IBM Virtualization Engine TS7510 to look like three different types of tape drives:

- IBM Linear Tape-Open (LTO) Generation 2 tape drives with 200 GB cartridges
- IBM LTO Generation 3 tape drives with 400 GB cartridges
- IBM 3592 Model J1A tape drives with 300 GB cartridges

Each virtual library can have only one type of virtual tape drive within it. If a virtual library is created and it is given LTO Generation 2 tape drives, you cannot add LTO Generation 3 drives or 3592-J1A Tape Drives to it later like you can in an actual tape library. If you want to change the drive types, you must create a new virtual library, and then you can migrate from one library to another. Table 2-1 lists the TS7510 overall emulation rules for both base and high availability (HA) configurations. For more information about high availability configurations, see 2.4.4, “High Availability Failover” on page 18.

Table 2-1 TS7510 Virtual Library emulation

3954 CV5 base configuration	3954 CV5 HA configuration
Up to 64 virtual libraries	Up to 128 virtual libraries
Up to 512 virtual drives	Up to 1024 virtual drives
Up to 4096 virtual cartridges	Up to 8,192 virtual cartridges

Even though IBM Virtualization Engine TS7510 is emulating LTO Generation 2, LTO Generation 3, and 3592-J1A Tape Drives, it is only emulating the format of the devices. It is not emulating the speed of the actual drives.

Tip: Choose the drive type based on the actual tape drives that will exist on the back end.

Virtual tape volumes

Virtual tapes volumes are associated with the drive that is chosen. If you choose LTO Generation 3 drives, the virtual tape volumes have LTO Generation 3 capacity. The default size for all media types is 5 GB. This means that at least 5 GB of space will be required for all virtual tape volumes once they have been mounted into a virtual drive. While writing to a virtual volume, the volume expands its size in increments defined by the volume type.

The increment sizes are as follows:

- LTO Generation 2 starting size is 5 GB with an incremental growth of 5 GB.
- IBM 3592 starting size is 5 GB with an incremental growth of 5 GB.
- LTO Generation 3 starting size is 5 GB with an incremental growth of 7 GB.

Important: When a virtual tape volume is reused by the ISV software, the IBM Virtualization Engine TS7510 reduces the volume to the initialized size of 5 GB.

Backup compression

Backup compression is an option of the data backup operation that you can turn on or off at any time from the Virtualization Engine console. Backup compression decreases the performance speed of the Virtualization Engine. If performance is an issue, you may consider not using the Backup compression option. However, if performance is not an issue, compression can significantly increase the amount of data placed into each virtual tape volume.

With Backup compression turned on, you must size the virtual tape cartridges approximately 10 percent lower than the physically attached back-end drives. If the amount of data on the virtual tape exceeds the amount of space on the physical tape, the Export function will fail.

2.4.2 Import, Export, and Auto Archive functions

Import and Export are standard functions of an actual tape library, which also makes them powerful functions of a virtual tape library. To *import* physical tapes, you must attach an IBM 3584 or 3494 tape library to the IBM Virtualization Engine TS7510.

Figure 2-4 illustrates the overall process of the Import and Export commands. The servers running the ISV backup application are shown on the left, and an IBM 3584 Tape Library is shown on the right. Both are attached to the IBM Virtualization Engine TS7510 in the middle. For example during an export, the ISV software issues a command to the TS7510 which moves the data in a virtual volume to the virtual vault, and from the virtual vault to the actual library. The import must be done at the Virtualization Engine Console to move data from a physical cartridge in the 3584 to a virtual cartridge on the TS7510.

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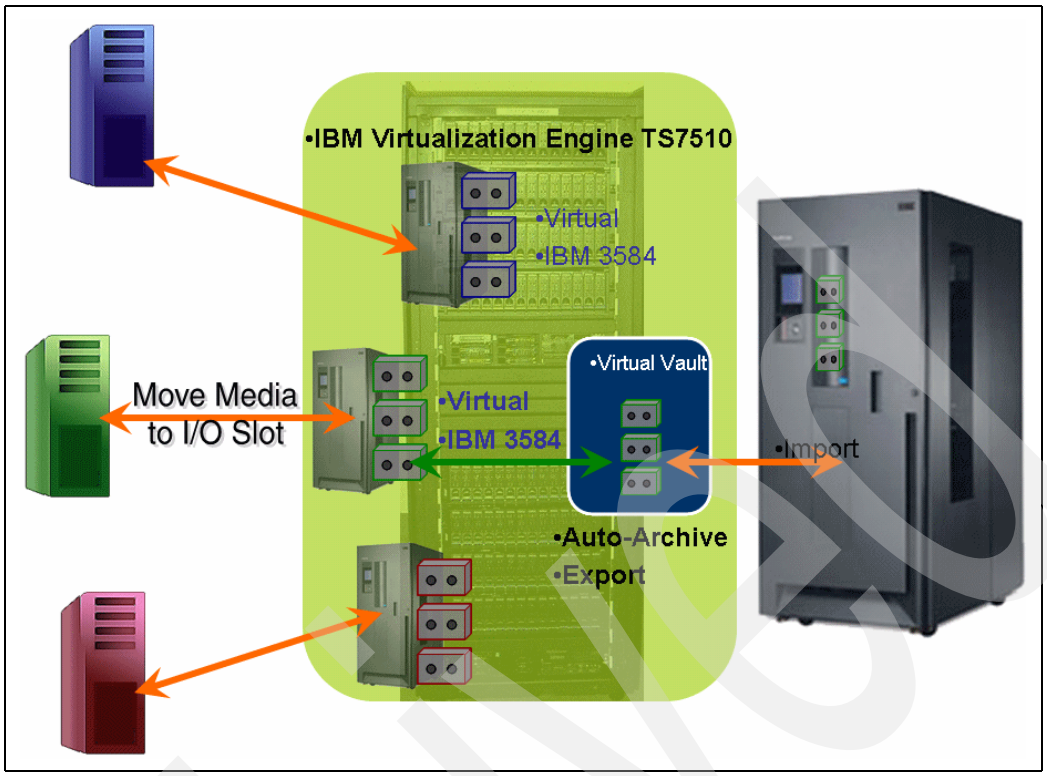

Figure 2-4 Virtualization Engine cartridge Import and Export movement

Import function

Once you connect to the physical tape library, you can import data from any physical tape attached to that library. There are three different modes for importing a physical tape for use as a virtual tape resource:

- Copy mode

  Copy mode copies the whole physical tape, block-by-block, to a virtual tape.

- Direct access mode

  Direct access mode links a physical tape to a virtual tape during the import process; no disk storage space is used. This allows quick access to data stored on the physical tape and avoids time needed to import the whole physical tape. This process can only be used for data restoration. The physical tape is in a read-only mode and cannot be used for backup use.

- Recycle mode

  Recycle mode only copies the first 10 MB of the physical tape and nothing else. It tries to preserve the tape header (plus or minus a few MB) without copying the backup data. This mode is useful if you want the ISV backup software to see the tape, but you know that the data no longer needs to be retained.

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Export function

When exporting a virtual tape to a physical tape, you must first have the ISV software eject the tape. When the virtual tape is ejected, it is automatically moved to a section of the IBM Virtualization Engine TS7510 called the *virtual vault*. Figure 2-4 illustrates the Export operation.

You can manually move any virtual tape to the virtual vault by using the Virtualization Engine console. We recommend that you *do not* do this, because it causes discrepancy in the ISV catalog that can only be corrected by rerunning a library inventory.

> **Tip:** Unless you want to rerun the ISVs inventory command, do not use the Virtualization Engine console to export virtual volumes from the library.

When the tape is in the virtual vault, you can export it using the Export Tape wizard. If a tape is has never been mounted on a virtual drive, you are prevented from moving it to the virtual vault, and the Export Tape option will not be available.

Like the Import function, the Export function also has multiple options:

- Move mode

  Move mode moves the virtual tape to actual tape based on a grace period setting. When you select zero days as the grace period, the virtual volume is immediately deleted as soon as the export has finished. If the grace period is set to one day, the cartridge is deleted after one day.

- Copy mode

  Copy mode moves the virtual volume to the virtual vault of the IBM Virtualization Engine TS7510 and creates an actual tape in the externally attached 3584 or 3494 tape library. Therefore, a virtual volume and an actual tape reside within the IBM Virtualization Engine TS7510 virtual vault and in the externally direct attached tape library.

- Export to Import/Export slots

  This is an option that you can turn on or off. It causes the exported physical tape to automatically move to one of the I/O slots on the physical library.

Auto Archive function

Auto Archive is an automatic export performed when the ISV backup software ejects the virtual tape. Options for Auto Archive are Copy and Move. Again you can move the tape to the Import/Export slots after this operation has finished.

When you activate the Auto Archive function, you are given the option to match the virtual barcode with an existing physical barcode. Auto Archive only works on virtual tapes which have been created using a physical barcode found on an actual tape.

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2.4.3 Network Replication

Network Replication provides a method to recover from complete data loss by sending copies of data off site. There are three methods of Network Replication: Remote Copy, Replication, and Auto Replication. To use the Network Replication function, you need two IBM Virtualization Engine TS7510s:

- The primary TS7510 that serves virtual tape drives to your backup servers
- A disaster recovery/remote Virtualization Engine TS7510

Remote Copy

Remote Copy is a manually triggered, one-time replication of a local virtual tape. Upon completion of the Remote Copy, the tape resides on the primary TS7510 and in the Replication Vault of the remote TS7510.

You cannot perform Remote Copy on a tape that has already been configured for Auto Replication. When using Remote Copy, the copied tape can reside either in one of the virtual tape libraries, in a virtual tape drive, or in the virtual vault. The Remote Copy option preserves the barcode from the Virtualization Engine which the remote copy initiated.

Figure 2-5 illustrates the Remote Copy movement. The primary Virtualization Engine is on the left, and the remote backup is on the right.

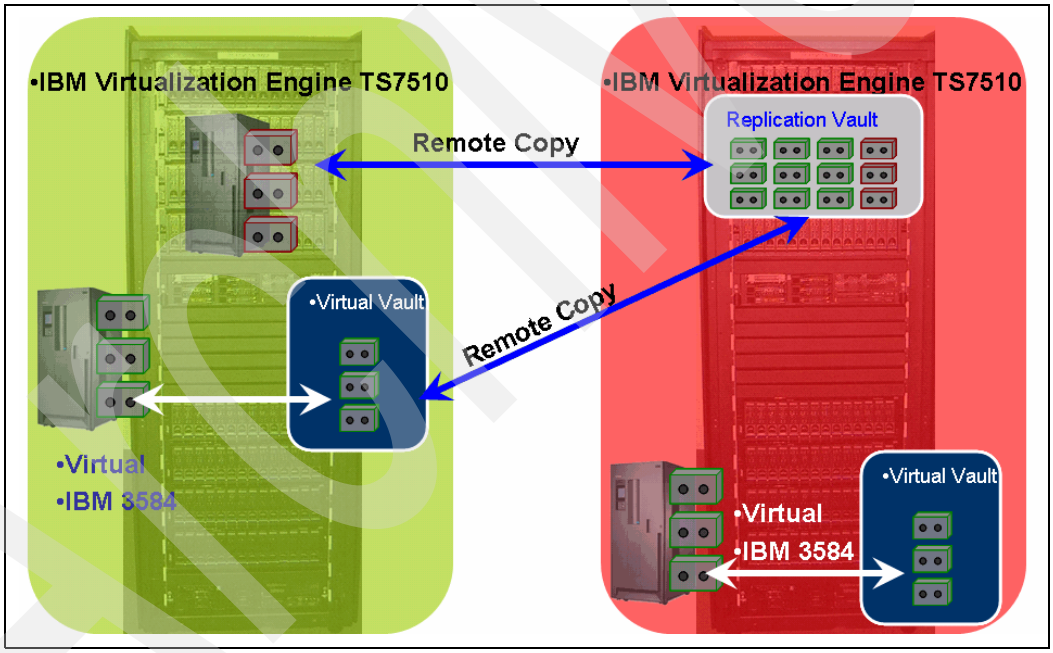

Figure 2-5 Remote Copy data movement

Replication

The Replication process is either triggered by a scheduled event or when the virtual volume reaches a certain predetermined size. When Replication is configured, a primary virtual volume is created and linked to the virtual replica on the remote Virtualization Engine. A replica tape is always linked to the original virtual tape. It cannot be used by any virtual library or for import/export by the remote Virtualization Engine until this linked relationship is broken. This condition is also known as *promoting a replica*. Its only purpose is to maintain an in-sync copy of the primary tape.

The replica tape simply gets incremental changes from the source tape, ensuring the two tapes are always in-sync at the end of a replication session. This is why it is a *dedicated relationship*. Since the incremental changes are trackable (because we know no one else is writing to or accessing the replica), there is never a need to replicate or remote copy the entire tape at each replication interval.

Data traveling across the replication path can be compressed, encrypted, or both. Additional license codes are required to activate these features, which we explain later. If the replica is promoted, it is placed in the virtual vault on the remote Virtualization Engine, with the same barcode label as the source virtual tape. It can then be used like any other virtual tape.

Figure 2-6 illustrates replication movement. The left TS7510 is the primary engine, and the right TS7510 is the backup. Data replicates from the primary to the backup utilizing the replication process. When the primary engine fails in order to use a replica that is on the backup engine, the virtual replica sitting in the replication vault is promoted to a virtual volume and moved to the virtual vault. It is either placed in a virtual library on the backup or copied back to the primary.

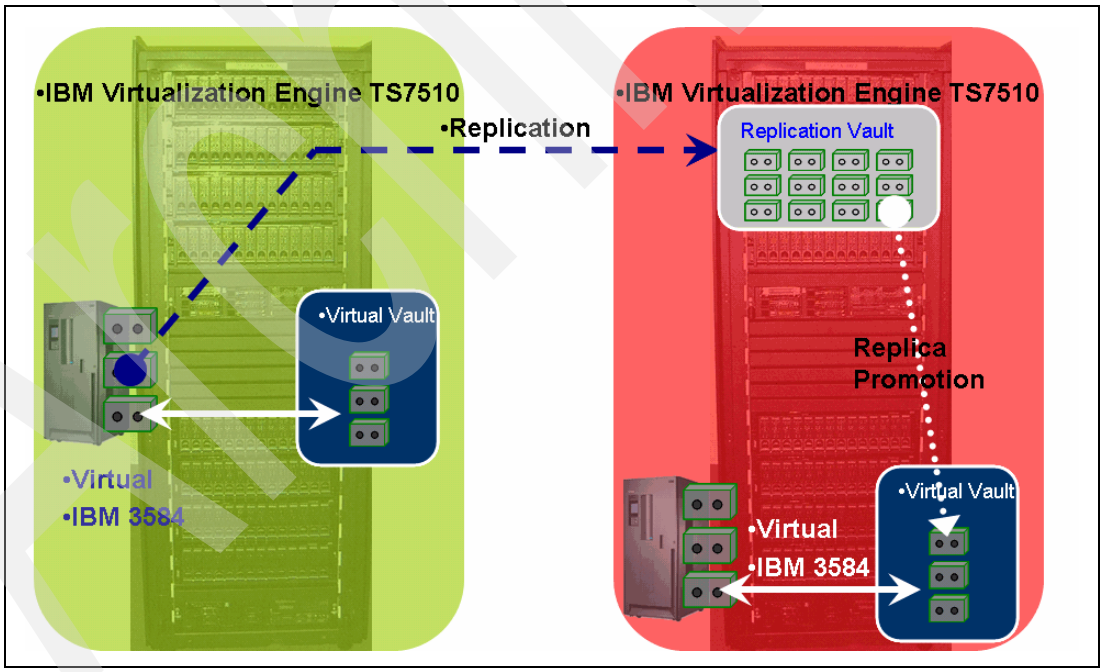

Figure 2-6 Replication data movement

Auto Replication

As we mentioned previously, Auto Archive involves a one-time copy or move of the virtual tape as soon as the backup software has sent an **`eject`** command. Auto Replication provides for the same, one-time copy or move after the eject, but the destination is to the remote Virtualization Engine instead of to a local physical 3584 or 3494 tape library.

Figure 2-7 illustrates the Auto Replication process. The left side shows the primary engine, and the right side shows the backup engine. The primary initiates the Auto Replication function. Also a one-time copy or move after the **`eject`** command is sent to the backup Virtualization Engine. The virtual volume is then placed in the replication vault.

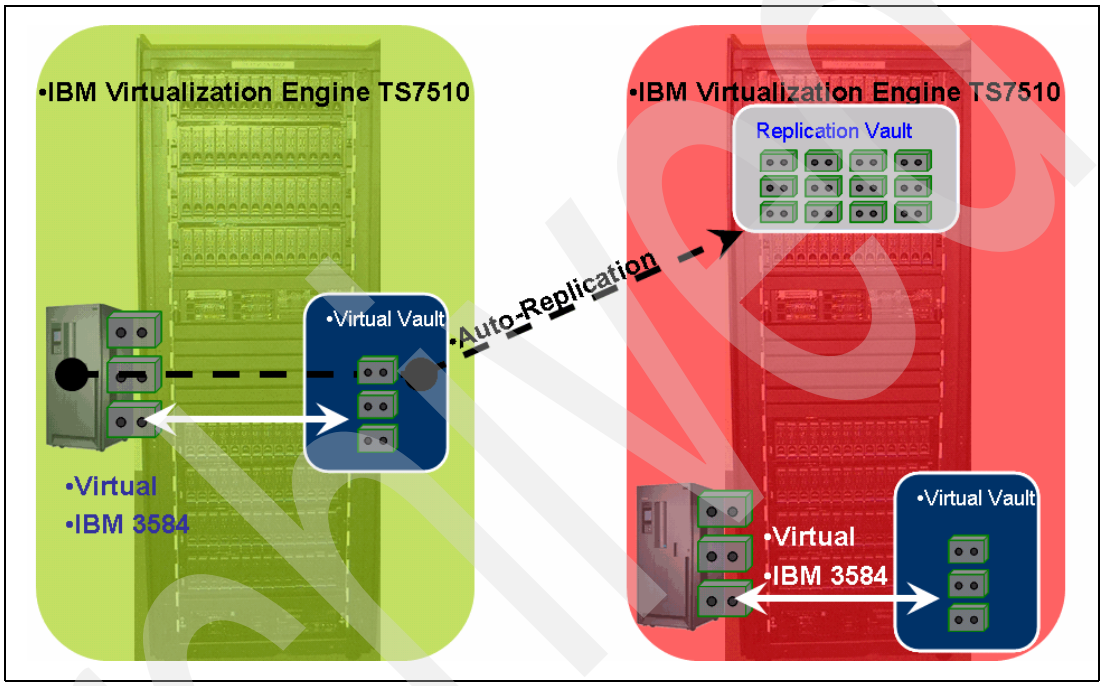

Figure 2-7 Auto Replication data movement

Network Encryption

Network Encryption, feature code (FC)7422, is influenced under Network Replication. The data is encrypted across the line on the fly and decrypted when it reaches the Remote Virtualization Engine. This feature encrypts the data while it is sent between two IBM Virtualization Engine TS7510s.

> **Important:** FC7421 (Network Replication) is a prerequisite for FC7422 (Network Encryption) and FC7423 (Network Compression). If two Model CV5 servers are configured in a high availability configuration, these software codes must exist on both models.

Network Compression

Network Compression, FC7423, is an option for the IBM Virtualization Engine TS7510. It compresses the data stream across the Ethernet network to enhance the performance of all replication functions.

> **Important:** Network Compression is only used in data transfers of virtual tape volumes between the primary and remote TS7510.

See Chapter 3, “Configuration and sizing” on page 19, for more details about ordering these feature codes.

2.4.4 High Availability Failover

You use the High Availability Failover option when a primary CV5 takes over the identity of the secondary (HA) CV5, because of a hardware or software failure that affects the proper operation of the Virtualization Engine. This option requires you to purchase the high availability configuration of the IBM Virtualization Engine TS7510. See 3.1, “Configuration options” on page 20, for more details about how to configure the HA configuration options.

High Availability Failover provides high availability for the TS7510 storage network, protecting you from potential problems such as, for example, storage device path failure, or Virtualization Engine TS7510 server failure.

Storage device path failure

A storage device path failure can be caused by the failure of one of the attached cables. High Availability Failover can eliminate this potential failure point by providing a multipath configuration. The IBM Virtualization Engine TS7510 automatically detects all paths to the storage devices. If one path fails, the TS7510 automatically switches to another active path.

IBM Virtualization Engine TS7510 server failure

IBM Virtualization Engine TS7510 failover option provides high availability for TS7510 operations by eliminating the downtime that can occur if a server fails for any reason.

The Virtualization Engine server Model CV5 is configured to monitor the high availability CV5. In the event that the server that is being monitored fails to fulfill its responsibilities, the monitoring server does a seamless takeover of another server’s identity. The IBM Virtualization Engine TS7510 uses a unique monitoring system to ensure the health of the servers. This self monitor checks each Virtualization Engine processes and connectivity to the server’s storage devices. In a High Availability Failover configuration, the TS7510 intelligent heart-beat monitor continuously monitors the other server. When the heartbeat is retrieved, the results are evaluated. If for some reason the heartbeat fails, the high availability unit takes overall processing of the clients.

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3

Configuration and sizing

In this chapter, we describe the different configuration options for the IBM Virtualization Engine TS7510. We discuss better backup practices and how to properly size your backup environment with the IBM Virtualization Engine TS7510 in mind.

Prior to reading this chapter, you should have a basic knowledge of the TS7510 architecture, which is explained in Chapter 2, “Architecture” on page 5.

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3.1 Configuration options

The configuration options that we present in the following sections range from the least amount of hardware required to get started with an IBM Virtualization Engine TS7510, to a fully expanded configuration.

3.1.1 Base configuration without high availability

The base hardware configuration without high availability (HA) consists of:

- One 3954 Model CV5 server (see 2.1, “IBM Virtualization Engine TS7510 Model CV5” on page 6)
- Two 3955 Model SV5 Controllers (see 2.2, “IBM Virtualization Engine TS7510 disk architecture” on page 7)
- One 3952 Model F05 Frame (see 2.3, “IBM 3952 Model F05 Frame” on page 10)

Figure 3-1 shows this configuration, in which 4.98 TB of space is available for virtual tape creation. This configuration also gives you up to 64 virtual libraries, up to 512 virtual drives, and up to 4096 cartridges.

Figure 3-1 Base IBM Virtualization Engine TS7510

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3.1.2 Base configuration with high availability

The base hardware configuration with high availability consists of:

- Two 3954 Model CV5 servers (see 2.1, “IBM Virtualization Engine TS7510 Model CV5” on page 6)
- Two 3955 Model SV5 Controllers (see 2.2, “IBM Virtualization Engine TS7510 disk architecture” on page 7)
- One 3952 Tape Frame Model F05 (see 2.3, “IBM 3952 Model F05 Frame” on page 10)

Figure 3-2 shows this configuration in which 4.98 TB are available for virtual tape creation.

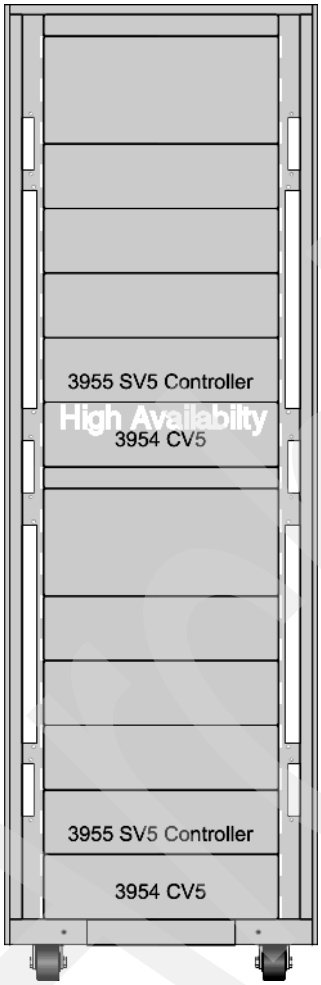

Figure 3-2 Base IBM Virtualization Engine TS7510 with high availability

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The high availability option doubles everything from performance, virtual library, virtual drive, and virtual cartridge options. Refer to Table 3-1 for more details.

Table 3-1 TS7510 Virtual Library configuration

3954 CV5 base configuration	3954 CV5 HA configuration
Up to 64 virtual libraries	128 virtual libraries
Up to 512 virtual drives	1024 virtual drives
Up to 4096 virtual cartridges	8,192 virtual cartridges

3.1.3 Incremental growth options

The IBM Virtualization Engine TS7510 is modular by design. It can grow in 3 TB increments by adding 3955 Model SX5 drawers one at a time. The primary rack design is capable of holding up to six expansion drawers with or without the high availability option.

Once the base rack is full, a second rack can be attached, again growing in single drawer increments of 3 TB until the maximum number of eight drawers is reached.

Note: The first two disk drawers added in the expansion cabinet have 2.5 TB of usable space, due to the hot spares required in the configuration.

Figure 3-3 shows the maximum configuration, which consists of:

- Base rack
  - One 3952 Tape Frame Model F05
  - Two 3955 Model CV5 servers
  - Six 3955 Model SX5 Cache Modules
- Expansion rack
  - One 3952 Tape Frame Model F05
  - Eight 3955 Model SX5 Cache Modules

Important: To expand beyond the base frame, the secondary Model CV5 (HA configuration) is required. Two Model CV5 controllers must be installed in the base frame before the expansion frame is permitted.

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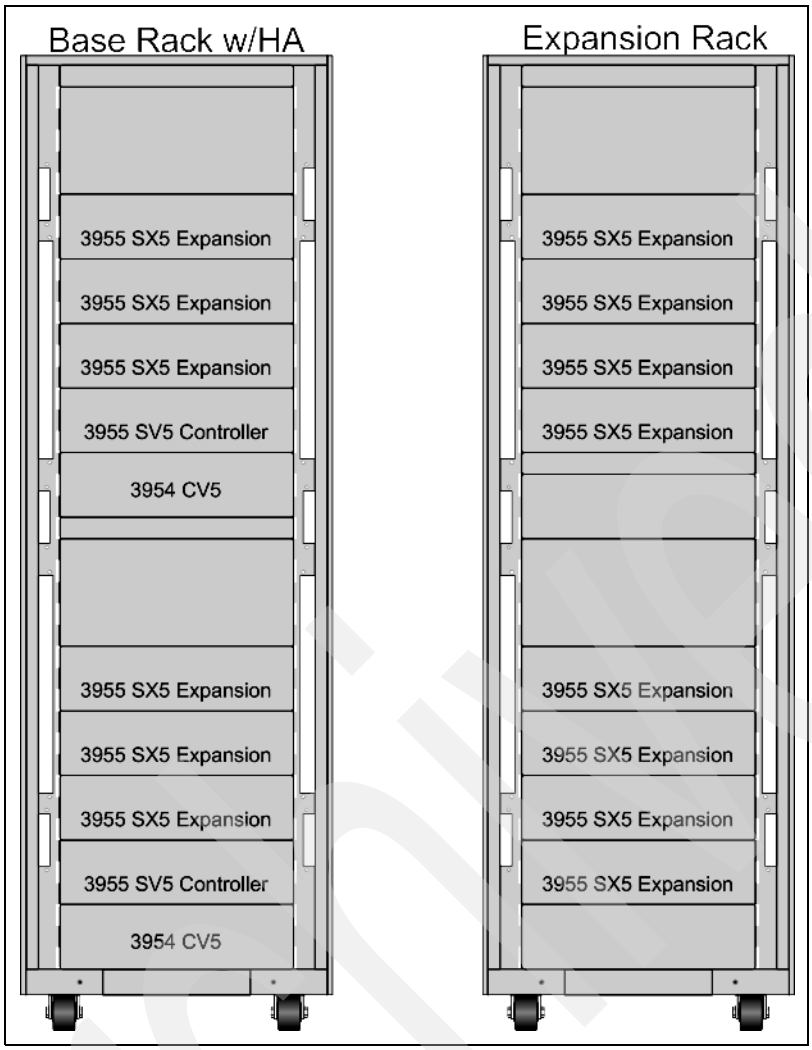

Figure 3-3 IBM Virtualization Engine TS7510 Dual Racks fully expanded with HA

3.1.4 Ordering information

Feature codes are required for ordering the different options for the IBM Virtualization Engine TS7510. The following tables list the different feature codes and their descriptions.

Table 3-2 describes the machine types, the model types, and the feature codes for the TS7510 3954 Model CV5 Controller.

Table 3-2 Feature codes associated with the 3954 Model CV5

Description	Machine type	Model	Feature
TS7510 Virtualization Engine	3954	CV5	Not applicable
13m LC/LC Fibre Cable	3954	CV5	6013
25m LC/LC Fibre Cable	3954	CV5	6025
61m LC/LC Fibre Cable	3954	CV5	6061
Activate Virtualization Engine	3954	CV5	7100

Description	Machine type	Model	Feature
Failover/Failback Enable	3954	CV5	7420
Network Replication	3954	CV5	7421
Network Encryption	3954	CV5	7422
Network Compression	3954	CV5	7423
VE Preload – AAS	3954	CV5	9301
Plant Install 3954-CV5	3954	CV5	9320
Field Merge 3954-CV5	3954	CV5	9321
No Factory Cables	3954	CV5	9700

Along with the controller, feature codes are associated with the disk subsystems, as listed in Table 3-3.

Table 3-3 TS7510 3955 Model SV5 and SX5 storage arrays

Description	Machine type	Model	Feature
TS7510 Cache Controller	3955	SV5	
TS7510 Cache Module	3955	SX5	
13m LC/LC Fibre Cable	3955	SV5	6013
25m LC/LC Fibre Cable	3955	SV5	6025
61m LC/LC Fibre Cable	3955	SV5	6061
3.5 TB SATA Storage	3955	SV5, SX5	7110
Enable SX5 in Expansion Frame	3955	SV5	7400
Plant Install 3955-SV5	3955	SV5	9322
Plant Install 3955-SX5	3955	SX5	9324
Field Merge 3955-SX5	3955	SX5	9325

Table 3-4 lists the machine types, the model types, and the feature codes for the TS7510 Tape Frame Model F05.

Table 3-4 TS7510 Model F05 19-inch rack enclosure

Description	Machine type	Model	Feature
Dual AC Power	3952	F05	1903
Remove 3955-SX5 from F05	3952	F05	4745
Plant Install 3954-CV5	3952	F05	5726
Field Install 3954-CV5	3952	F05	5727
Plant Install 3955-SV5	3952	F05	5736
Plant Install 3955-SX5	3952	F05	5746
Field Install 3955-SX5	3952	F05	5747

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Description	Machine type	Model	Feature
TS7500 Series Base Unit	3952	F05	7310
TS7500 Series Expansion Unit	3952	F05	7311
NEMA L6-30 Power Cord	3952	F05	9954
RS 3750DP Power Cord	3952	F05	9955
IEC 309 Power Cord	3952	F05	9956
PDL 4.3m Power Cord	3952	F05	9957

The software feature codes differ from country to country. Table 3-5 lists the software and hardware feature codes associated with the 3954-CV5 for the United States (U.S.), Asia Pacific (AP), Latin America (LA), and Canada.

Table 3-5 3954-CV5 for the U.S., AP, LA, and Canada

Program name	3954-CV5 feature code	5639-CC7 feature code	Charge metric
TS7510 V1R1 Software		3229	Per server
Failover/Failback	7420	3234	Per server
Network Replication	7421	3231	Per server
Network Encryption	7422	3232	Per server
Network Compression	7423	3232	Per server
Console & Capacity Support		3233	Per terabyte

Table 3-6 describes the Software and Hardware feature codes associated with the 3954-CV5 for Europe, the Middle East, and Africa.

Table 3-6 3954-CV5 for Europe, the Middle East, and Africa

Program name	3954-CV5 feature code	5639-CC7 feature code	Charge metric
TS7510 V1R1 Software		U5DTC1	Per server
Failover/Failback	7420	U5DNC1	Per server
Network Replication	7421	U5DSC1	Per server
Network Encryption	7422	U5DRC1	Per server
Network Compression	7423	U5DPC1	Per server
Console & Capacity Support		U5DMC1	Per terabyte

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3.1.5 Software maintenance

Software maintenance for one year is included in the initial price of the IBM Virtualization Engine TS7510 V1R1 software. To provide continuous software maintenance coverage, purchase one-year or three-year software maintenance renewal features prior to the expiration of the original software maintenance registration features. For Console & Capacity Support per TB, purchase software maintenance renewal for the total terabyte capacity managed by the IBM Virtualization Engine TS7510 at the time of renewal. Software maintenance renewals supersede and replace previous maintenance levels. If software maintenance has expired, you must order the after-license renewal program ID (5639-DD4 for one year and 5639-DD7 for three years) using the current maximum storage TB levels managed by the IBM Virtualization Engine TS7510 on the same basis as previously described.

Along with hardware and software feature codes, there are different levels of extended maintenance codes. Table 3-7 lists the first year extended maintenance codes. The four-character codes apply in the Americas, Asia, and Australia. The six-character codes apply in Europe, Middle East, and Africa.

Table 3-7 TS7510 V1R1 one-year maintenance

Description	**One-year maintenance agreement**		
	Registration (no charge feature code)	**Renewal before expiration (charge feature code)**	**Renewal after expiration (charge feature code)**
TS7510 V1R1 Software Maintenance Program ID	5639-DD3	5639-DD3	5639-DD4
TS7510 V1R1 Software	3243/U5DZC2	3244/U5DZC3	3251/U5D5C4
Network Compression	3235/U5DWC2	3236/U5DWC3	3252/U5D2C4
Network Replication	3237/U5DYC2	3238/U5DYC3	3248/U5D4C4
Network Encryption	3241/U5DXC2	3242/U5DXC3	3249/U5D3C4
Console & Capacity Support per TB	3245/U5DUC2	3246/U5DUC3	3250/U5D0C4
Failover/Failback	3239/U5DVC2	3240/U5DVC3	3247/U5D1C4

Each year of extended maintenance has its own set of feature codes. The column on the far right in Table 3-7 describes the codes required for IBM Virtualization Engine TS7510 V1R1 software one-year extended maintenance after a license expires.

Along with the one-year maintenance extension, IBM also offers three-year agreements. Table 3-8 lists the maintenance feature codes required to handle the three different three-year agreements.

The column for program number 5639-DD5 in Table 3-8 describes the one-time charge feature numbers that are required for the IBM Virtualization Engine TS7510 three-year maintenance agreement *upon initial purchase*. The column for 5639-DD6 describes the one-time charge feature numbers that are required for the IBM Virtualization Engine TS7510 three-year maintenance agreement renewal codes used *before maintenance expires*. And the column for 5639-DD7 describes the one-time charge feature numbers required for the three-year maintenance agreement renewal codes of the IBM Virtualization Engine TS7510 *after maintenance expires*.

Table 3-8 TS7510 V1R1 software three-year maintenance

Description	Three-year maintenance agreement		
	Initial purchase	**Renewal before expiration**	**Renewal after expiration**
TS7510 V1R1 Software Maintenance Program ID	5639-DD5	5639-DD6	5639-DD7
TS7510 V1R1 Software	3254/U5EBC5	3259/U5EHC6	3265/U5EPC7
Network Compression	3256/U5D8C5	3262/U5EEC6	3267/U5ELC7
Network Replication	3257/U5EAC5	3260/U5EGC6	3266/U5ENC7
Network Encryption	3253/U5D9C5	3261/U5EFC6	3270/U5EMC7
Console & Capacity Support per TB	3255/U5D6C5	3264/U5ECC6	3268/U5EJC7
Failover/Failback	3258/U5D7C5	3263/U5EDC6	3269/U5EKC7

3.2 Backup practices and recommendations

In this section, we review backup practices and make recommendations on how to properly size an IBM Virtualization Engine TS7510. To properly size an IBM Virtualization Engine TS7510, you must have ample knowledge of the backup environment.

You should gather the following information in advance:

- Current backup types for the type of data
- Location from where the data flows (storage area network (SAN), local area network (LAN), or wide area network (WAN)
- Time at which a majority of the restores occurs
- The specific service-level agreements (SLAs) that are associated with your backups

We take you through the importance of all this information in the following sections. Each piece of information has an outcome to the overall solution. Once you consider all of this information, the proper solution will be easy to put together. The reason for this entire process is to understand the nature of the data being backed up and where it belongs, whether it is meant to reside on pure disk, pure tape, or on the IBM Virtualization Engine TS7510.

3.2.1 Current backup types

Two types of backup are being performed primarily in data centers today. It is important to understand the advantages of these types of backups and which belong in your backup environment. The two types of backup types are:

- **Full backups**: With this type of backup, everything that is on the server is backed up. While this is an effective way to back up a server or disk subsystem, it is wasteful.
- **Differential or incremental backups**: This type of backup dramatically reduces the amount of tape, disk, or both required for all jobs. It is an alternative to the full backup.

The reason for looking into which backup type is used for which type of data is to determine whether an architectural change in the way backups are done can benefit the current environment.

You must also consider the type of data to back up:

- Database

  Database data tends to be highly compressible, especially if you are backing up database dumps and transaction logs. Backing up the database dumps and transaction logs is a wonderful way to back up data, especially if the databases are very large. This type of data is best housed on pure tape. However, there are cases where it is useful to keep a couple of copies on pure disk or on the IBM Virtualization Engine TS7510 for immediate recovery of data.

- E-mail

  E-mail data tends to be filling for both disk and tape. Due to government regulations, companies are forced to keep e-mail for the lifetime of the employee. If the employee is an executive, companies must keep e-mail for the life of the company. We recommend that you have a mixed environment for e-mail, both the IBM Virtualization Engine TS7510 for a week or two of e-mail data and pure tape for remainder of the time after that.

- File servers

  File servers tend to house thousands of unused files. Incremental backups and using the IBM Virtualization Engine TS7510 are perfect for file server type data. Since incremental backups save everything that has changed since the last full backup, the amount of physical disk required is usually at a bare minimum. It provides the least expensive way to protect this type of data along with a fast way to restore it.

- Images and highly compressed data

  Images are normally used for archive type of data, and the file sizes can be either very small or very large. Since they are normally highly compressed data types, they do not compress on disk or compact on tape. Because they can require large amounts of storage media, this type of data should preferably reside on high capacity tape.

- Company-critical data

  Company-critical data needed for day-to-day operations should reside on the IBM Virtualization Engine TS7510. In addition, and for disaster recovery, it should be written to native tape. While backup data for the past few days is housed on the IBM Virtualization Engine TS7510 for immediate need, it is still protected in a pure tape format for legal review on or off site.

Important: With all the different types of data, write down the amount of each type that is backed up daily. This will assist you in calculating the amount of disk space required in the equation in 3.2.5, “Basic equations for data backup” on page 31.

You can use the worksheet provided in Table 3-9 to help you in sizing the backup requirements for your data.

Table 3-9 Evaluating backup requirements

Data group	Backup type	Daily amount of backup data	Restore requirements	Comments
Application	Incremental or full			
Client	Incremental or full			

3.2.2 Location where the data resides

Where most of the primary data resides is as important as the type of data. Your data may reside in the following locations:

- Storage area network
- Local area network
- Wide area network

If data is housed on the existing SAN, then the usage of both tape and the IBM Virtualization Engine TS7510 is beneficial. Since most modern day tape devices can buffer data being written, they can receive data at least as fast as disk and write pretty much equal to disk speeds or even faster.

Most companies' primary data pools are spread across a LAN or a WAN. If your data is residing in either a LAN or WAN, you must consider a lot of factors. If most of the data is sitting on the LAN, it is important to know the type of connection:

- 10/100 Mb Ethernet
- Gigabit Ethernet

The majority of companies today are running 10/100 megabit networks, with some gigabit backbones in place as dedicated backup networks. Those with Gigabit Ethernet have an advantage, because servers on Gigabit Ethernet networks back up faster than those on 10/100 networks.

Regardless of which network you are using, you must analyze each server for the amount of data it is backing up. The server may warrant being attached directly to the SAN or Gigabit Ethernet LAN to enhance the backup process.

If a WAN exists in your environment, it is usually over dedicated lines from the local phone company. The WAN can be a great companion. With the IBM Virtualization Engine TS7510, we can replicate our virtual tapes (2.4.3, "Network Replication" on page 15), which gives us the ability to do off-site vaulting of our backup data.

> **Tip:** High-speed networks dedicated to backups can significantly enhance backup speeds. We recommend that you install Gigabit Ethernet networks, SANs, or both to optimize backup performance.

3.2.3 Time at which the majority of restores occurs: Restore pattern

You should also investigate the time at which the majority of the restores occurs. They usually occurs after the first two weeks from when the data is backed up. Table 3-10 can help you build a time line to judge how much disk you will need based on your current backup scheme. If the majority of your restores happen in the first two weeks, we recommend that you acquire enough disk for the IBM Virtualization Engine TS7510 for at least four weeks worth of storage. This will allow for growth and protect you from any surprises.

Use Table 3-10 as a guide, but be sure to check it for all of the data that you plan to put on the IBM Virtualization Engine TS7510 or tape for that matter.

Table 3-10 Restore pattern

Number of restores	1 day	5 days	10 days	15 days
1 - 5				
6 - 10				
11 - 20				
20 - 30				
30 - 50				

Tip: Once you determine when most of your restores occur, you can properly size the amount of disk required for the TS7510. The number of days is important to the overall equation defined in 3.2.5, “Basic equations for data backup” on page 31.

3.2.4 Service-level agreements

SLAs are an important part of the backup environment. They keep divisions within companies in line. The SLA defines a promise level for the amount of time it takes to back up and restore certain types of data.

For example, all e-mail that is less than two weeks old needs to be restored within one hour of the request. In this case, the data should be stored on the IBM Virtualization Engine TS7510 so that data can be restored immediately. Other SLAs may define that all requests for restores of data, which is more than one month old, can have 24 to 36 hours recall time. In this case, the data is usually housed on tape either on site or off site and requires a physical tape library attached to the IBM Virtualization Engine TS7510.

When sizing an environment, take all aspects into account. The two questions that you should ask with regard to SLAs are:

- What are the current backup and restore SLAs?
- Do these SLAs have an off-site requirement?

Tip: If you do not have any SLAs established, we recommend that you establish them. Doing so helps to reduce the costs associated with storing data and places higher priority backups in better accessible positions.

3.2.5 Basic equations for data backup

In summary, you need to solve a basic equation for each type of backup data. You need the amount of the daily backups for each data type, the SLAs associated with restoring these types of data, and the number of days necessary to hold this data on disk to accomplish the restores.

The following equation describes the most basic method required to properly size the amount of disk you need for the IBM Virtualization Engine TS7510. You take the amount of data that you backup daily and multiply it by the average number of days that restores occur (see also Table 3-10 on page 30). This gives you the amount of disk space that is required to accomplish the current backups. In summary, you use this equation:

```
(daily amount of backup data) x (number of days restores normally occur for that type of
data) = (disk space required for current backup environment)
```

Once you know the amount of disk space, you need to multiply that number by the percentage of monthly data growth which will give you the percentage of disk growth. You use this equation:

```
(disk space required for current backup environment) x (% monthly data growth)=
(% of disk growth)
```

Finally multiply the disk space that is required for the current backup environment with the percentage of disk growth. This gives you the amount of disk required for the IBM Virtualization Engine TS7510. The equation is as follows:

```
(disk space required for current backup environment) x (% of disk growth)=
(amount of disk required for the initial IBM Virtualization Engine TS7510)
```

We cannot stress the importance of SLAs enough. SLAs are key because they help us decide where the best place is to store the data. If the data has a storing period of one to three weeks, keeping it on the IBM Virtualization Engine TS7510 is a good idea. If storing the data has a requirement of more than three weeks, then it belongs on tape after that time, since tape is still the least expensive and most reliable way to store data in a portable format.

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Installation planning and basic setup

In this chapter, we present important details to help you plan for the installation and basic setup of the IBM Virtualization Engine TS7510. In doing so, we examine the supported environments, device driver installation, and preparation for using software from an independent software vendor (ISV).

By the end of this chapter, you should understand the implementation requirements for IBM Virtualization Engine TS7510 and the tasks that are necessary to install and implement it in your environment.

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4.1 Installation planning

Physical planning is a customer responsibility. You can find detailed planning information in the *IBM Virtualization Engine TS7510 Introduction and Planning Guide*, GC26-7767. In this section, we give you an overview on the requirements for installing the IBM Virtualization Engine TS7510 in your environment.

4.1.1 Physical site planning

When you are planning the floor and space requirements of your storage units, consider the dimensions and weight of the IBM Virtualization Engine TS7510 components. The total weight of the TS7510 depends on the number of components installed. Table 4-1 lists the weight of each component.

Table 4-1 TS7510 component weight

Unit	Weight
3952 Tape Frame	261 kg (575 lb) not configured; 695 kg (1450 lb) maximum configuration (contains two 3955-SV5, six 3955-SX5, 3954-CV5)
TS7510 Virtualization Engine (3954-CV5)	26 kg (58 lb)
TS7510 Cache Controller (3955–SV5)	40 kg (88 lb)
TS7510 Cache Module (3955–SX5)	40 kg (88 lb)

Table 4-2 shows the physical dimensions of the 3952 Tape Frame Model F05.

Table 4-2 TS7510 physical dimension

	Height	Width	Depth
3952-F05	1804 mm (71.0 in)	644 mm (25.4 in)	1098 mm (43.2 in)

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Figure 4-1 shows the physical foot print of the 3952 Tape Frame Model F05, including service clearance.

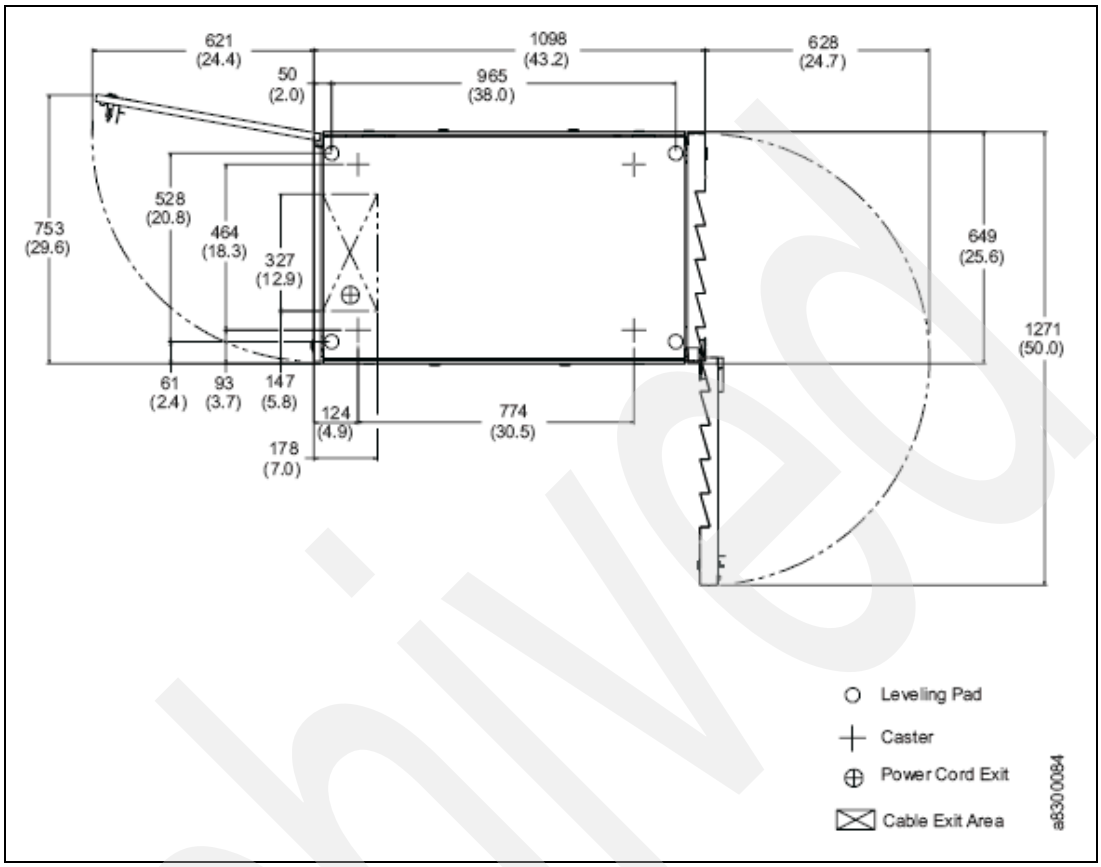

Figure 4-1 3952-F05 physical foot print

Table 4-3 lists the power requirements and the heat output of the IBM Virtualization Engine TS7510 components.

Table 4-3 Heat output and electrical specifications

Unit	Heat output	Electrical power	Inrush current	Leakage current
TS7510 Virtualization Engine (3954-CV5)	1766 BTU/hr 0.518 kW	0.51 kVA		
TS7510 Cache Controller (3955–SV5)	1088 BTU/hr	390 W		
TS7510 Cache Module (3955–SX5)	1088 BTU/hr	390 W		
3952 Tape Frame with maximum configuration	13.7 kBTU/hrs	4.0 kVA	300 Ampere	11.5 mA

There are no unique power supply requirements for the IBM Virtualization Engine TS7510. The 3952 Tape Frame Model F05 contains a power supply that can attach to 200 V to 240 V ac at 50 Hz to 60 Hz.

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Redundant power is available with the Dual AC Power feature (feature code (FC) 1903). This feature provides one additional Power Distribution Unit to allow connection to independent branch power circuits. If you order this feature, you receive two power cords.

All components of TS7510 are dual power ready (CV5, SV5, SX5). Without the Dual AC Power feature (FC1903), all components run on a single power distribution.

4.1.2 Supported environments

The IBM Virtualization Engine TS7510 is supported on a wide range of environments. In this section, we give you an overview what is supported. For the most current list of supported products or for more information about support, refer to:

http://www.ibm.com/servers/storage/tape

Host systems

IBM Virtualization Engine TS7510 supports the host systems listed in Table 4-4.

Table 4-4 Supported host systems

Platform	Minimum supported levels
RS6000 or IBM @server pSeries®	AIX® 5L™ Version 5.1, or later
Wintel and xSeries	Microsoft® Windows® 2000 (build 2195 or later), Windows 2003 (build 3790, or later), Linux Red Hat Enterprise Linux (RHEL) 3.0, SUSE Linux Enterprise Server (SLES) 8 SP3, and SLES 9
IBM @server pSeries or zSeries® for Linux	SLES 8 SP3 and SLES 9
HP	HP-UX 11.0, 11.i (64 bit), 11.23i, and 11.23pi
Sun™	Solaris™ 8 and 9

Backup applications (ISV software)

The IBM Virtualization Engine TS7510 is supported currently by the following ISV software products:

- IBM Tivoli Storage Manager at version (5.2.7 and 5.3.2 and later)
- Symantec Veritas NetBackup
  - At Versions 5.1 and 6.0 (and later) on the following operating systems:
    - AIX
    - Win2k
    - Win2k3 (32-bit)
    - RHEL3
  - Support for virtual libraries with emulation of LTO2 and 3592-J1A Tape Drives and with library type TS7510
  - No support for Import/Export by NetBackup

More ISV software products will support IBM Virtualization Engine TS7510 over time. For the latest information, see:

http://www.ibm.com/servers/storage/tape

SAN environments

The IBM Virtualization Engine TS7510 is supported by a variety of Fibre Channel (FC) switches and Fibre Channel directors which supports Fibre Channel Arbitrated Loop (FC-AL) login. The support is dependent on the server, operating system, and host bus adapter that are being used.

For a current list of supported products or more information about the support and prerequisites, refer to:

http://www.ibm.com/servers/storage/tape

For the supported host bus adapter (HBA) firmware levels and SAN fabric components, see:

http://www-03.ibm.com/servers/storage/support/config/hba/index.wss

Backend tape libraries and tape drives

To use the Import/Export function of the IBM Virtualization Engine TS7510, at least one of the following tape drive or tape library types must be connected to the TS7510:

- IBM 3592-J1A Enterprise Tape Drive
- IBM LTO Ultrium 2
- IBM LTO Ultrium 3
- IBM 3584 UltraScalable Tape Library
- IBM 3494 Tape Library

The Import/Export function works only with the same media type in the front end (virtual) and in the back end (physical). This means that, for example, you cannot export a virtual LTO2 media to a physical 3592 media.

4.1.3 Management Console

A Management Console is used for configuration, management, and service support of the IBM Virtualization Engine TS7510. This console is required by the TS7510 and is either supplied by the customer or optionally ordered from IBM. The minimum requirements for the Management Console are:

- Hardware requirements
  - x86 (Pentium® or later) microprocessor
  - 512 MB memory
  - 175 MB of disk space for Virtualization Engine Console
  - Keyboard, mouse, and CD-ROM drive
  - Super VGA monitor (at least 800 x 600 and 256 colors)
  - One Ethernet port for attachment to the TS7510 management network
  - One additional Ethernet port recommended for Internet access
  - A Web browser and Java™-2 JRE installed
- Supported operating environments
  - Windows 2000 with Service Pack 4 (SP4)
  - Windows 2000 Advanced Server SP4
  - Windows 2000 Datacenter Server SP4
  - Windows 2003 Server Enterprise Edition
  - Windows 2003 Datacenter Edition

The Management Console must be installed prior to the installation of the IBM Virtualization Engine TS7510.

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4.1.4 Virtualization Engine Console

For configuration, management, and service support of the IBM Virtualization Engine TS7510, IBM provides a graphical user interface (GUI), which is called *Virtualization Engine Console* (VE Console). The installation package, which contains the VE Console, is provided on a CD. You must install this VE Console on the Management Console server and, for your convenience, you can also install the VE Console on additional servers. The system must be a Microsoft Windows machine as described in 4.1.3, “Management Console” on page 37.

The VE Console does configuration and monitoring of the IBM Virtualization Engine TS7510.

4.1.5 Customer provided items and infrastructure responsibilities

In general, customers are responsible for providing the appropriate infrastructure resources, such as cables and switches, which are required to support IBM Virtualization Engine TS7510 connections to host and physical tape libraries. Customers are responsible for obtaining a Management Console and the appropriate adapters and cables. In addition, customers are responsible for providing Fibre Channel and Ethernet switches.

Specifically, the customer must provide the following hardware and cabling resources prior to the installation of the IBM Virtualization Engine TS7510:

- Ethernet switches and cables for connecting the TS7510 to the Management Console
  - One single node needs two Ethernet ports (management port and Remote Supervisor Adapter (RSA)) and two IP addresses.
  - A dual node configuration (active/active failover) needs six Ethernet ports and 10 IP addresses.
    - One Ethernet port and one IP address for RSA for each node
    - One Ethernet port and two IP addresses for management and first heartbeat connection for each node
    - One Ethernet port and two IP address for a second heartbeat connection for each node (must be on different subnet than the first heartbeat connection)
- Fibre Channel switches and cables for connecting the TS7510 to the host and tape devices and libraries
- Management Console, as described in 4.1.3, “Management Console” on page 37

Customers are responsible for providing network connections (cables and switches), real tape libraries (if needed), Simple Network Management Protocol (SNMP), e-mail server, and e-mail services for Call Home (for remote alerting).

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4.2 Installation of IBM Virtualization Engine TS7510

The IBM Virtualization Engine TS7510 hardware is shipped pre-assembled with software preloaded. However several externally connected items, such as the VE Console, require setup and some software installation to facilitate the installation.

4.2.1 IBM Systems Services Representative tasks

The IBM Systems Service Representative (SSR) who installs the IBM Virtualization Engine TS7510 is responsible for performing the following tasks during the installation:

- Unpacking and setting up the TS7510 frame
- Connecting the network cables
  - Ethernet 1
  - Ethernet 2 needed for HA Failover
  - RSA Ethernet for reliability, availability, and serviceability (RAS) functions of the CV5 hardware itself
- Connecting the Fibre Channel cables
  - Adapter 0 (PCI Slot 3, Port 1) and Adapter 2 (PCI Slot 4, Port 1) target ports for host attachments
  - Adapter 1 (PCI Slot 3, Port 2) and Adapter 3 (PCI Slot 4, Port 2) interchangeable ports for real tape or host attachments
- Setting IP addresses according to customer-provided network assignments
  - Customer must provide IP addresses, subnet mask, and default gateway information.
- Verifying that the TS7510 hardware is functioning properly
- Verifying the communications between TS7510 and Management Console

4.2.2 Customer tasks

After the IBM Virtualization Engine TS7510 is installed and configured by the IBM SSR, the user or customer must perform the following tasks:

- Creating zones for the connected hosts
- Creating virtual libraries and the associated virtual tape drives
- Creating virtual volumes
- Installing IBM tape device drivers or the required drivers from the backup ISV
- Configuring the ISV software for using TS7510

We describe all of the necessary tasks in the following sections.

4.3 SAN zoning

SAN zoning requires special considerations. The IBM Virtualization Engine TS7510 is relatively restrictive in how you zone a server to it. You must set up one zone for every initiator to target. This means that you need at least one zone for every server. If you have more than one Fibre Channel HBA in your server or if you want to connect to more than one Fibre Channel port on the TS7510, you need additional zones.

You must use soft zoning with worldwide port names (WWPN). Otherwise failover will not work.

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For a HA configuration (Dual Node), you do not have to zone the failover Fibre Channel port of the second CV5. If a failover happens, the failover Fibre Channel port takes over the WWPN of the failing Fibre Channel port. Therefore no change in zoning is required.

Figure 4-2 illustrates two servers both using resources on node 1. Two SAN zones were created for every initiator to target connections. Zones were created with WWPNs. If a failover occurs, the WWPN of node 1 will be transferred to node 2, and the target port of node 2 runs with two WWPNs. Running jobs will fail, although new jobs will be redirected to node 2.

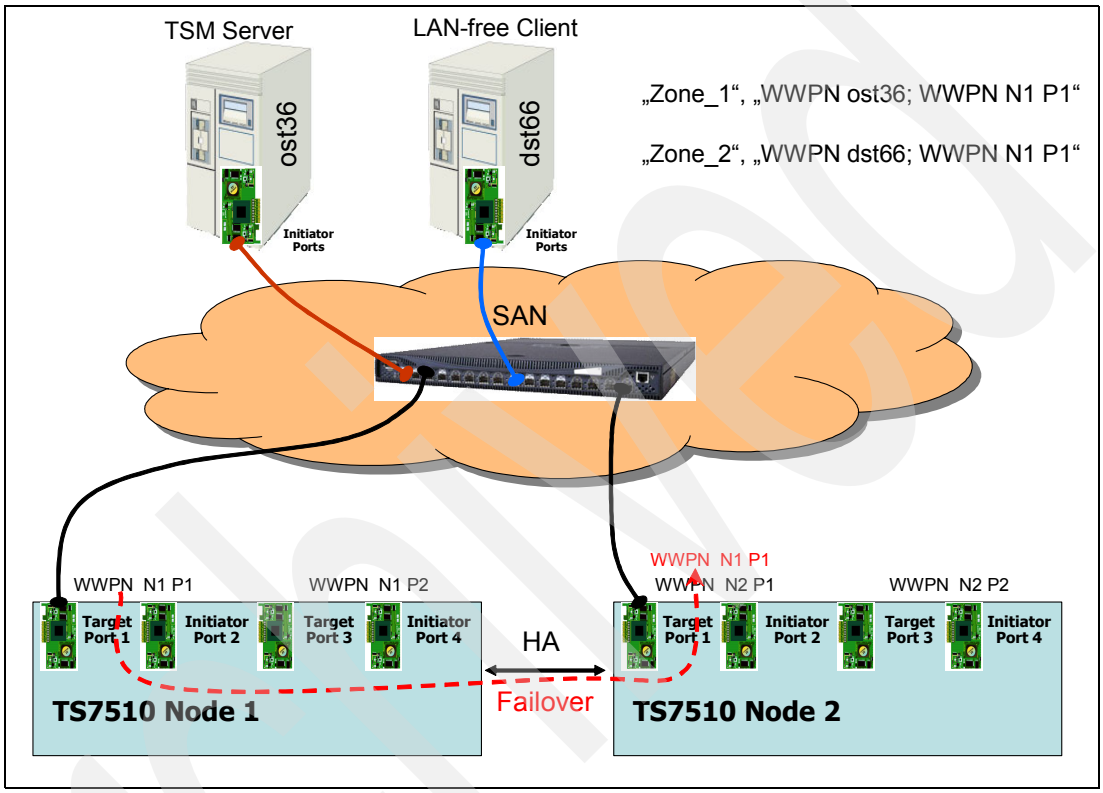

Figure 4-2 Zoning with HA

Because the IBM Virtualization Engine TS7510 boots from SV5 disks, no other disk devices should be zoned to the TS7510. Otherwise the TS7510 might not boot. Therefore before you boot the TS7510, ensure that zoning is already implemented and that the TS7510 does not see any other disk devices.

4.4 Basic setup of IBM Virtualization Engine TS7510

In the following sections, we explain how to set up and configure your IBM Virtualization Engine TS7510. We take you through an example of how to configure a virtual tape library with six virtual 3592-J1A Tape Drives. We connect this tape library to a Tivoli Storage Manager server, called *ost36*. We connect three of the six tape drives to a LAN-free client, called *dst66*. Both servers, ost36 and dst66, are running AIX. In addition, we connect one physical 3584 Tape Library with two 3592-J1A Tape Drives and configure Import/Export functions (see Figure 4-3).

In this scenario, we assume that SAN zoning is already done for the servers ost36 and dst36 to the TS7510, called *cvtrock*, and SAN zoning is done for the physical library to cvtrock. In addition we assume that the SSR performed the hardware installation and set up the first IP address. We start the basic setup by installing the VE Console.

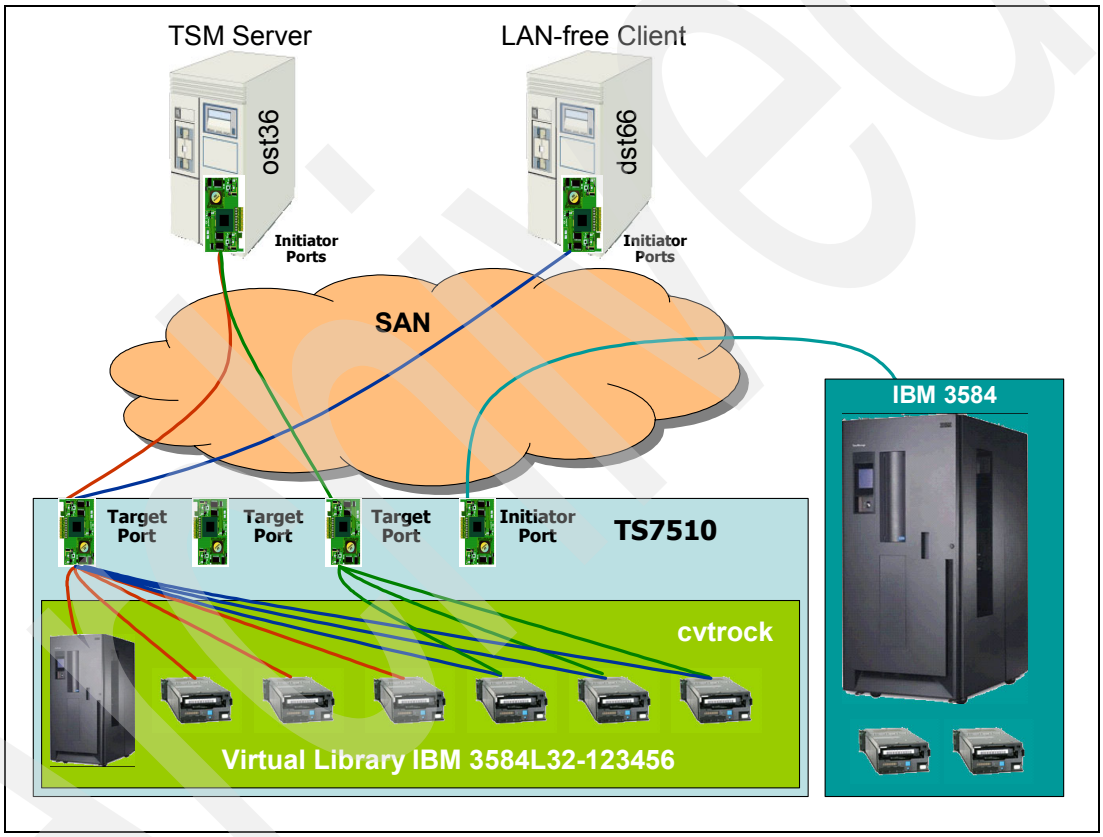

Figure 4-3 Our setup

4.4.1 Installing and setting up VE Console the first time

The VE Console installation CD includes a setup program for installation on Microsoft Windows computers. Follow these steps:

1. Insert the CD into your CD drive.
2. When the CD browser launches, select **Install Products** → **Install VE for Tape Console**.

3. In the Choose Destination Location panel of the installation wizard (Figure 4-4), you can change the installation folder if you want. By default, the VE Console is installed in the C:\Program Files\IBM\VE for Tape folder. Click **Next**.

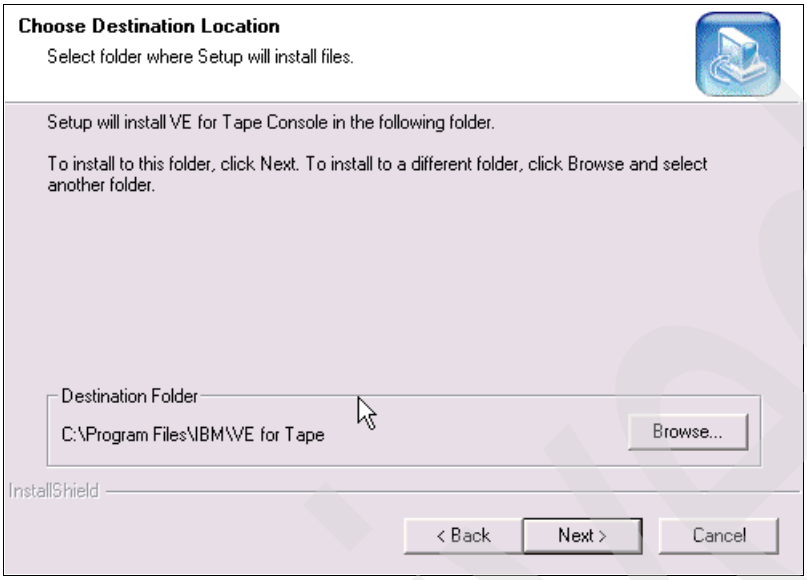

Figure 4-4 VE Console installation wizard panel indicating file destination

4. Click the **VE for Tape Console** icon, created by the installation on your desktop, to launch the VE Console.
5. When you start the VE Console for the first time, you need to create a connection to the TS7510.
   a. Select **Edit** → **Add**.
   b. In the VE for Tape User Login window (Figure 4-5), type the network name or IP address of your TS7510, and log in with your user ID and password.

   > **Tip:** The default user name is VETAPEUSER, and default password is VEUSERPASSWORD.

   c. Click **OK**.

Figure 4-5 VE Console login to TS7510

If the connection is successful, you see the entry and status window of your TS7510, as shown in Figure 4-6. In this window, you see an overview of the hardware of your TS7510. In the lower right corner, you also see the available free space capacity, the used capacity for system and tape logs, and the used capacity for your data (here called *Others*).

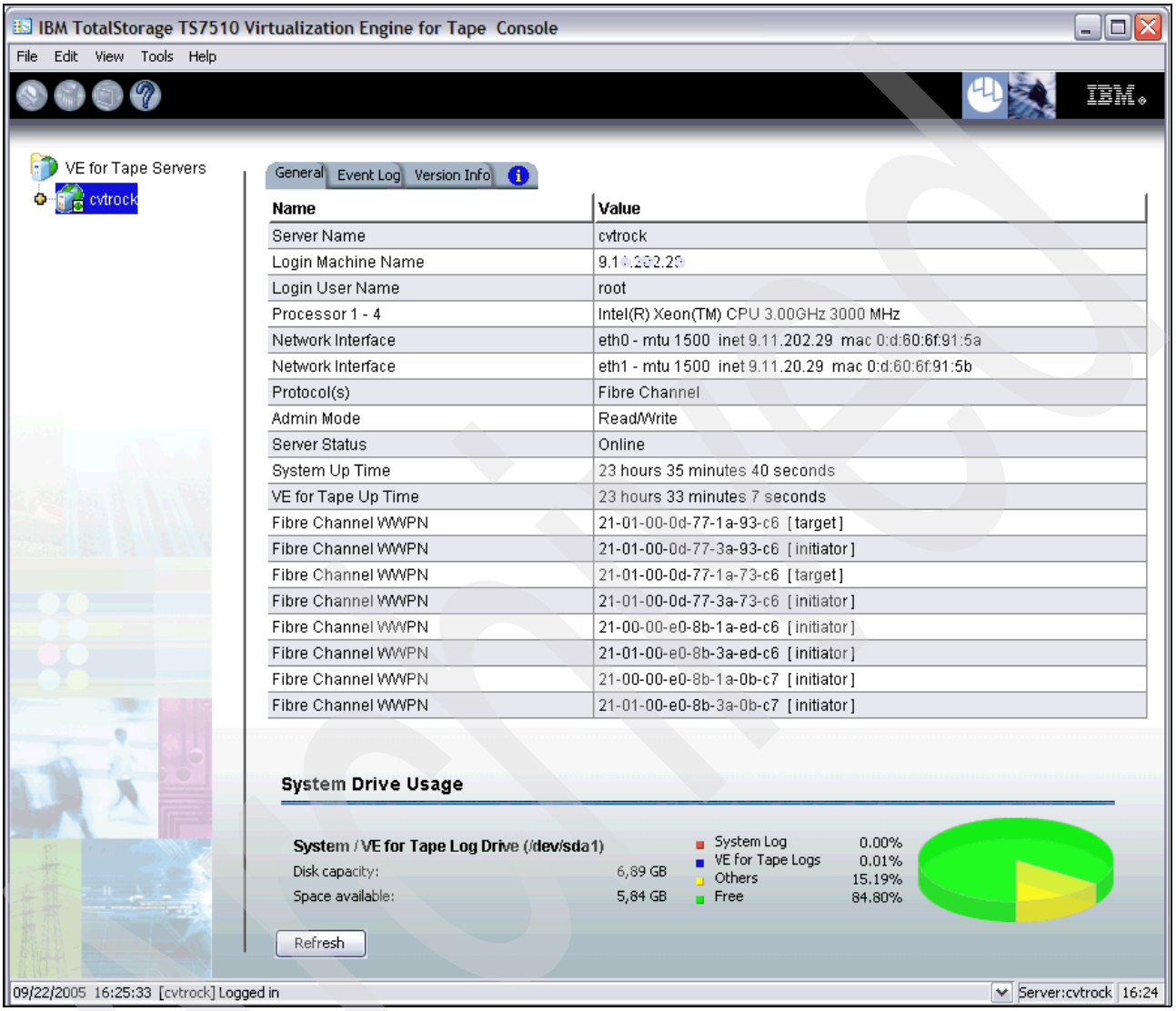

Figure 4-6 VE Console status window

4.4.2 Setting up the network

The basic network setup is done during the installation by the SSR. However, you may need to set up or check information that is specific to your network.

1. Right-click ***your TS7510 server*** and select **System Maintenance** → **Network Configuration**, as shown in Figure 4-7.

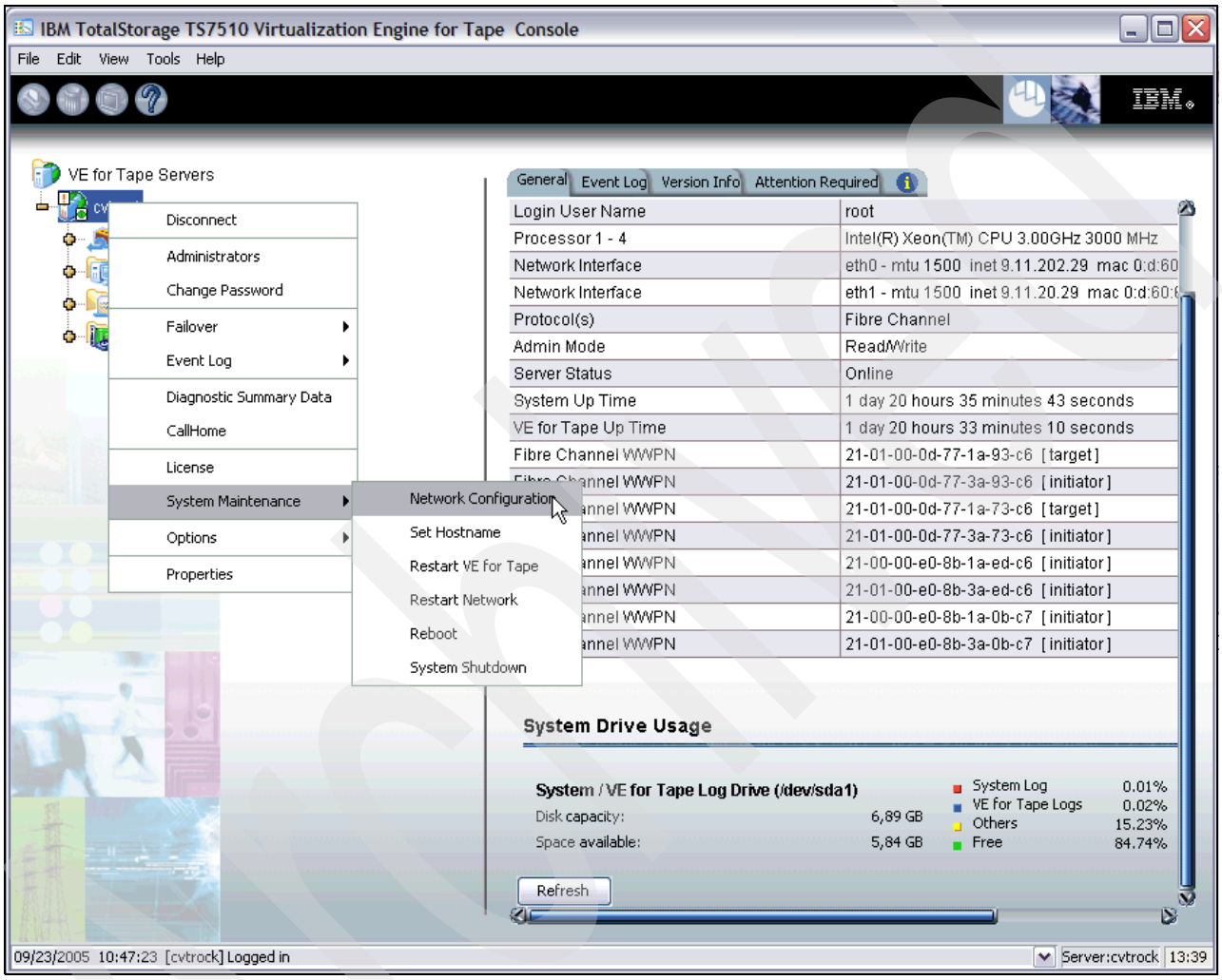

Figure 4-7 VE Console: Selecting the Network Configuration option

2. In the Network Configuration window (Figure 4-8), you perform the following actions:
   a. Enter the following information about your network configuration, if necessary.
      i. For Domain name, enter the internal domain name.
      ii. For the Append suffix to DNS lookup option, you can choose to enter a domain name. If you enter a name, it is appended to the machine name for name resolution.
      iii. For DNS, specify the IP address of your DNS server.
      iv. For Default gateway, type the IP address of your default gateway.

      Without a default gateway, you may not be able to connect to your TS7510 from outside of your subnet.
   b. Enter the network settings for the management port. For the heartbeat and failover network settings, see 4.4.13, “Setting up High Availability Failover” on page 88.

Note: In a single-node (nonfailover) configuration, you must configure ETH1 with a static dummy IP address and assign a gateway for ETH1.

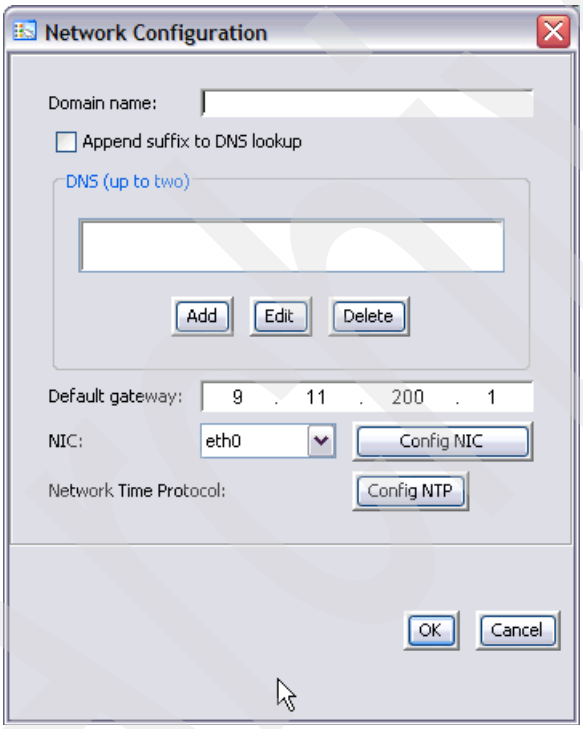

Figure 4-8 Network Configuration window

i. For NIC, select **eth0** or **eth1**.

ii. Click **Config NIC** to configure or see each Ethernet (see Figure 4-9). If you select *Static*, you must click the **Add** button to add IP addresses and subnet masks. Click **OK**.

> **Note:** For Active-Active failover configurations, you must use static IP addresses.

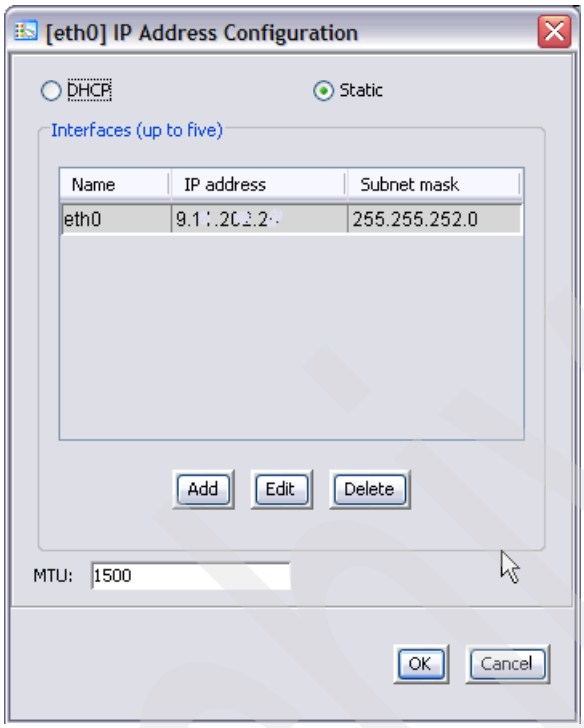

Figure 4-9 IP Address Configuration window

c. In the Network Configuration window, click **OK**.

4.4.3 Changing the default password

Next you should change the default password. Right-click ***your TS7510 server*** and select **Change Password**.

In the window that opens, type the original password (`VEUSERPASSWORD`), type the new password, and then type the new password again to confirm it.

4.4.4 Changing the console options

For your convenience, you may change some console options, such as remember password or time out for logging out. As shown in Figure 4-10, we changed the timeout value to 0 so that we are never logged out.

Here, you also have the possibility to enable the *advanced tape creation method*. With this method, you can create different configurations, which do not follow rules for real tape. Use care if you create a configuration that deviates from real tape. Such configurations might not be supported by your backup application.

Without the advanced tape creation method, which is the default method, the creation of tape libraries and tape drives follow the rules of a real physical tape. Therefore most of the required settings are predefined and must not be chosen by the user. For example, the volume size is predefined based on the cartridge type.

Important: We recommend that you *do not* use the advanced tape creation method, unless you need it and know exactly what you are doing.

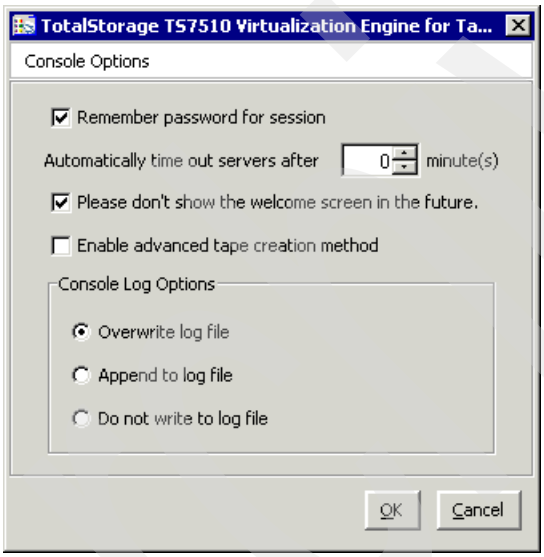

Figure 4-10 Console Options window

4.4.5 Setting up the Fibre Channel

As explained in 2.1, “IBM Virtualization Engine TS7510 Model CV5” on page 6, four Fibre Channel ports are available for connection to the backup server and to the native tape drives and libraries. Two of the four ports are already set up as the initiator for host connections:

- Adapter 0 (PCI Slot 3, Port 1)
- Adapter 2 (PCI Slot 4, Port 1)

The two other ports are interchangeable either for real tape connections or for host connections. By default, those two adapters are set up for real tape connections:

- Adapter 1 (PCI Slot 3, Port 2)
- Adapter 3 (PCI Slot 4, Port 2)

To change the interchangeable adapters:

1. Select **Physical Resources** → **Storage HBAs**. Right-click the adapter which you want to change and select **Enable Target Mode** as shown in Figure 4-11.

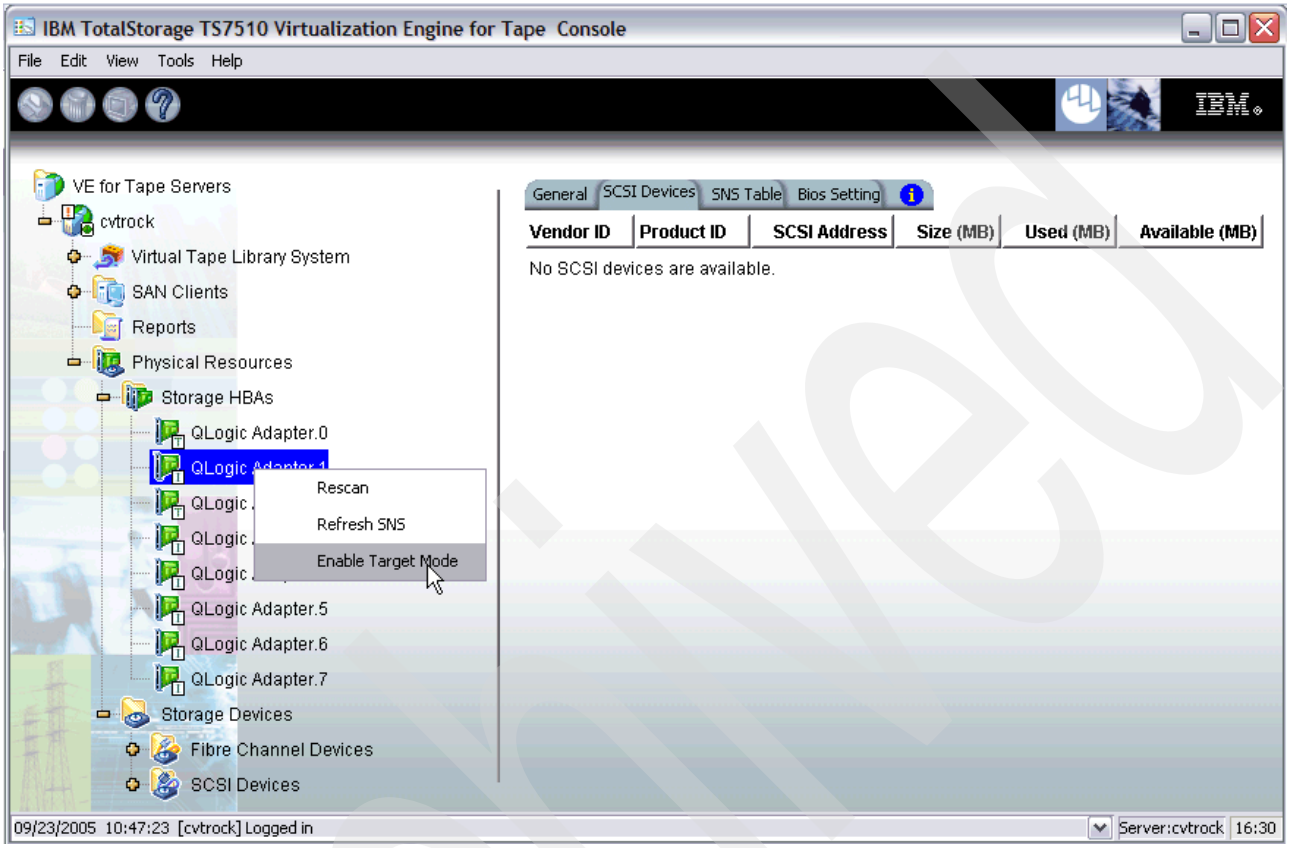

Figure 4-11 Selecting the Enable Target Mode option

2. In the Enable Target Mode window, select the **Soft Alpa creation method** option and click **OK** to enable the target mode (see Figure 4-12).

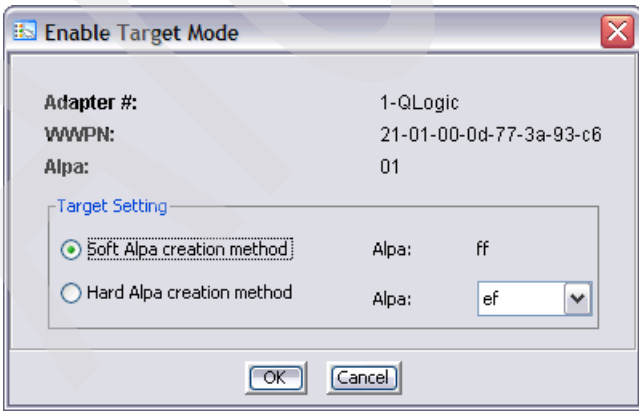

Figure 4-12 Enable Target Mode window

4.4.6 Setting up and using the physical library

The IBM Virtualization Engine TS7510 allows connection to real physical tape drives and tape libraries for importing and exporting real tape cartridges. You should use this function only for tape vaulting and not for a hierarchical storage approach, such as disk to disk to tape (D2D2T) backup. In Chapter 5, “IBM Tivoli Storage Manager usage considerations” on page 109, we discuss how the Import/Export function works and the possibilities for having a hierarchical storage approach.

Installing the physical library

In this section, we take you through an example that shows you how to connect an IBM 3584 Tape Library with two 3592-J1A Tape Drives installed. For more information or if you want to connect an IBM 3494 Tape Library, refer to the *IBM Virtualization Engine TS7510 - User’s Guide*, GC26-7769. In this scenario, we assume that you have already connected the IBM 3584 Tape Library to the Fibre Channel SAN and you have enabled zoning so that the TS7510 can see the tape library and the tape drives.

Follow these steps:

1. As shown in the left navigation pane in Figure 4-13, right-click the **FC HBA** where the tape library is connected and select **Rescan**.

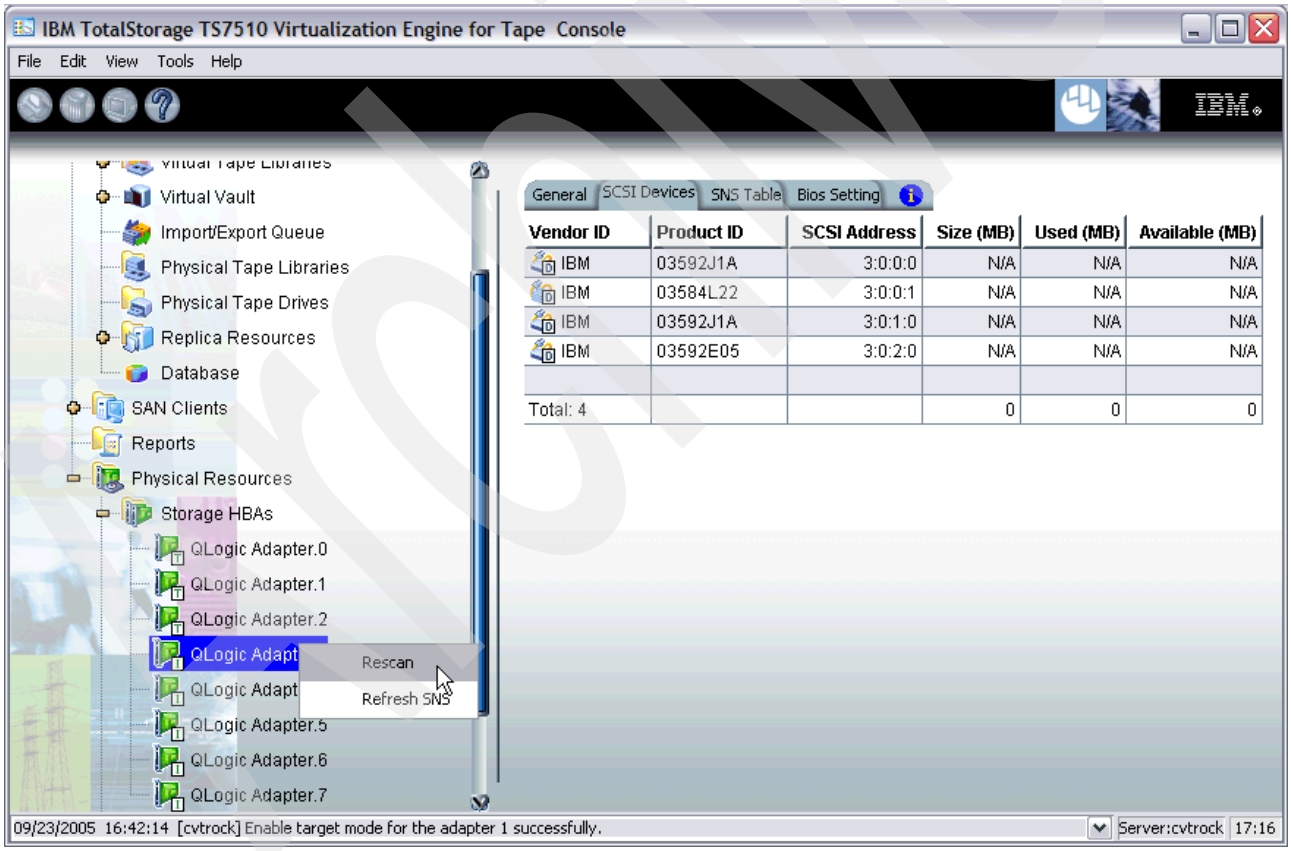

Figure 4-13 Selecting Rescan for the Fibre Channel

2. In the right pane, click the **SCSI Devices** tab. Check whether all devices are recognized by the Fibre Channel HBA.

   In our example, shown in Figure 4-13, you can see one IBM 3584-L22, two 3592-J1A Tape Drives, and one 3592-E05. We are not using the Model E05 in our example, because it is

not currently supported. A product preview, with the initial announcement of the IBM Virtualization Engine TS7510, states that future features and capabilities of the TS7510 will include support for the IBM System Storage TS1120 Tape Drive Model E05.

> **Note:** Product previews provide insight into IBM plans and direction. Specific availability dates, ordering information, and terms and conditions will be provided when the product is announced.

3. In the left pane, right-click **Physical Tape Libraries** and select **Assign**.
4. In the Assign Physical Tape Libraries window (Figure 4-14), select the device name of your library and click **Assign**.

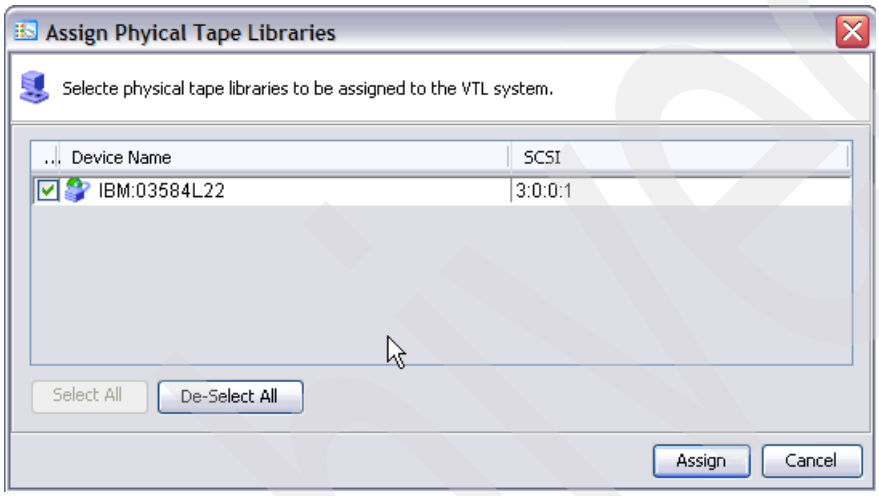

Figure 4-14 Assign Physical Tape Libraries window

5. After the tape library is assigned, assign the tape drives to it.
   a. For this scenario, right-click the **IBM:03584L22** icon and select **Assign**.
   b. In the Assign Physical Tape Drives window (Figure 4-15), select the tape drives you want to use. In our example, we select both 3592-J1A Tape Drives. Click **Assign**. Then both tape drives are allocated to the tape library.

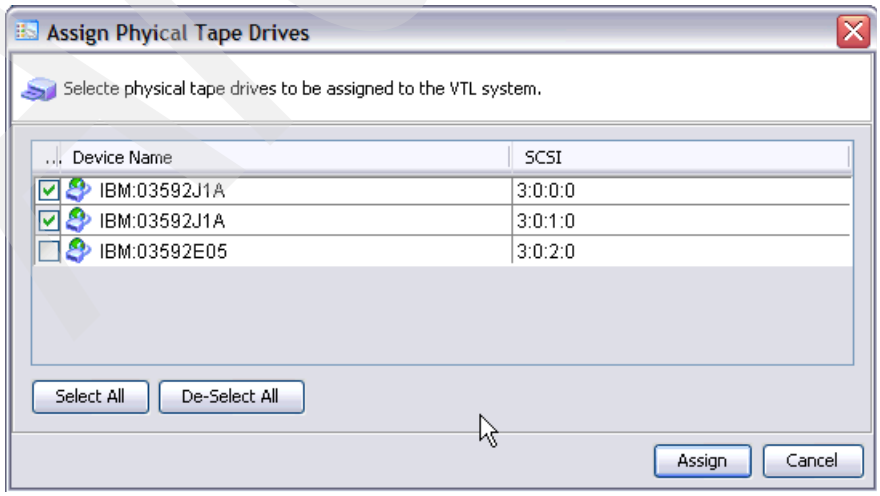

Figure 4-15 Assign Physical Tape Drives window

Verifying the installation of the physical library

Now you must verify that the tape library is properly installed. To do this, we start an inventory and move some cartridges around.

1. As shown in Figure 4-16, right-click the ***library*** and select **Inventory**. The inventory of a 3584 Tape Library normally takes a few seconds, depending on the library size.

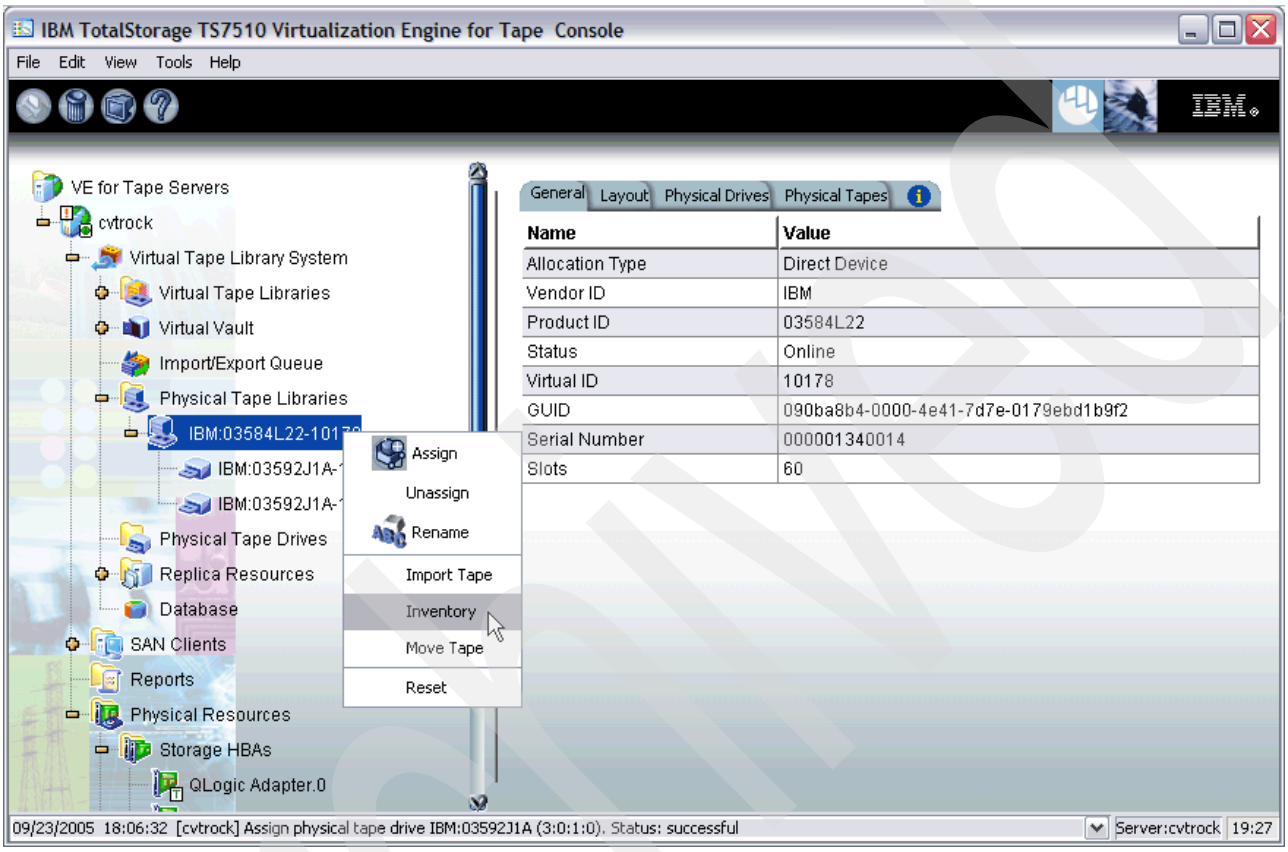

Figure 4-16 Selecting Inventory for a library

Archived

2. A library inventory starts. After it is done, check the results by selecting the **Physical Tapes** tab as shown in Figure 4-17. This window shows the available physical tape cartridges stored in your tape library.

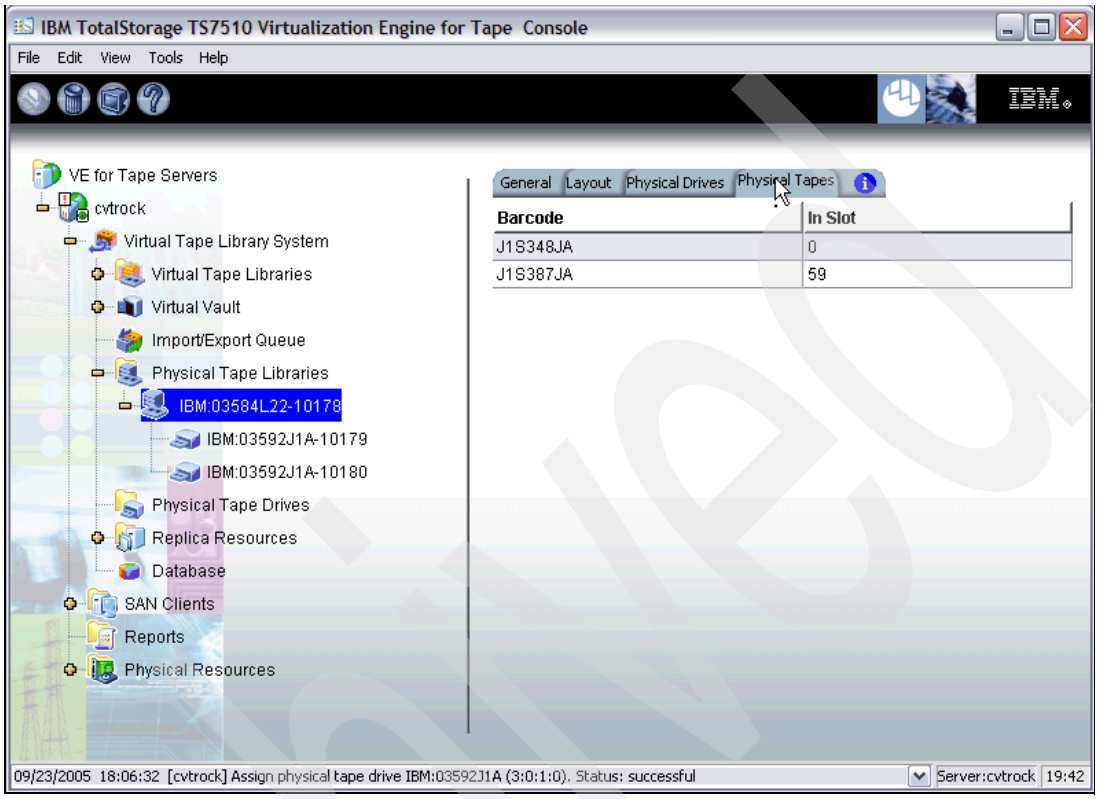

Figure 4-17 Physical Tape Inventory

3. You are now able to move some tapes around. Right-click the tape library and select **Move Tape**. You might want to select to move from *slot to slot* or *slot to drive*.

After the move is done, the physical tape inventory should reflect your movements. If not, check the event log. For more information about the event log, see 6.2.3, “Event log monitoring” on page 139.

4.4.7 Adding SAN clients to IBM Virtualization Engine TS7510

In the physical world, you assign tape drives and tape libraries to a host by creating appropriate SAN zones. With SAN zones, you can separate hosts from connecting to every tape drive. With the tape virtualization of the IBM Virtualization Engine TS7510, you can have several tape drives and several tape libraries on one single Fibre Channel port. Therefore SAN zoning, which is based on Fibre Channel ports, might not be sufficient for separating hosts. For that reason, the TS7510 allows you to create access rules on a host basis.

You can assign tape libraries and each single tape drive separately to the attached hosts, or you can assign tape libraries and tape drives to all connected hosts (Everyone_FC). If you want to control the access to tape resources, you need to introduce the attached host (SAN client) to the TS7510.

To add SAN clients:

1. Right-click the **SAN Client** icon and select **Add**, as shown in Figure 4-18.

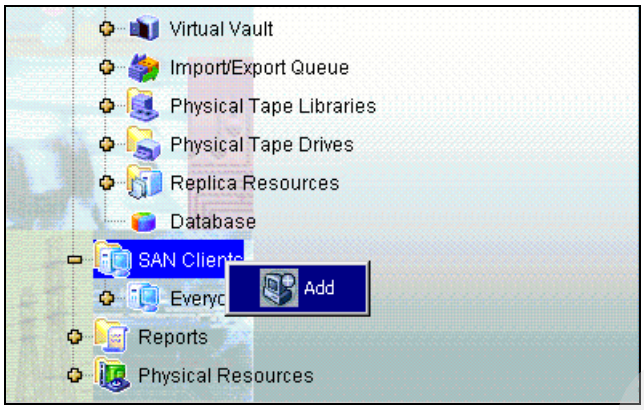

Figure 4-18 Adding SAN clients

2. In the Enter the Fibre Channel Client Name panel (Figure 4-19), type the client name. You may choose a client name together with information about the Fibre Channel HBA, such as server_fcHBA. The client IP address setup is not needed in this version of the IBM Virtualization Engine TS7510. Here we add the server ost36 with the WWPN 10-00-00-00-c9-24-ca-67.

   Click **Next**.

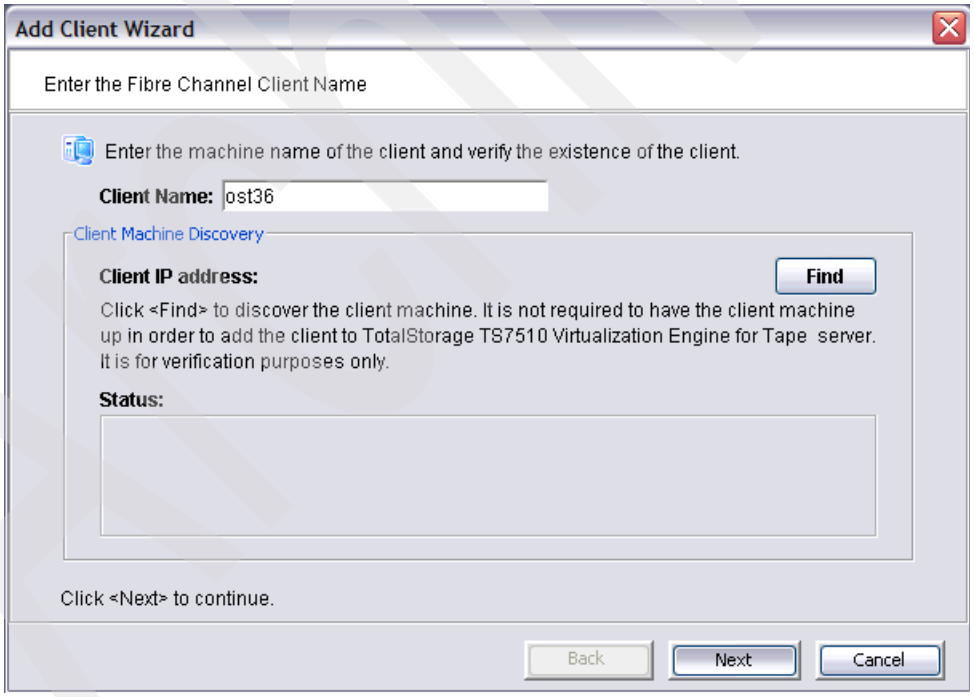

Figure 4-19 Add Client Wizard: Specifying the client name of the Fibre Channel

3. In the Set Client Fibre Channel Properties panel (Figure 4-20), select the WWPN of the client, and respectively the WWPN of the Fibre Channel HBA, you want to add. If your client has several Fibre Channel HBAs and you want to connect to the TS7510 over several Fibre Channel links, you *must* select the corresponding WWPNs of those Fibre Channel HBAs. Click **Next**.

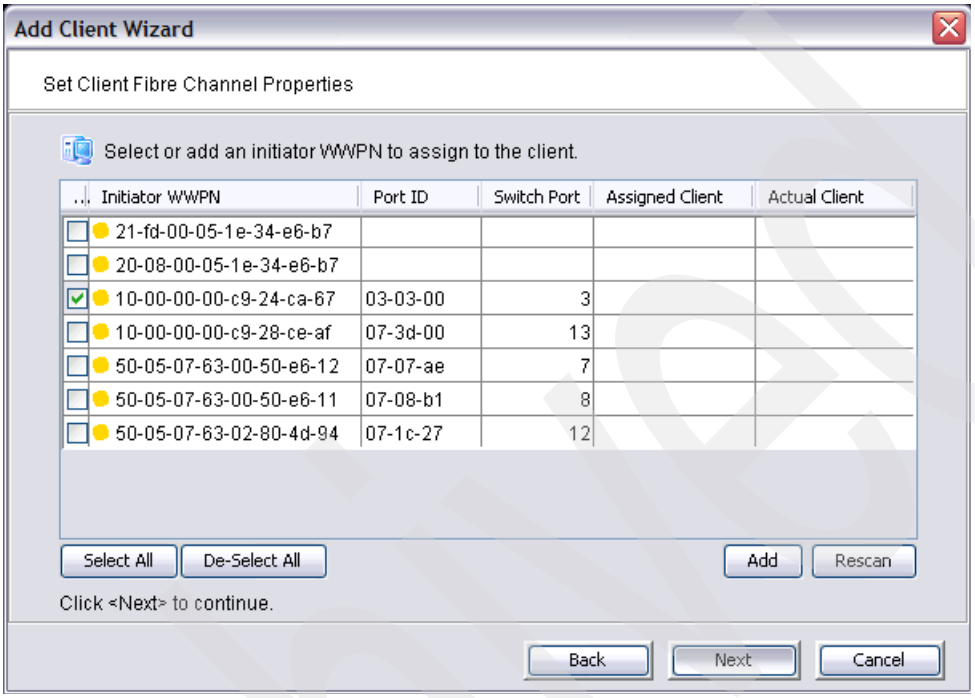

Figure 4-20 Add Client Wizard: Selecting the WWPN

4. In the Fibre Channel Option panel (Figure 4-21), determine whether you want to use *Volume Set Addressing* (VSA) for this adapter. This may be required for particular Fibre Channel storage depending upon the storage system's requirements. For example, storage that is connected to an HP-UX host with an HP Fibre Channel adapter requires VSA addressing.

> **Restriction:** IBM *@server* iSeries™ support will be available in a post-GA release of the IBM Virtualization Engine TS7510. For the latest information about supported hosts, refer to the *Independent Software Vendor (ISV) matrix for IBM Virtualization Engine TS7510* on the Web at:
>
> http://www-03.ibm.com/servers/storage/tape/compatibility/pdf/ts7510_isv_matrix.pdf

When the iSeries server is supported, you can select **Enable iSeries Support for iSeries Server Support** option and then click **Next**.

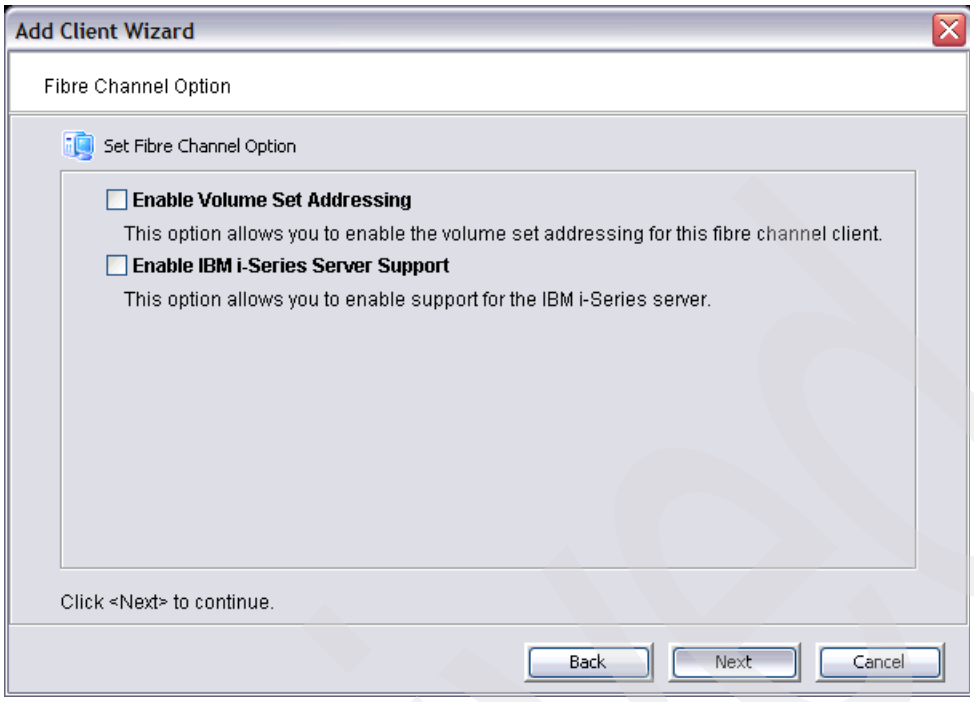

Figure 4-21 Fibre Channel Option panel

5. The next panel (Figure 4-22) shows a summary of your selections. If the information is correct, click **Finish**, and your SAN client is added. If the information is not correct, click the **Back** button to make any necessary corrections.

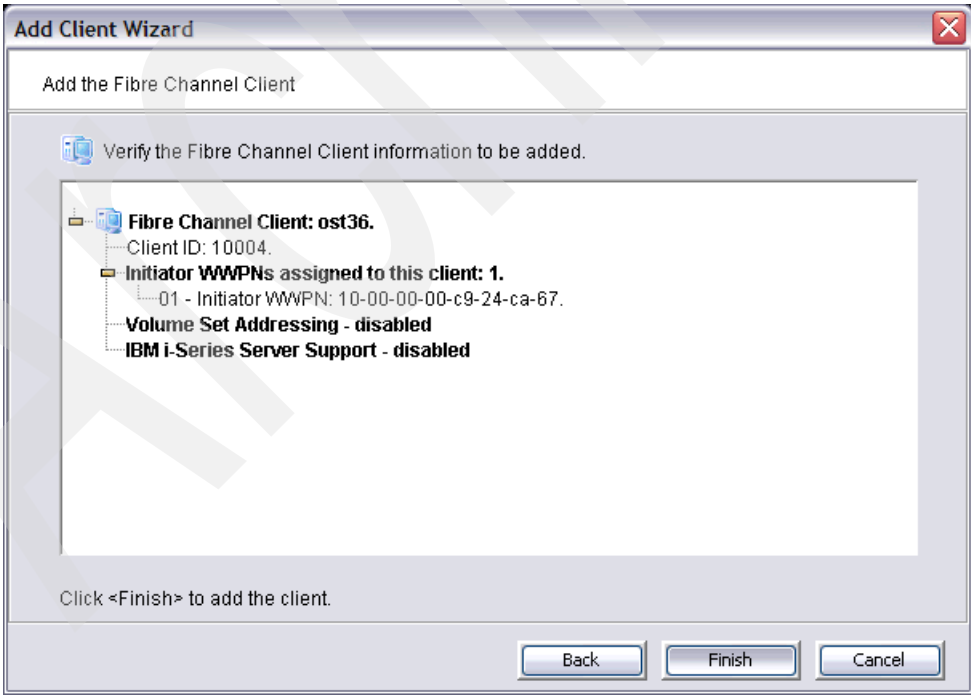

Figure 4-22 Add Client Wizard: Summary panel

To learn how to assign this client to a library and to drives, see 4.4.10, “LUN masking: Assigning a host to a library and drives” on page 69.

4.4.8 Creating libraries, tape drives, and cartridges

The IBM Virtualization Engine TS7510 comes preconfigured with two virtual IBM 3584 libraries per 3954-CV5 Virtualization Engine. Each library is comprised of 12 virtual LTO-2 tape drives and 117 slots. Each library is preconfigured with virtual tape cartridges. The number of tape cartridges that are preconfigured is proportional to the total system capacity. Each default library and the associated drives have been assigned to the Everyone_FC client, and two of the four Qlogic adapter ports are set to Target mode (0 or 2). The default libraries are accessible as soon as the TS7510 is powered on. You can immediately start using these libraries without any additional configuration necessary through the VE Console.

You can use the default libraries, if they are suitable for your usage, or you can change the default libraries, and you can create additional new libraries. Keep in mind the following rules:

- Up to 64 virtual libraries are supported by one single node.
- Up to 512 virtual drives are supported by one single node.
- Up to 4096 virtual tape cartridges are supported by one single node.
- One virtual library can contain only drives of one type.
  - No mixed configuration is supported.
  - LTO2 and LTO3, therefore, cannot exist in one virtual library.
- If the Import/Export function is used, the virtual drive type and virtual cartridge capacity must match with the physical drive type and physical cartridge capacity.
- Use library type IBM 3584 L32, except if you are using Veritas NetBackup, in which case, you must use library type TS7510.

For detailed information about how to create and change a virtual library, refer to the *IBM Virtualization Engine TS7510 - User's Guide*, GC26-7769.

To create a virtual tape library with six virtual 3592-J1A Tape Drives, follow these steps:

1. As shown in Figure 4-23, right-click the **Virtual Tape Library System** icon and select **New**. This starts the Creating Virtual Tape Library Wizard.

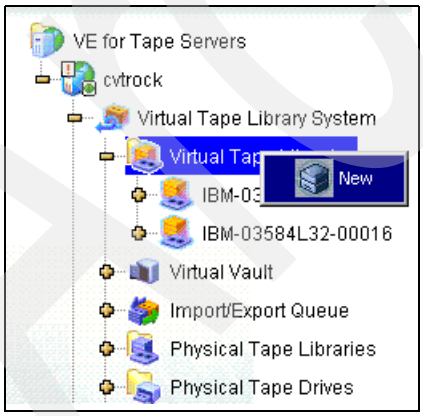

Figure 4-23 Starting to create a new virtual library

2. In the Specify Virtual Library Name and Type panel (Figure 4-24), select the library type, and type a name for the new virtual library.

   When using Veritas NetBackup as a backup application, select TS7510 for the library type. For all other applications, use IBM 3584-L32. In this example, for the library type, we select **IBM 3584-L32** and for Virtual Library Name, we type `IBM-03584L32-123456`. Then click **Next**.

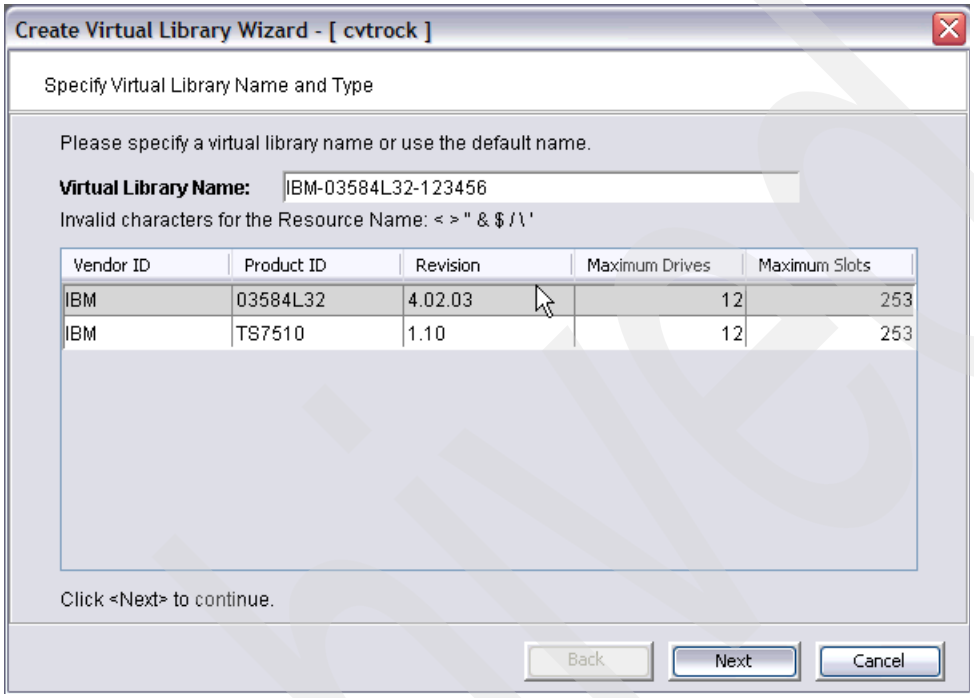

Figure 4-24 Specify Virtual Library Name and Type panel

Archived

3. Define the virtual tape drive. As shown in the Enter Virtual Drive Information panel (Figure 4-25), you can choose either LTO Ultrium Generation 2, LTO Ultrium Generation 3, or 3592-J1A as the tape drive. You can also select the number of tape drives you want to create and specify the drive name prefix used by the TS7510. We choose six 3592-J1A Tape Drives and leave the default drive name IBM-03592J1A.

   Note: Veritas NetBackup only supports library type TS7510 with drive type LTO Ultrium 2 or 3592-J1A.

   Click **Next**.

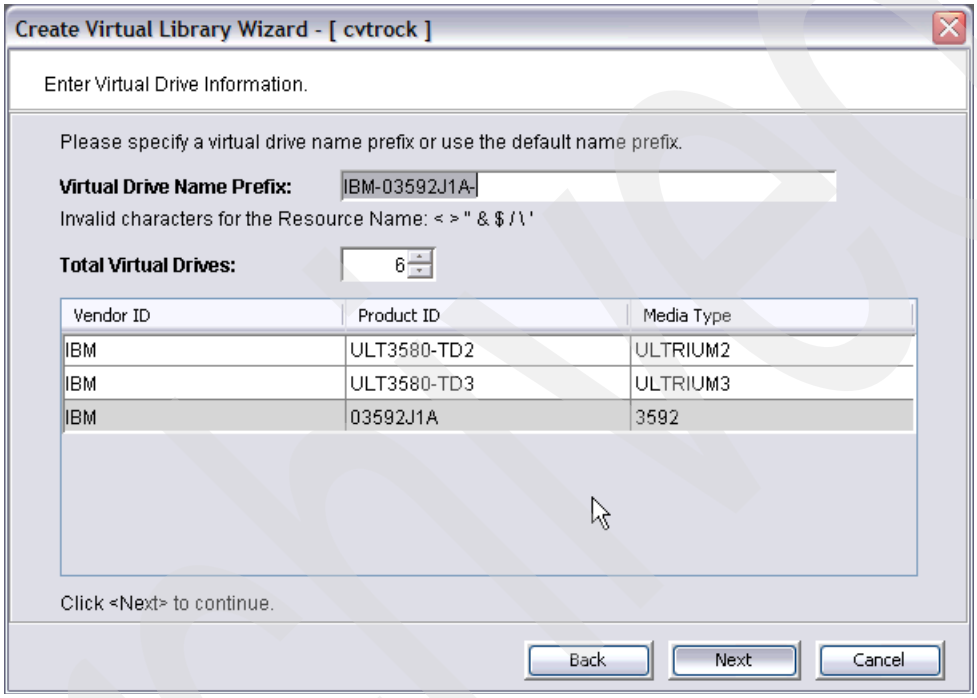

Figure 4-25 Selecting the tape drive

4. In the Enter Virtual Library Information panel (Figure 4-26), for this example, we select **Auto Archive / Replication**. You select this option if the TS7510 should automatically *move* or *copy* virtual volumes to physical tape or to another TS7510, whenever a virtual tape volume is moved to the *input/output station (I/O station)*, either by the ISV (exported from the ISV application) or manually.

   Note: The I/O station is also referred to by other names, such as *Import/Export* and *bulk IO*, but the names have the same meaning.

   You may have a physical tape connected to the TS7510. In this case, you can also select Auto Archive / Replication for *automatic copying* of virtual volumes to real, physical tape after you or your backup application has moved the virtual volume to the I/O station. That is, you export a cartridge.

   You can select either Copy or Move. The *Copy* function copies the data from the virtual tape to a real physical tape, and the virtual volume remains stored in the virtual vault.

   With the *Move* function, you can specify how long to store the virtual volume in the virtual vault, before it is deleted. If you select 0 days, the virtual volume is deleted after the data is copied to the physical tape. In addition, you can have the TS7510 move the copied

physical tape cartridge to the I/O station of your physical library (3584 or 3494). You do this by selecting the Exporting physical tapes to I/E slots after export option. In this example, we select **Auto Archive** and the **Move** function and then click **Next**.

> **Important:** Auto Archive works only if virtual barcode labels match the physical barcode labels.

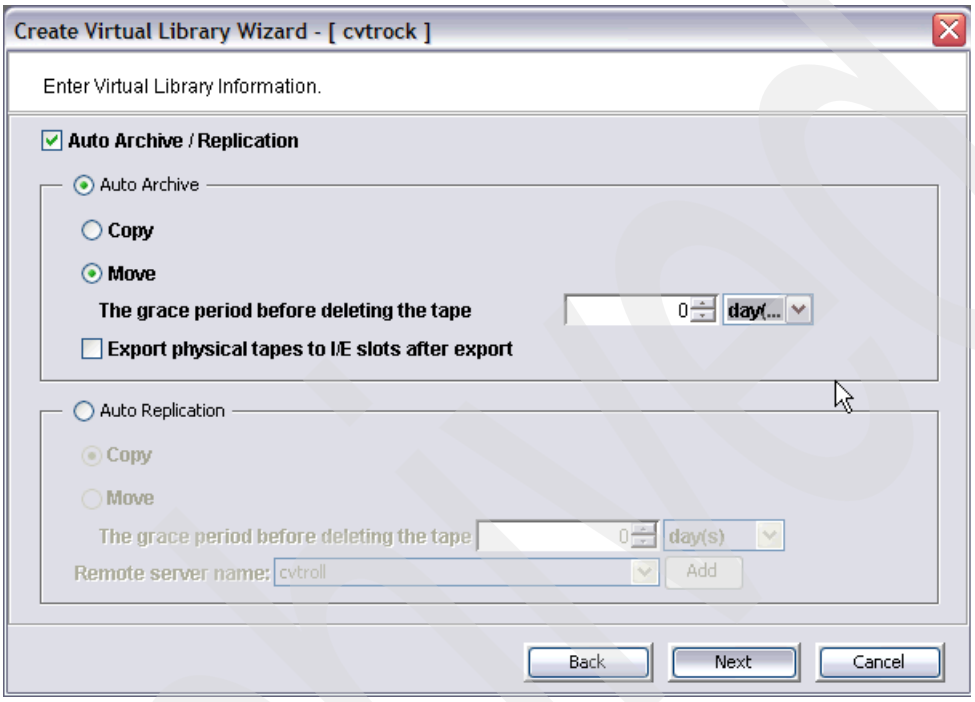

Figure 4-26 Selecting the Auto Archive / Replication option

For more information about Auto Archive or Auto Replication, see 2.4.2, “Import, Export, and Auto Archive functions” on page 12. We demonstrate the Auto Archive function in 5.3, “Using Import/Export with Auto Archive for vaulting” on page 115.

5. In the next panel (Figure 4-27), you specify a volume range. This defines only the barcode range for the virtual volumes, but does not create the virtual volumes.

   If you want to export tapes from the TS7510 to real tape, keep in mind that export works only if the barcode labels of the virtual and physical volumes match. If you want all virtual volumes to have the capability to be exported, you must select the *same* volume range as you have for your physical tape cartridges. In our example, we select a different barcode range than our physical tape library has in use. As you can see in Figure 4-27, we choose the volume range AA0000 to AA0099.

   Also on this panel, you can select the size of the virtual library and the size of the I/O station. We want to create an virtual library with 1000 slots to allow for a possible growth in the next few years. You can use the Export to physical tape check box to limit the maximum size of a virtual tape in order to match a physical cartridge. We leave the I/O station at the default of 10 slots.

   Click **Next**.

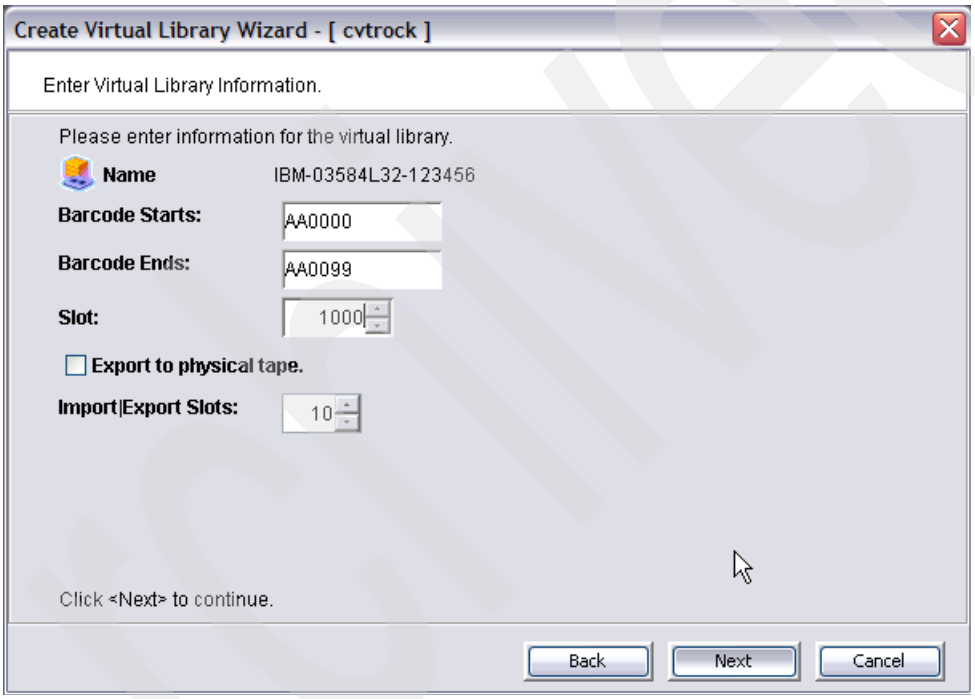

Figure 4-27 Virtual volume barcode range

6. You see an information message like the example in Figure 4-28. which indicates that we are going to create a library with more than 253 slots. This should not be a problem for any ISV software unless you do not have the right license from your ISV to support the size of this library. Some ISVs, such as Legato Networker, license slots in the library.

   You see a similar message if you create a library with more than 12 tape drives, which is not a problem.

   Click **OK** to the message.

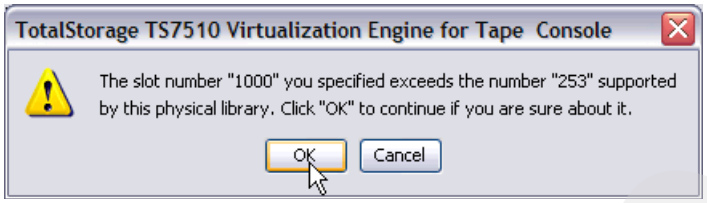

Figure 4-28 Information message about the library size

7. In the Create Virtual Library panel (Figure 4-29), verify the details and click **Finish** if it is correct. Then the virtual library is created.

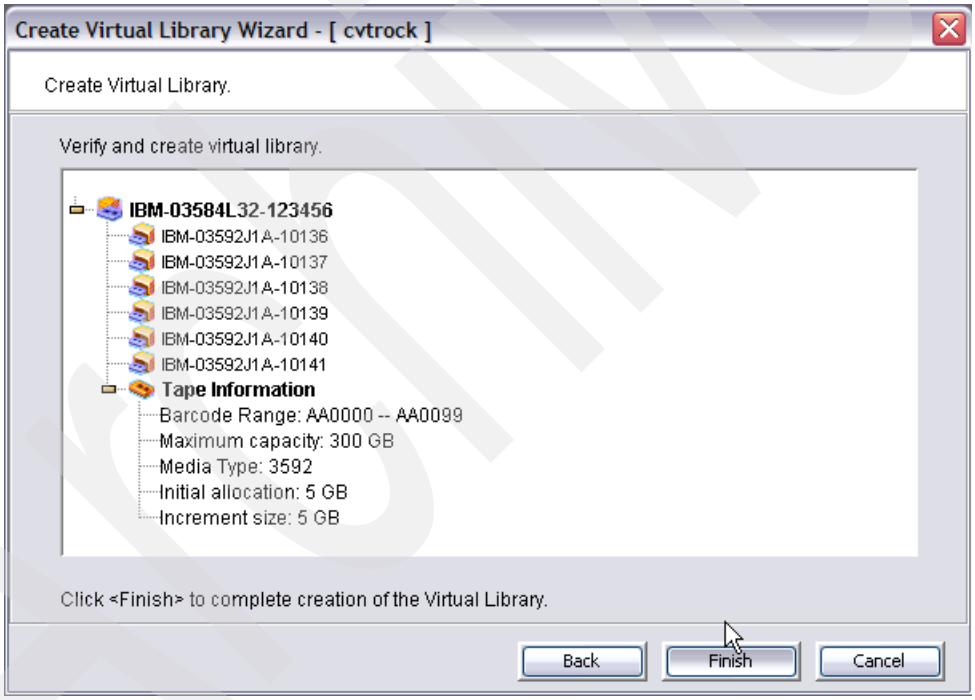

Figure 4-29 Virtual library details

Archived

8. After you create the virtual library, you can create virtual volumes. Because we want to show how Export/Import works, we create virtual tapes which match the physical barcode label.

   We currently have only one physical library connected, so there is no further selection to make in the Select a Physical Tape Library panel (Figure 4-30). To create virtual tapes, which do not match physical tapes, for example if no physical tape is connected to the TS7510, refer to 4.4.9, “Creating additional virtual volumes” on page 65. Click **Next**.

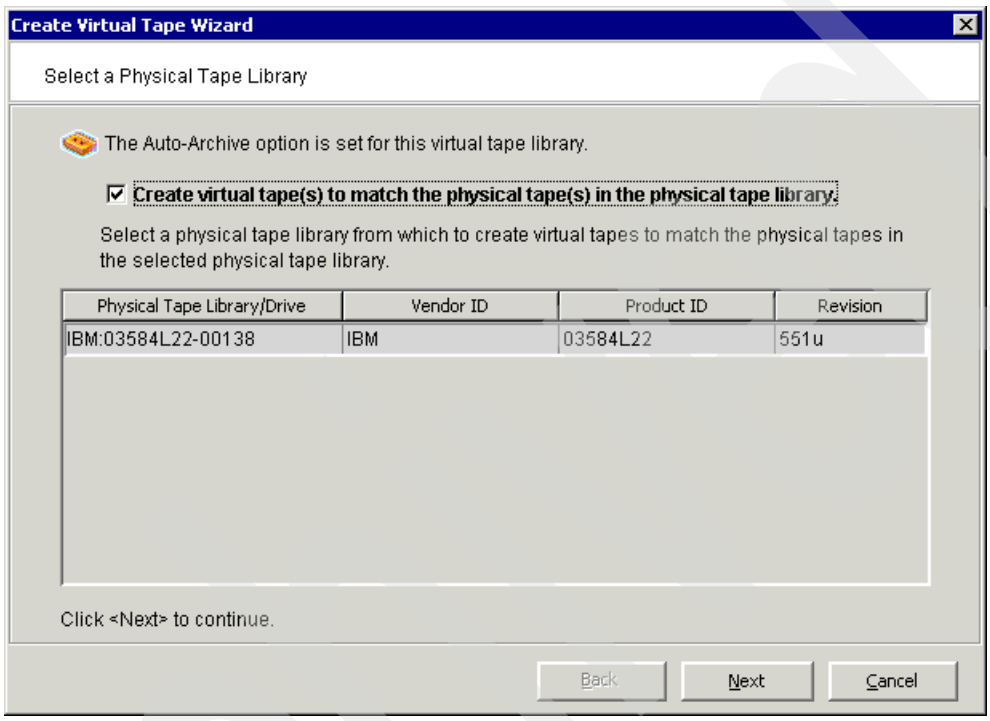

Figure 4-30 Creating virtual tapes which match the physical barcode label

9. In the Select Physical Tape(s) panel (Figure 4-31), you see the inventory of the physical tape library. Select which physical barcode label to create as a virtual tape. Our physical library has only three physical tapes. Because we want to use all of them, we select all three.

> **Note:** The creation of virtual tapes that match the physical tapes does not copy any data from physical tape to virtual tape. If you want to use the data on physical tapes in the TS7510, use the Import option instead.

Click **Next**.

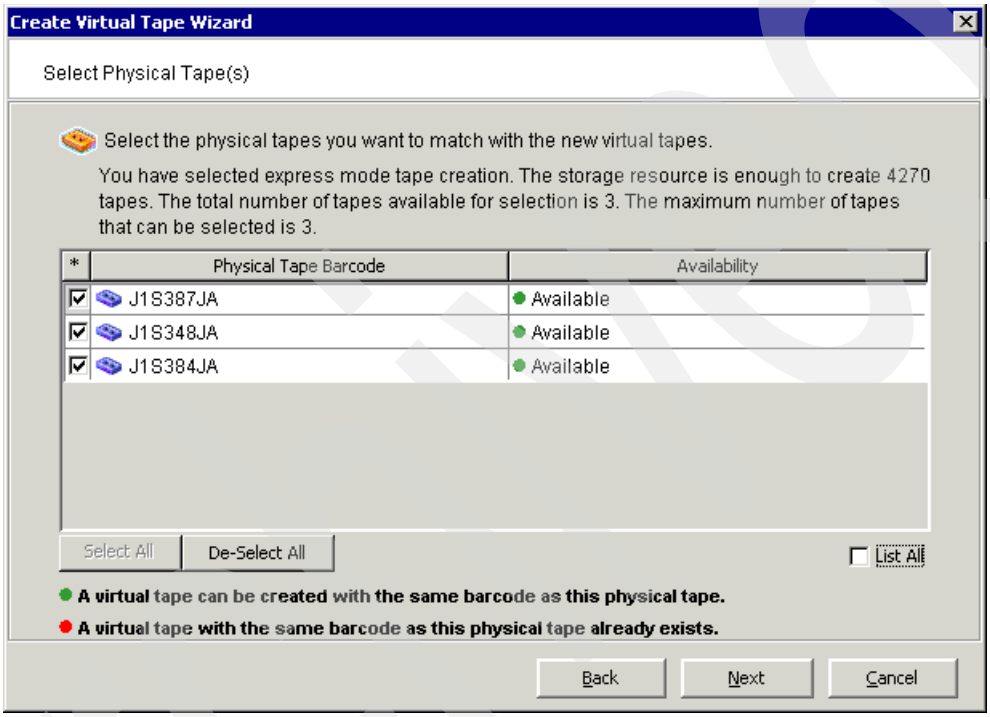

Figure 4-31 Selecting the physical tapes to match the new virtual tapes

10. In the Specify Batch Mode Information panel (Figure 4-32), you can choose the initial virtual tape size. The default size for all media types is 5 GB. This means that at least 5 GB of space is required for all virtual tape volumes. You may change this value, but it is not necessary, because while writing to a virtual volume, the volume expands its size in increments defined by the increment size. The increment size is for LTO2 and 3592 5 GB and for LTO3 7 GB. In this example, we keep the default initial size.

    Click **Finish**.

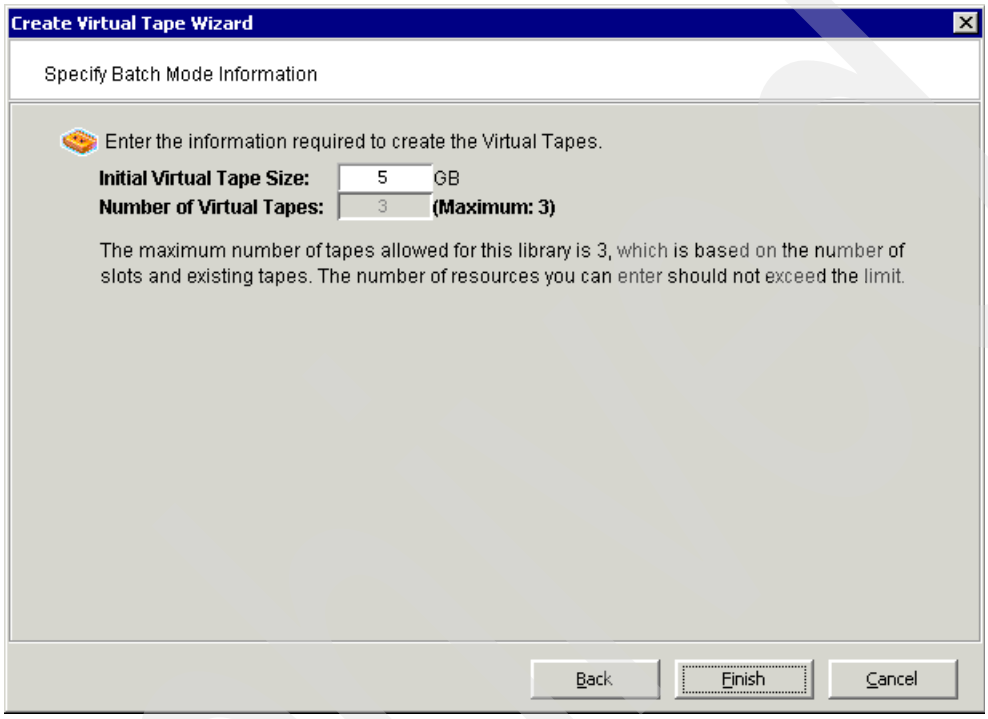

Figure 4-32 Setting the initial virtual tape size

The TS7510 creates three virtual tapes with barcode labels that match the physical barcode labels and have an initial size of 5 GB.

Figure 4-33 shows an overview of the newly created library. Notice the serial number of the library 4CPQY00202. We recommend that you remember this number, so you can have it available in future steps, such as to install the device driver and set up the ISV software.

General | Virtual Drives | Virtual Tapes | Clients

Name	Value
Name	IBM-03584L32-123456
Virtual ID	143
Vendor ID	IBM
Product ID	03584L32
Revision	4.02.03
Number of Slots	1000
Number of Drives	6
Number of Tapes	3
Serial No	4CPQY00202
Barcode Begin	AA0000
Barcode End	AA0099
Tape Capacity On Demand	Yes
Initial Allocation Size (MB)	5,120
Increment Size (MB)	5,120
Maximum Capacity (MB)	307,200
Auto Archive	Enabled with Copy mode
Auto Replication	Disabled
Media Type	3592

Figure 4-33 Virtual library summary

We have now created a virtual library. Other than the libraries already created by default, this newly created library is not yet assigned to any host. Therefore to make this library usable by any host, we must assign a host to the library, which is explained in 4.4.10, “LUN masking: Assigning a host to a library and drives” on page 69. But first, we must create some additional virtual volumes for this library as explained in the following section.

4.4.9 Creating additional virtual volumes

In our example, we have created a few virtual tape cartridges which match the physical barcode labels. Here we show you how to create virtual tape cartridges that do not match any physical tape labels. Because Import/Export is a special option, which only a few customers use, you may create virtual volumes without matching physical tape labels in most environments.

You should not create more virtual volumes than you can store in the IBM Virtualization Engine TS7510. Use the following formula to calculate the maximum number of virtual volumes:

```
(total usable capacity on TS7510) / (defined virtual volume capacity) = maximum number of
virtual volumes
```

We want to create some virtual volumes in our recently created virtual tape library, called IBM-03584L32-123456. Follow these steps:

1. As shown in Figure 4-34, select ***your tape library*** (where you want to create the virtual cartridges) → **Tapes** → **New Tape(s)**.

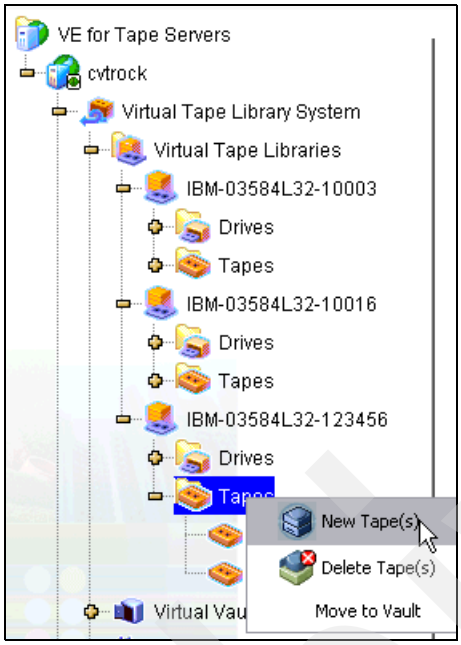

Figure 4-34 Selecting New Tape(s) to create virtual volumes

Archived

2. In the Select a Physical Tape Library panel (Figure 4-35), you can choose a physical tape library. As discussed previously, we want to create virtual volumes that do not match any physical tape labels. Because those virtual volumes cannot be exported to physical tape, we do not select the Create virtual tape(s) to match the physical tape(s) in the physical library option.

   Click **Next**.

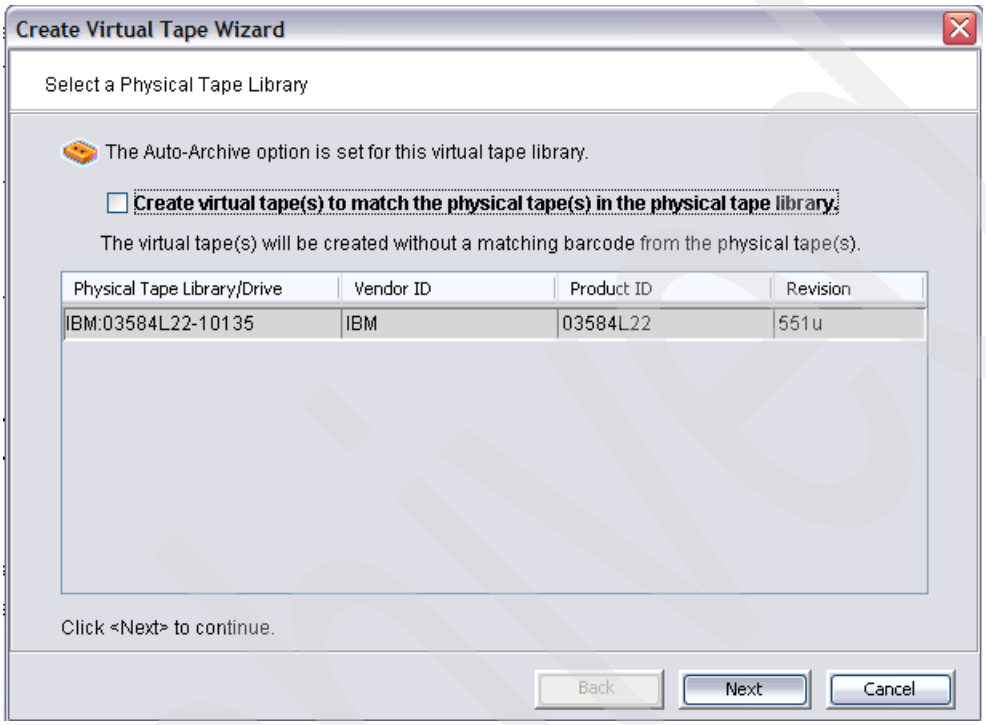

Figure 4-35 Panel for choosing a physical tape library: Create virtual tapes option not selected

Archived

3. In the Specify Batch Mode Information panel (Figure 4-36), the initial size per default is 5 GB. In this example, we keep the default. As explained earlier, the virtual volume will expand in increments of 5 GB for LTO2 and 3592 and in increments of 7 GB for LTO3, if more data is written to the tape than can fit in its original size. We create five virtual tapes.

   Because we use 3592-J1A Tape Drives in our library, the TS7510 creates only 3592 tape cartridges. No selection of a cartridge type is needed.

   Click **Finish**.

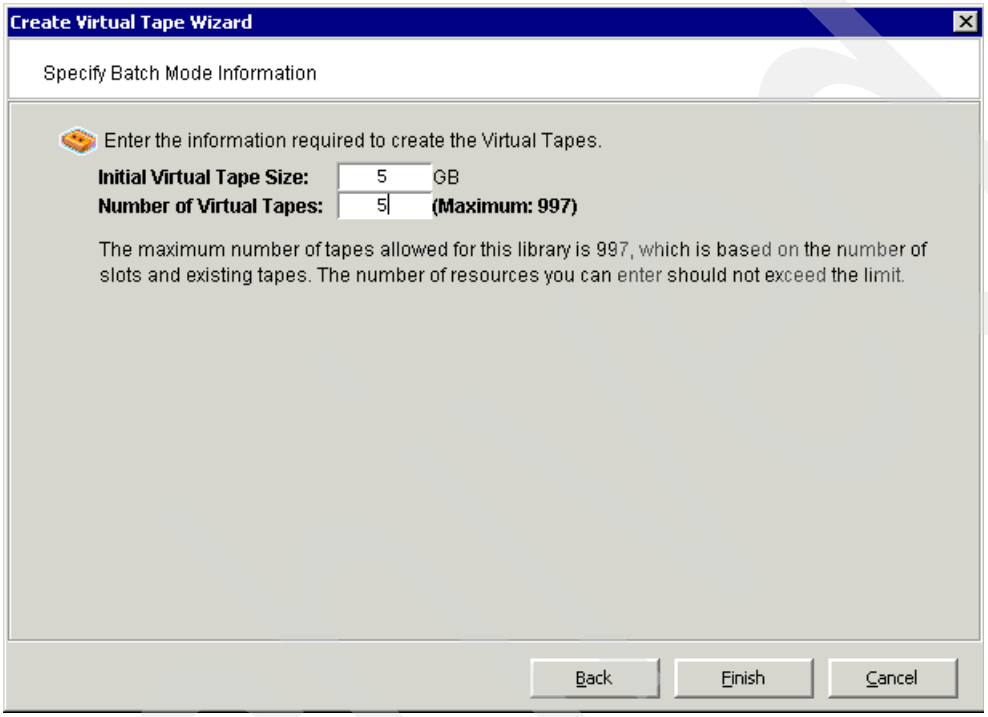

Figure 4-36 Selecting the initial size and number of tapes

The TS7510 creates the virtual volumes. Figure 4-37 shows the results.

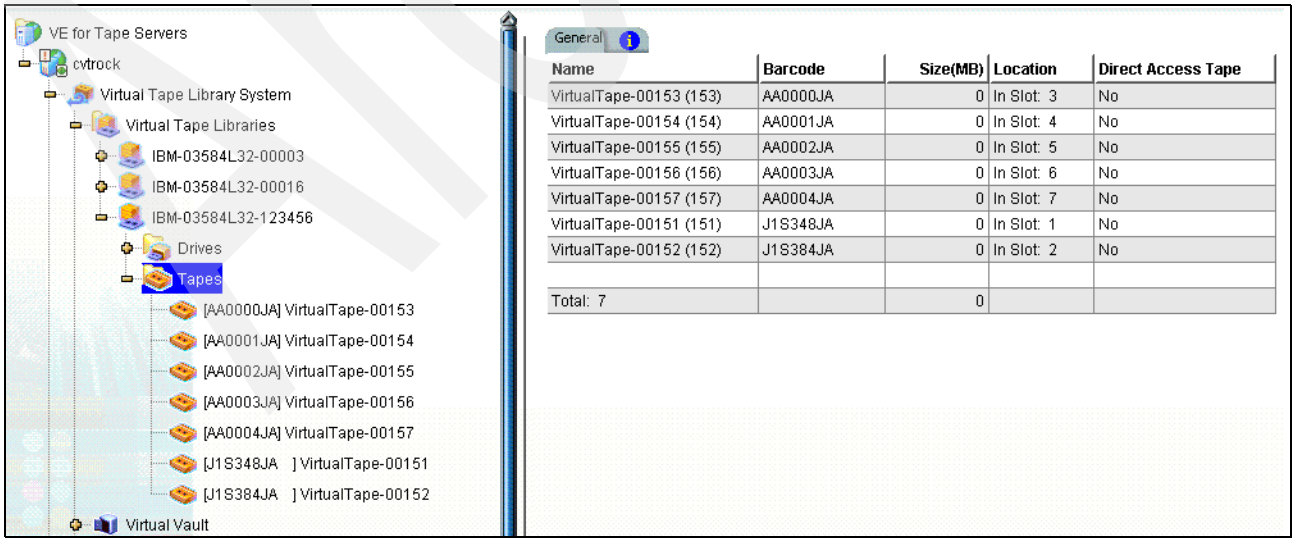

Figure 4-37 Virtual tape volumes

4.4.10 LUN masking: Assigning a host to a library and drives

Up to this point, we have created the library with drives and tape cartridges. Only the two libraries created during manufacturing were assigned to every host. All libraries that you create must be assigned to the host to enable its access to those libraries.

In addition to the assignment of a host to a virtual library and virtual drives, you can select which Fibre Channel target port from the IBM Virtualization Engine TS7510 to use. With this option, you can balance the workload to different Fibre Channel HBAs (target ports) by assigning a couple of drives to one Fibre Channel HBA and other drives to other Fibre Channel HBAs on the TS7510.

We want to use the newly created library with one Tivoli Storage Manager server, ost36, and with one Tivoli Storage Manager LAN-free client, dst66. The Tivoli Storage Manager server ost36 should see the whole library including all six drives. The LAN-free client dst66 should only see three drives (drives 4 through 6) as shown in Figure 4-38.

For more information about our redbook test setup, see Chapter 5, “IBM Tivoli Storage Manager usage considerations” on page 109.

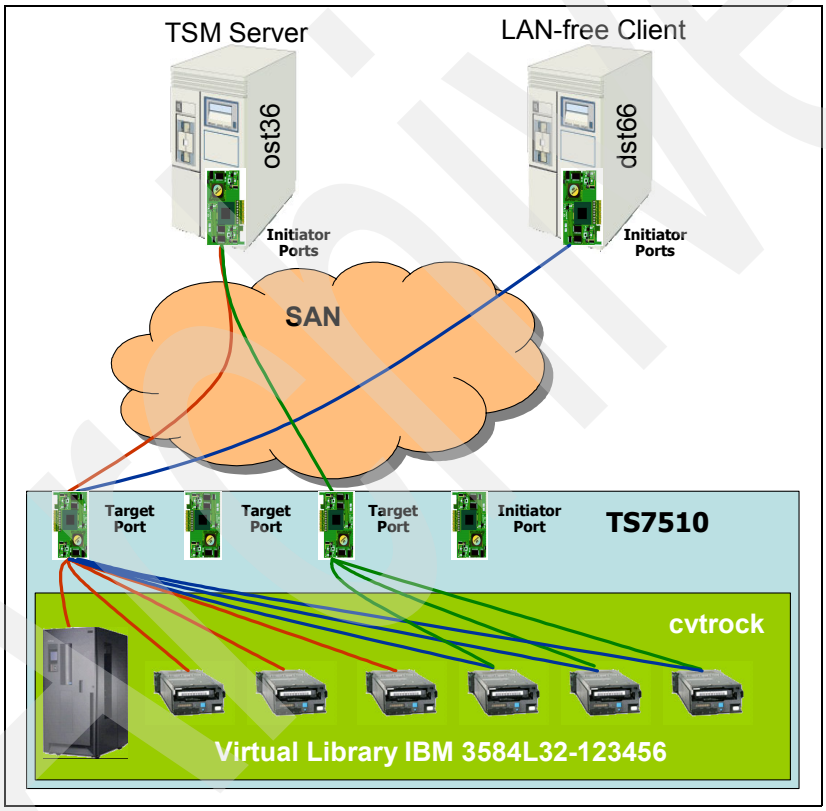

Figure 4-38 Client assignment

In this example, we assign the Tivoli Storage Manager server ost36 to the complete library. To assign a host to the library, follow these steps:

1. Right-click the host icon and select **Assign**, as shown in Figure 4-39.

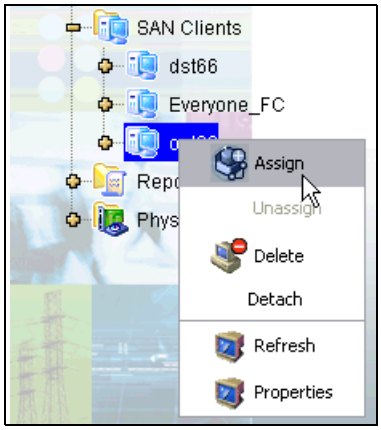

Figure 4-39 Selecting Assign to assign a SAN host to a virtual library

Archived

2. In the Select Tape Libraries or Drives panel (Figure 4-40), you can select different access modes to assign libraries and drives. The access types are:
   - *Read/Write* access indicates that only one client can access the library or drive. If another host tries to access the library or the drive, this access is denied.
   - *Read/Write Non-Exclusive* access indicates that several clients can access the drive or library. Use this mode if the library or the drives will be shared. In our example, we want to share the drives between one Tivoli Storage Manager server and one LAN-free client.

   You can assign the complete library with drives over a Fibre Channel target port. Or you can assign the drives individually by selecting the Allow drive(s) in the library to be assigned individually check box. We select **Allow drive(s) in the library to be assigned individually** as well as the library and the first three drives. The other three tape drives will be assigned over a different Fibre Channel port.

   Click **Next**.

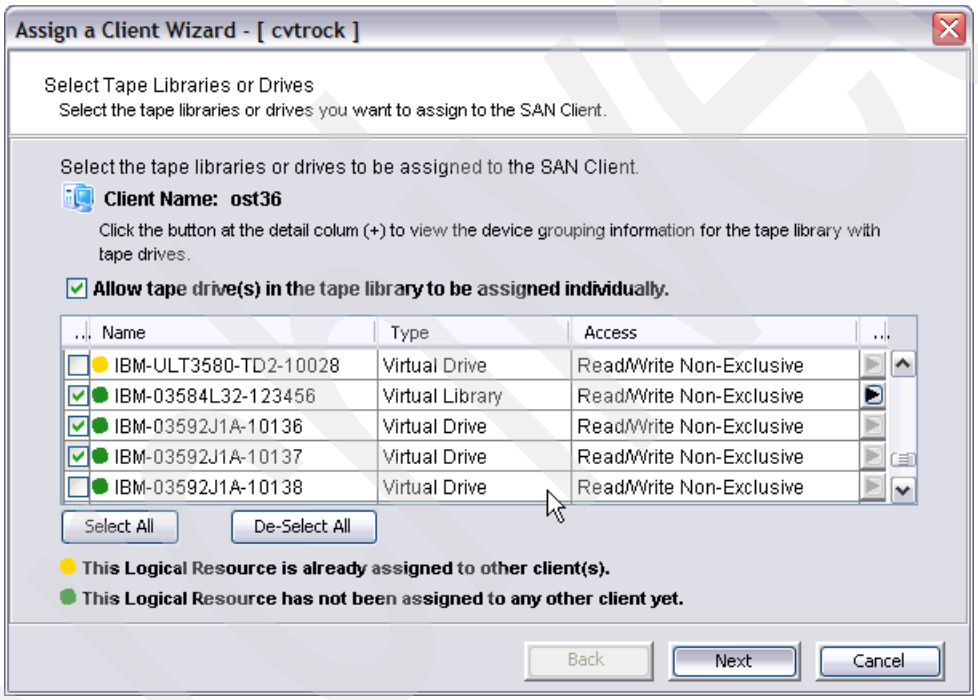

Figure 4-40 Assigning a client to the library and drives

3. In the Select a Fibre Channel Target panel (Figure 4-41), select the Fibre Channel HBA to use for the connection to the host. This selection is available only if several paths from the host to the TS7510 exist. This means several zones must be created, because only one initiator and only one target should be in one zone.

   If your server has several Fibre Channel HBAs for connecting to the TS7510, you must select each Fibre Channel HBA WWPN when you add the SAN client, as explained in 4.4.7, “Adding SAN clients to IBM Virtualization Engine TS7510” on page 52.

   In our limited configuration for this redbook, our server ost36 only has one 2 Gb Fibre Channel HBA. Therefore load balancing does not make sense. Because we want to show you how to assign tape drives over different Fibre Channel targets, we select target port **21-01-00-0d-77-1a-93-c6** for our assignment of the first three drives and for the library.

   Click **Next**.

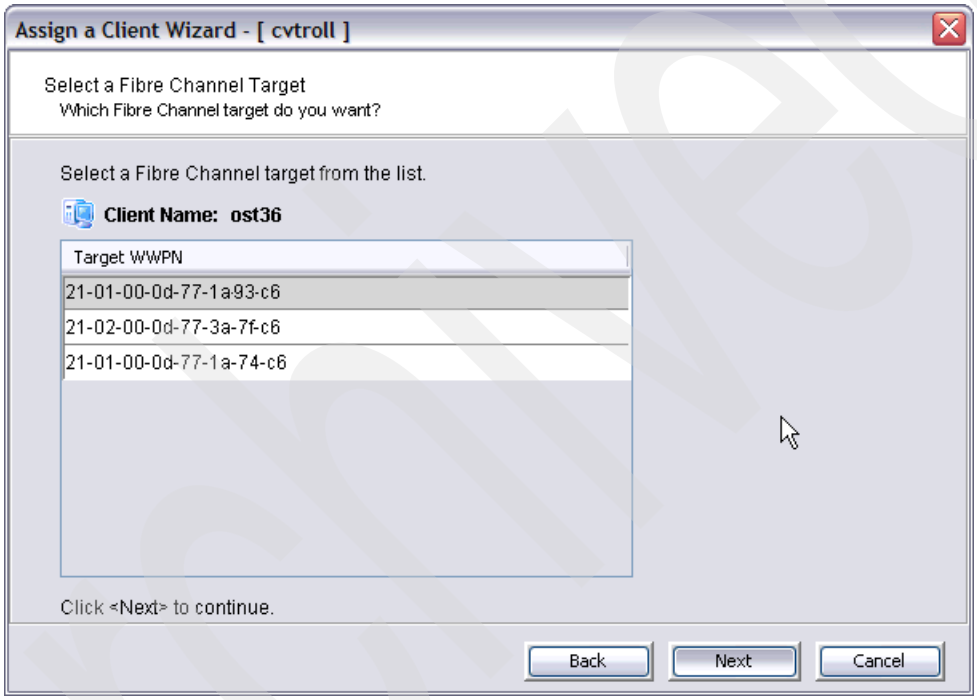

Figure 4-41 Selecting a target WWPN

4. In the Assign Tape Libraries or Drives to the SAN Client panel (Figure 4-42), verify your selection before you make this assignment. If everything appears to be correct, click **Finish**. To make changes, click the **Back** button.

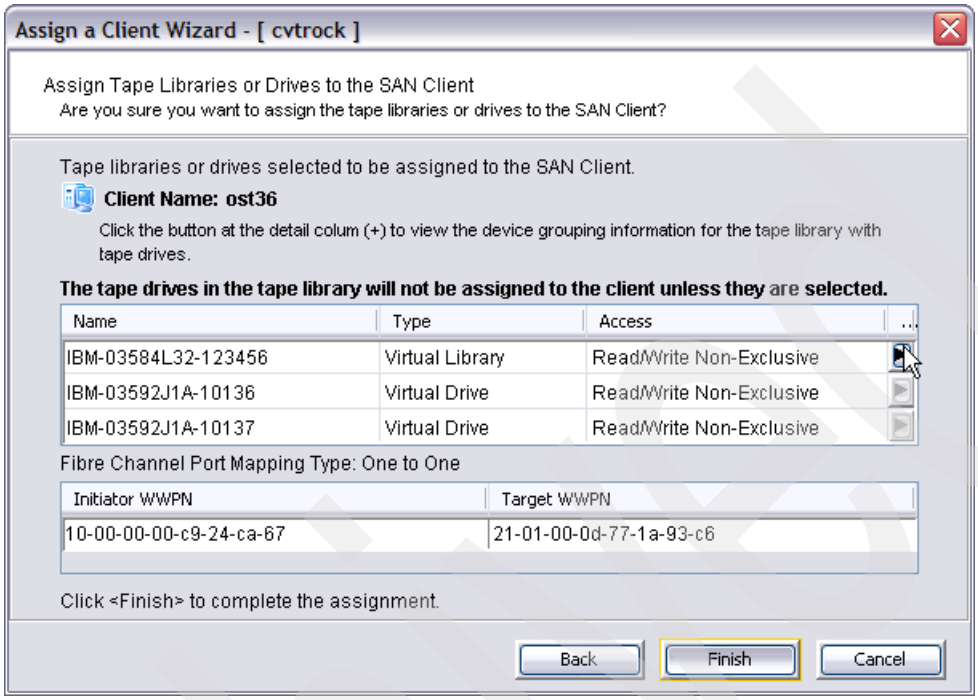

Figure 4-42 Summary of the client assignment

We have now assigned the first three tape drives and the library to host ost36. We repeat the steps and assign the other three tape drives to ost36 and to our LAN-free client dst66.

4.4.11 Importing and exporting virtual volumes

You primarily use the Import/Export function to export cartridges which are already copied from the IBM Virtualization Engine TS7510 for vaulting, or to import data which is on physical tape. This function is *not* intended for moving data which might still be needed for normal operation, such as restore. For data movement from the TS7510 to real, physical tape, use the ISV function, as explained in the example in Chapter 5, “IBM Tivoli Storage Manager usage considerations” on page 109.

As discussed in 2.4.2, “Import, Export, and Auto Archive functions” on page 12, you have different options for using the Import/Export function. We have already demonstrated how to configure *Auto Archive* in the library configuration as explained in 4.4.8, “Creating libraries, tape drives, and cartridges” on page 56. You can learn more about *Auto Archive* in 5.3, “Using Import/Export with Auto Archive for vaulting” on page 115.

In this section, we show you how to manually import and export virtual volumes to or from a real physical cartridge via the VE Console.

Importing a tape cartridge

You can use Import for data which is exported or for data which comes from the vault or from other sources and should be accessible through the IBM Virtualization Engine TS7510. You can copy all content from the physical tape to a virtual library on the TS7510. Or you may give direct access to the physical cartridge through the TS7510 without copying any data to the

virtual volume cache. The direct access gives the application read-only access to the cartridge.

> **Note:** For some ISV software, you have to set the access mode for direct access cartridges to *read-only*. On Tivoli Storage Manager, set the cartridges to *read-only* using the **`update volume vol_name access=readonly`** command before you access it.

To import a tape cartridge, follow these steps:

1. As shown in Figure 4-43, right-click the physical library where the cartridge resides and select **Import Tape**.

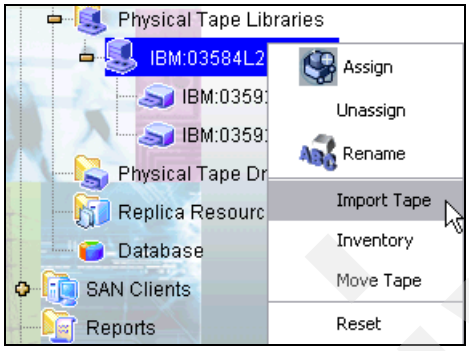

Figure 4-43 Selecting Import Tape to import the physical tape

2. Select the virtual library to which you want to import the physical data, as shown in Figure 4-44. Then click **Next**.

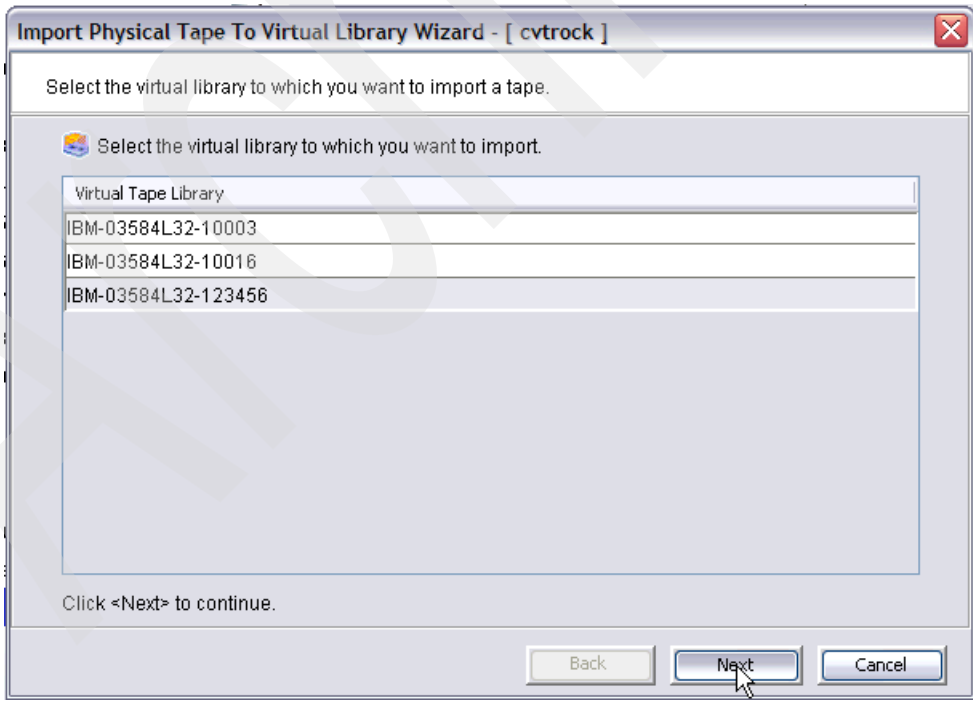

Figure 4-44 Selecting the virtual library to which you want to import a tape

3. In the next panel (Figure 4-45), you see the inventory of the physical library. Select one or more cartridges for importing. You may also select the virtual slot into which the virtual cartridge should be imported. We recommend that you do not change the *virtual tape barcode*, unless you need to do so. Without the relation of physical to virtual tape barcode, no further association exists that could be used to identify the relationship between virtual and physical cartridges. The TS7510 does not track any relationship.

   In our physical library, there are two physical cartridges. We import the physical tape with the barcode J1S387JA to the virtual slot 0 (which was the first available slot). Then click **Next**.

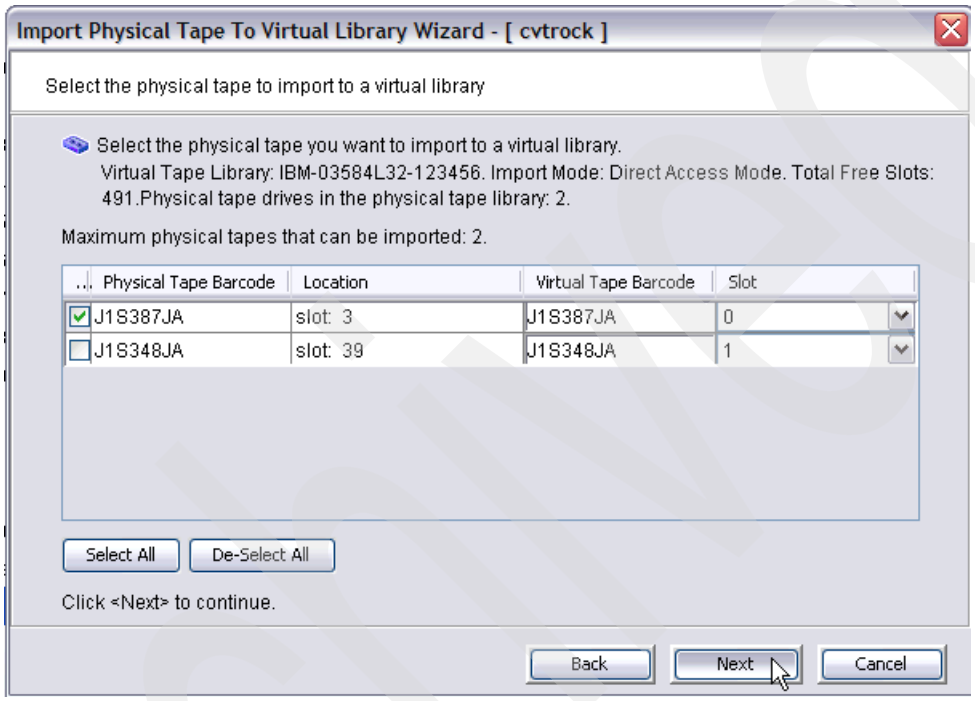

Figure 4-45 Selecting the physical tape to import to a virtual library

4. Select in which mode you want to import the physical tape (see Figure 4-46). Choose either Copy Mode or Direct Access Mode. We select **Direct Access Mode**.

> **Note:** Direct Access mode gives you read-only access to the physical tape.

There is no usage, to our knowledge, for Recycle Mode for any standard ISV backup application. You might use it only for a special reason such as for nonstandard ISV applications.

Click **Next**.

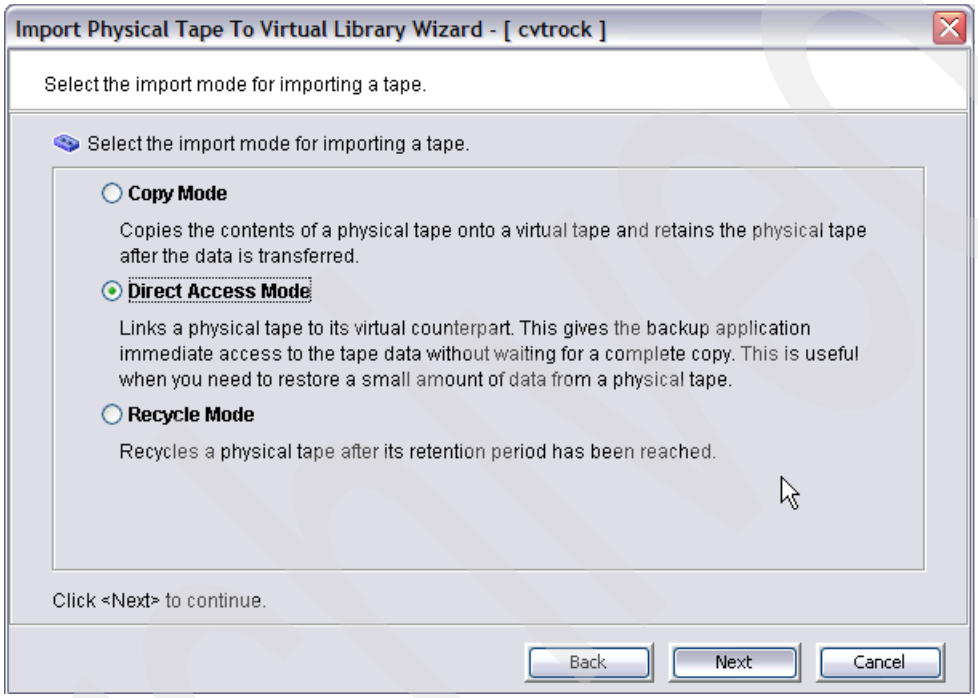

Figure 4-46 Select the import mode

After the import job is finished, you can see the imported volume under the virtual library inventory. As you can see in Figure 4-48, in the left pane, the cartridge that was imported in Direct Access mode has a small letter D on the icon, and in the right pane, the Allocation Type is *Direct Access Tape*.

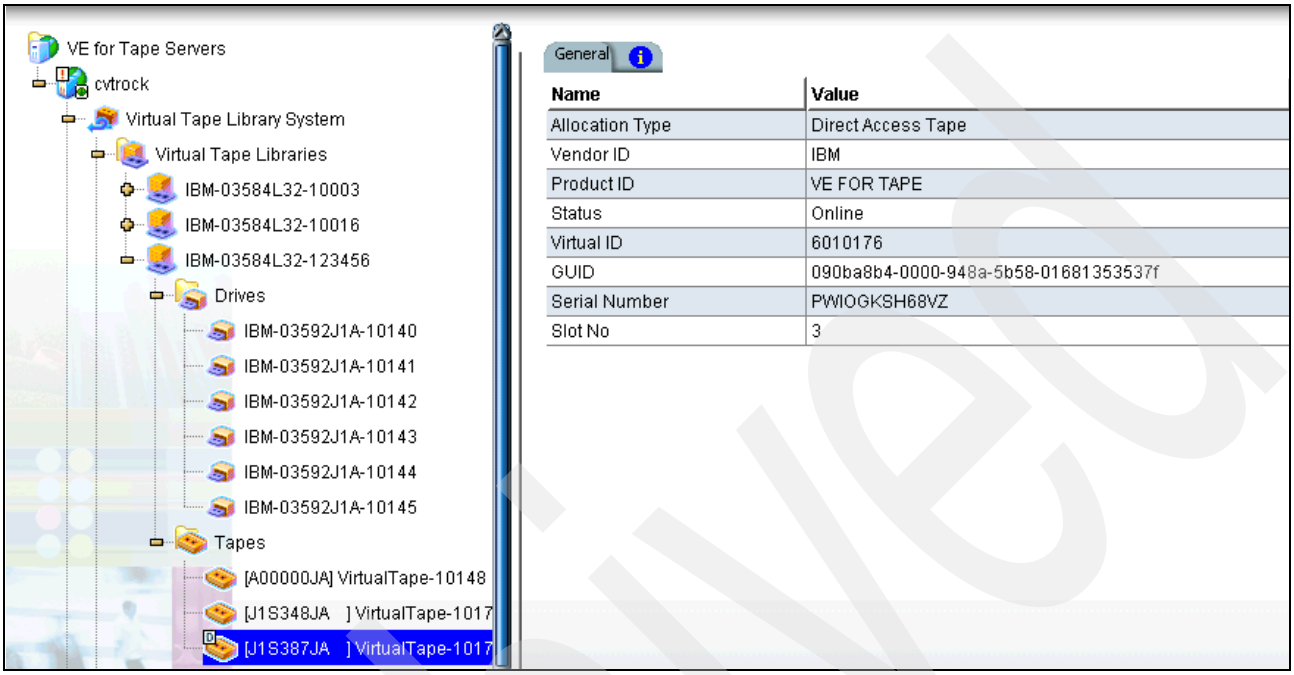

Figure 4-47 Imported volume showing the allocation type Direct Access Tape

Exporting a tape

You can export only virtual volumes that are in the *virtual vault*. You might move a cartridge from a virtual library to the *virtual vault* by using the VE Console, but then the ISV application is not aware that this volume is no longer in the virtual library. Therefore we recommend that you use ISV commands to move the cartridge to the I/O station, which is the virtual vault.

An exported cartridge might be deleted from the TS7510 after a defined time (move), or it may be kept as a copy in the virtual vault (copy).

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To export a tape, follow these steps:

1. Right-click the virtual volume which you want to export and select **Export Tape** as shown in Figure 4-48.

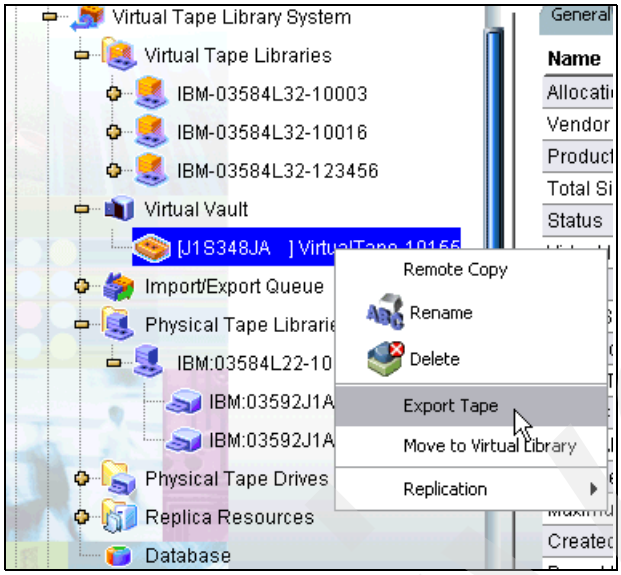

Figure 4-48 Selecting Export Tape

2. As shown in Figure 4-49, select the physical tape library into which you want to export your virtual volume. We have one physical library connected to the TS7510, so no further selection is needed. Click **Next**.

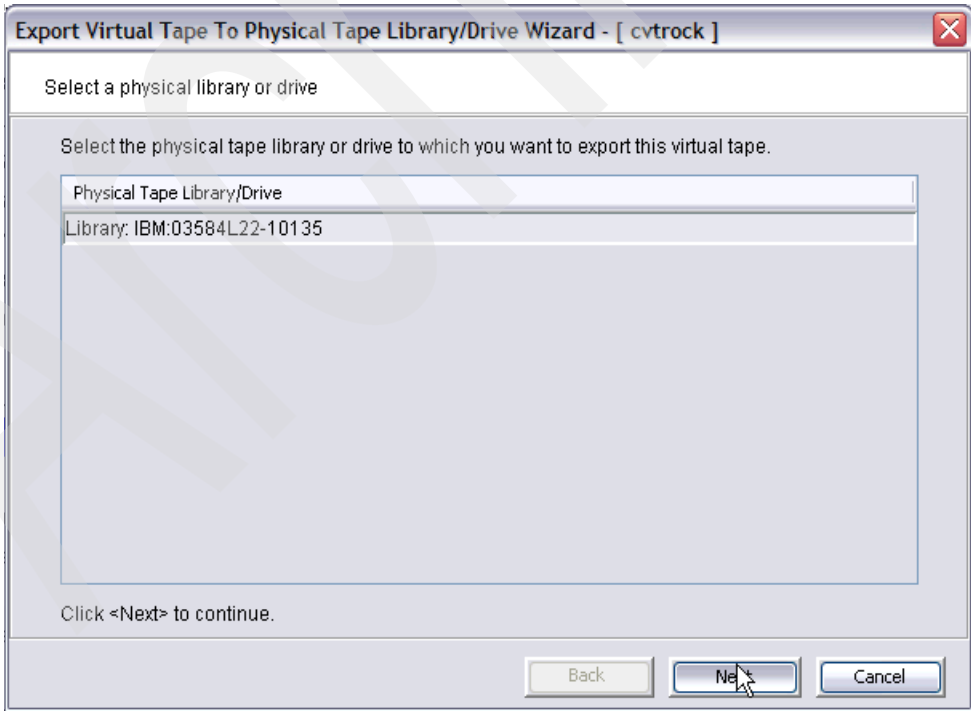

Figure 4-49 Selecting a physical library or drive

3. In the next panel (Figure 4-50), select the export mode.
   - *Copy Mode* enables you to keep the virtual volume in the virtual vault and copy the content of the virtual volume to a physical tape cartridge.
   - *Move Mode* enables you to copy the content of the virtual volume to a physical cartridge. It then deletes the virtual volume after a selected period of time. If you select 0 days, the virtual volume is deleted after all data is written to the physical cartridge.

   In this example, we select to delete the virtual volume after the data is written to the physical volume. Then click **Next**.

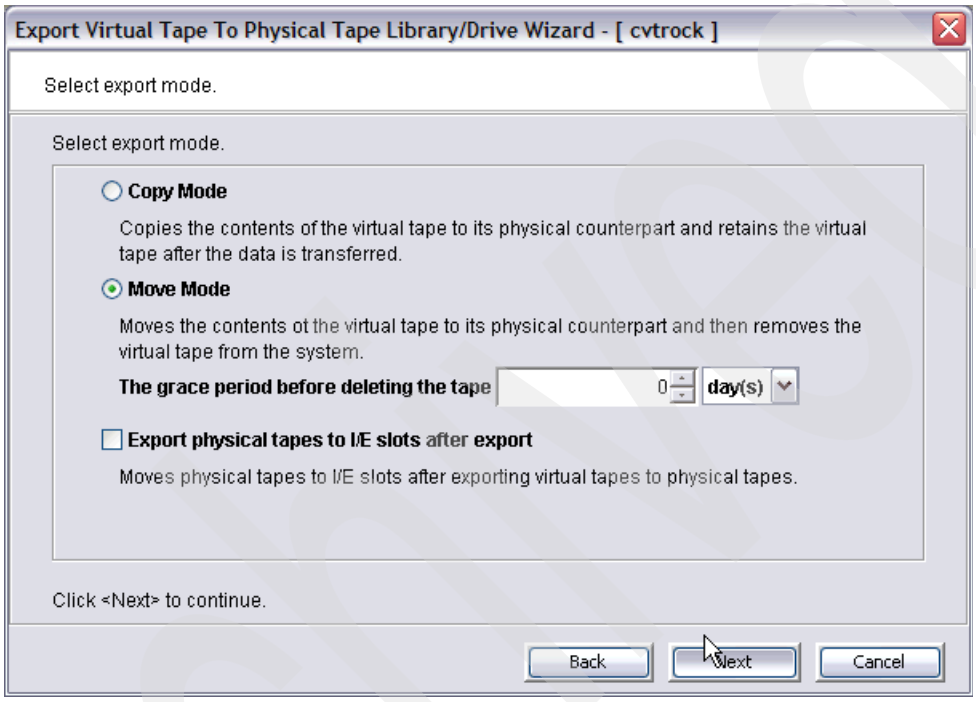

Figure 4-50 Selecting the export mode

4. Select the virtual tape which you want to export and select the physical tape cartridge on which the data should be written (see Figure 4-51). When you select Same Barcode, you do not need to select the physical tape.

   After the virtual tape is exported, there is no longer any tracking of the virtual volume by the TS7510. Use care when exporting the virtual volume to a physical cartridge with different barcode label.

   Important: We highly recommend that you export volumes to the same barcode only.

   In this example, we are exporting one virtual cartridge, J1S348, to a physical cartridge with the same barcode label on it. Click **Next**.

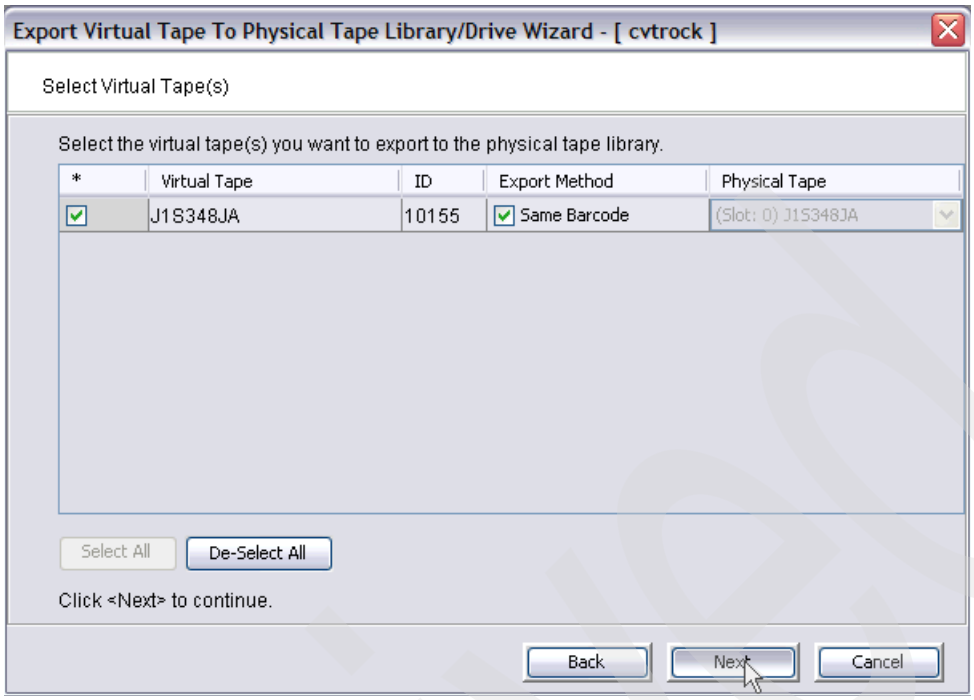

Figure 4-51 Selecting the virtual tape to export to a physical cartridge

5. Verify the export information and click **Finish** (see Figure 4-52).

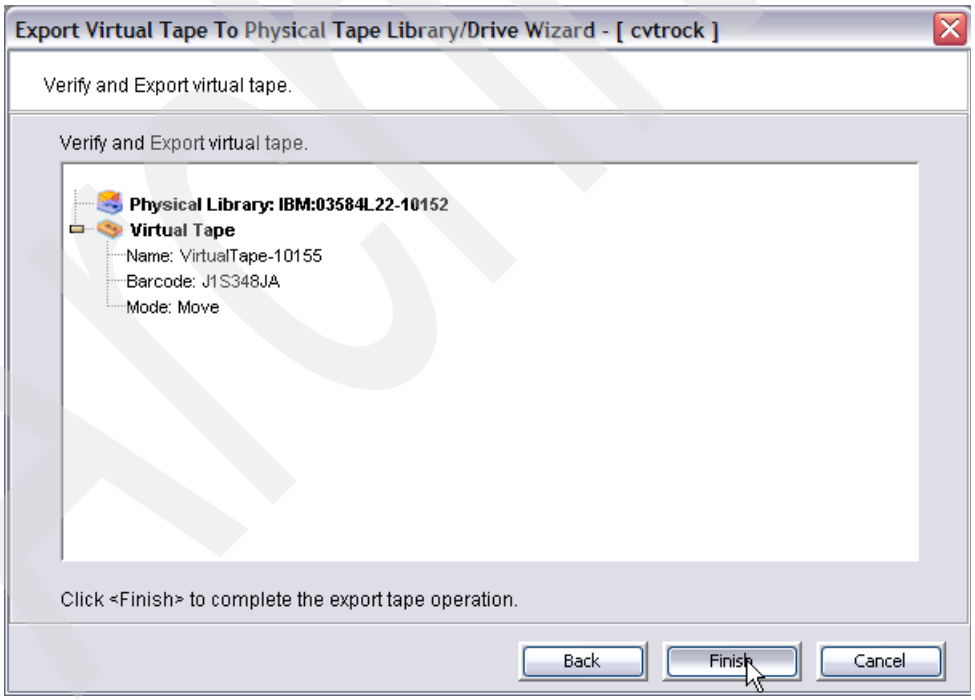

Figure 4-52 Summary information about the export

The export job starts. The TS7510 loads the physical cartridge into a tape drive and copies the data from the virtual to the physical cartridge. You can view the progress of the export job by selecting the job icon under the Import/Export Queue, as shown in Figure 4-53.

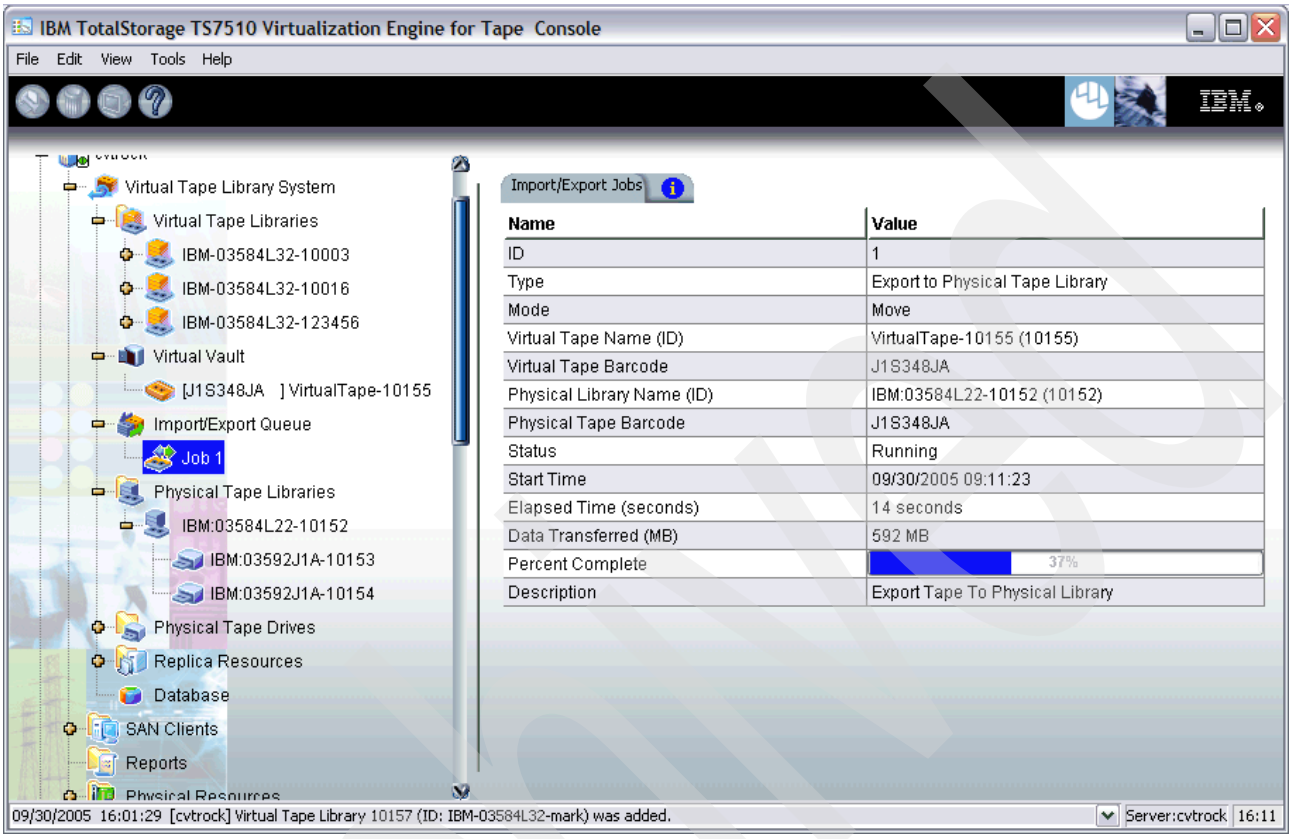

Figure 4-53 Viewing the progress of the export job

4.4.12 Setting up replication

In 2.4.3, “Network Replication” on page 15, we discussed the three different replication options. In this section, we show you how to set up replication.

To set up replication, you must comply with the following requirements:

- Replication is an option that must be licensed. Both IBM Virtualization Engine TS7510s must have the replication license enabled.
- The target IBM Virtualization Engine TS7510 must have enough disk space available for the replica resource.

Replication

Replication copies data from a source virtual volume to another IBM Virtualization Engine TS7510 on a regular basis that is triggered by time schedules or by amount of changed data. We want to enable replication on the newly created virtual library and, for the source, use another TS7510 called *cvtroll*.

To enable the replication, follow these steps:

1. As shown in Figure 4-54, right-click the virtual library that you want to enable for replication, and select **Replication** → **Add**.

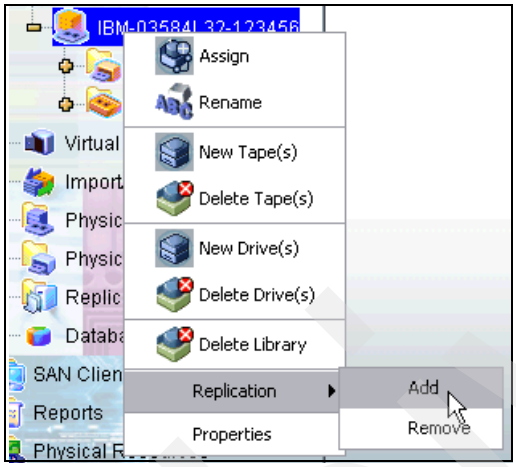

Figure 4-54 Enabling Replication

2. Replication is based on the virtual tape volume. In the Select Virtual Tapes to enable Replication option panel (Figure 4-55), select the tapes which you want to replicate. We select all available volumes. Click **Next**.

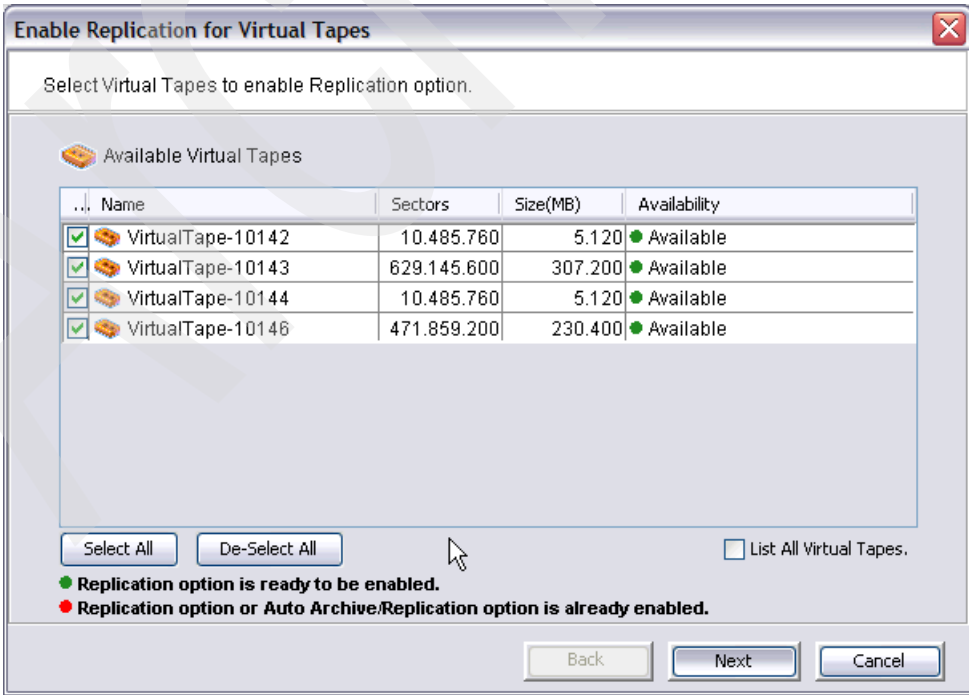

Figure 4-55 Selecting the virtual volume for replication

3. In the Select the Target Server panel (Figure 4-56), select the target TS7510. If the target TS7510 is not yet defined, click **Add** and define the target TS7510. When you return to this panel, click **Next**.

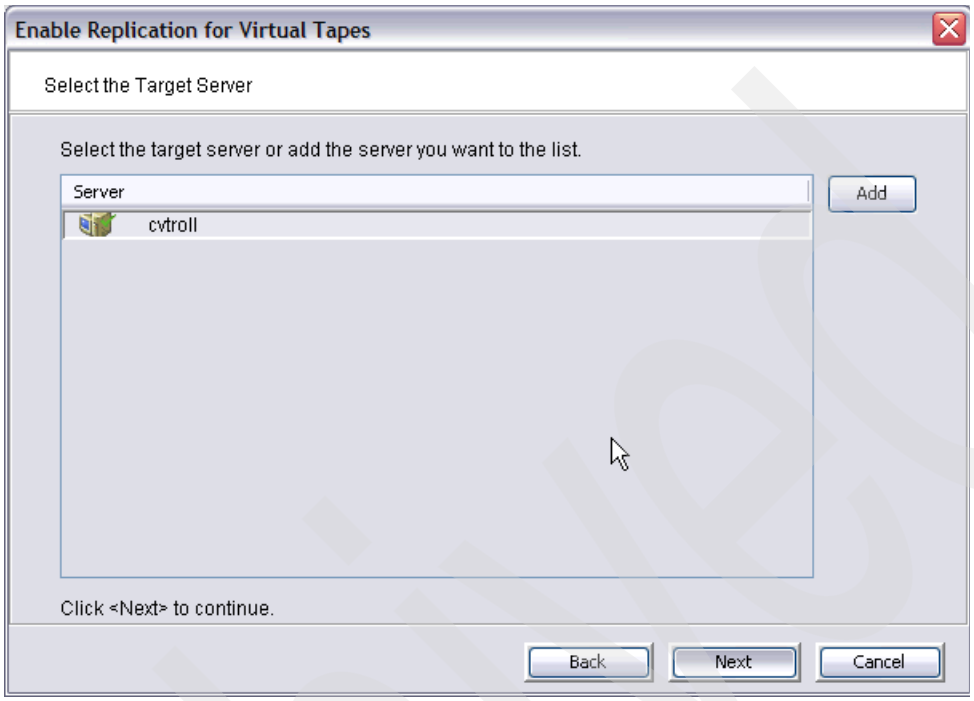

Figure 4-56 Selecting the target TS7510

Archived

4. Different triggers can be used for replication. In the Select the Replication Policy for the Virtual Tape display (Figure 4-57), you can define the triggers for replication.

   You can specify for replication to start after a defined amount of data is changed on a volume. The replication then starts after the volume is dismounted from a virtual tape drive. You can also specify a trigger which either starts periodically or starts every day at the same time.

   We want to replicate every time data is written to a cartridge. Therefore, we select **Start replication when the amount of new data reaches 1 MB**. Click **Next**.

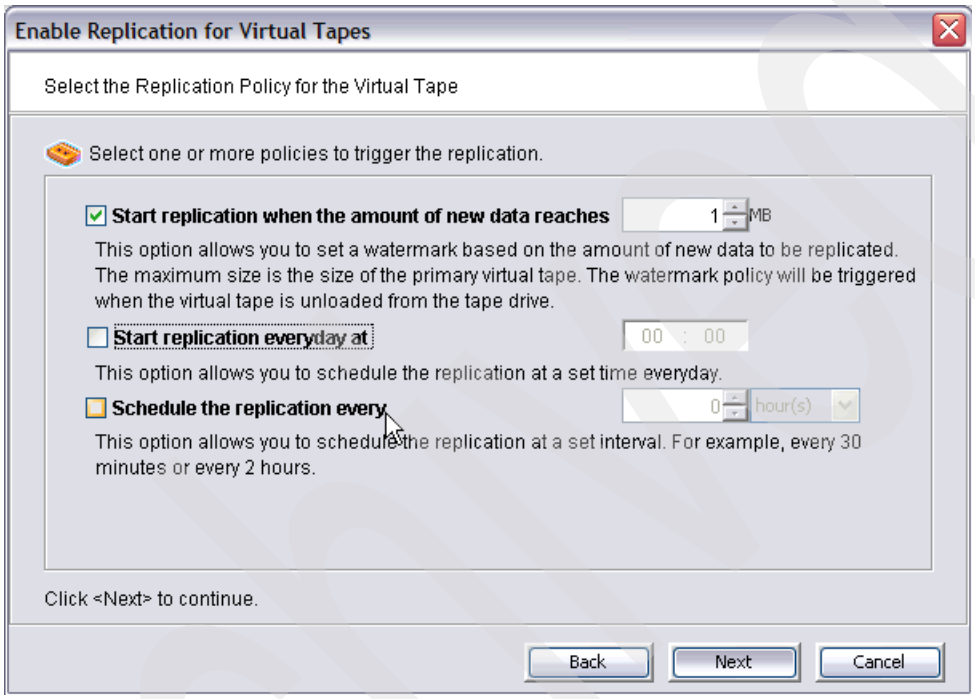

Figure 4-57 Specifying a replication trigger

5. In the Specify the Options for Data Transmission panel (Figure 4-58), you can select compression, encryption, or both options. However both of these options require that you have an additional license on both TS7510 servers. Because we only have a replication license, we do not choose either option.

   Click **Next**.

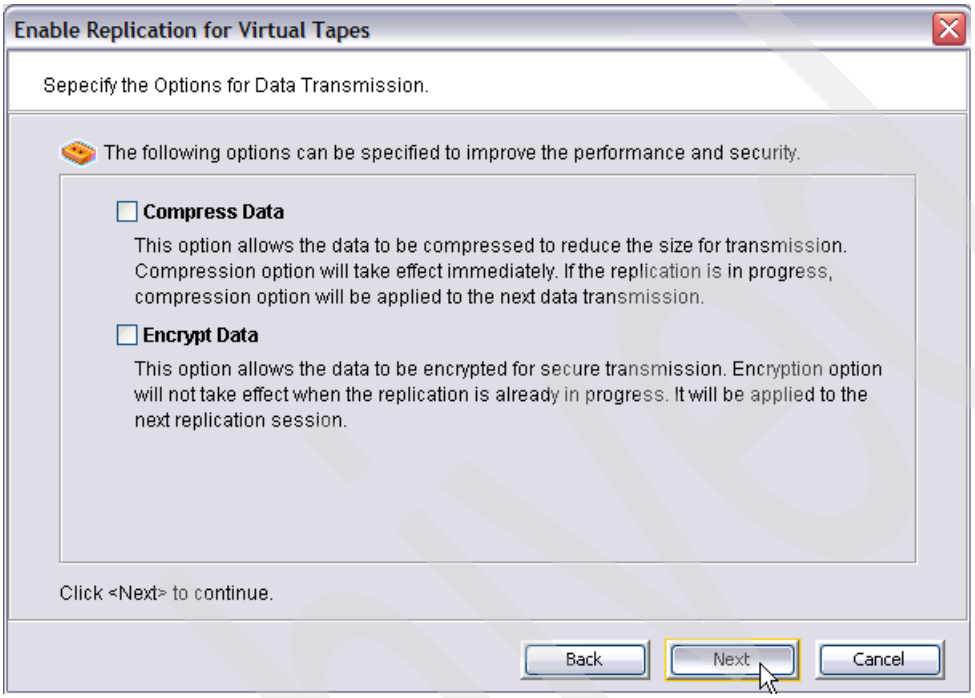

Figure 4-58 Options for compression and encryption for data transmission

Archived

6. You can check the status of the replication. As shown in Figure 4-59, click the **Replication** tab for the desired volume. In our example, we wrote data to volume AA0004. After dismounting, the TS7510 begins to replicate the newly changed data to the second TS7510.

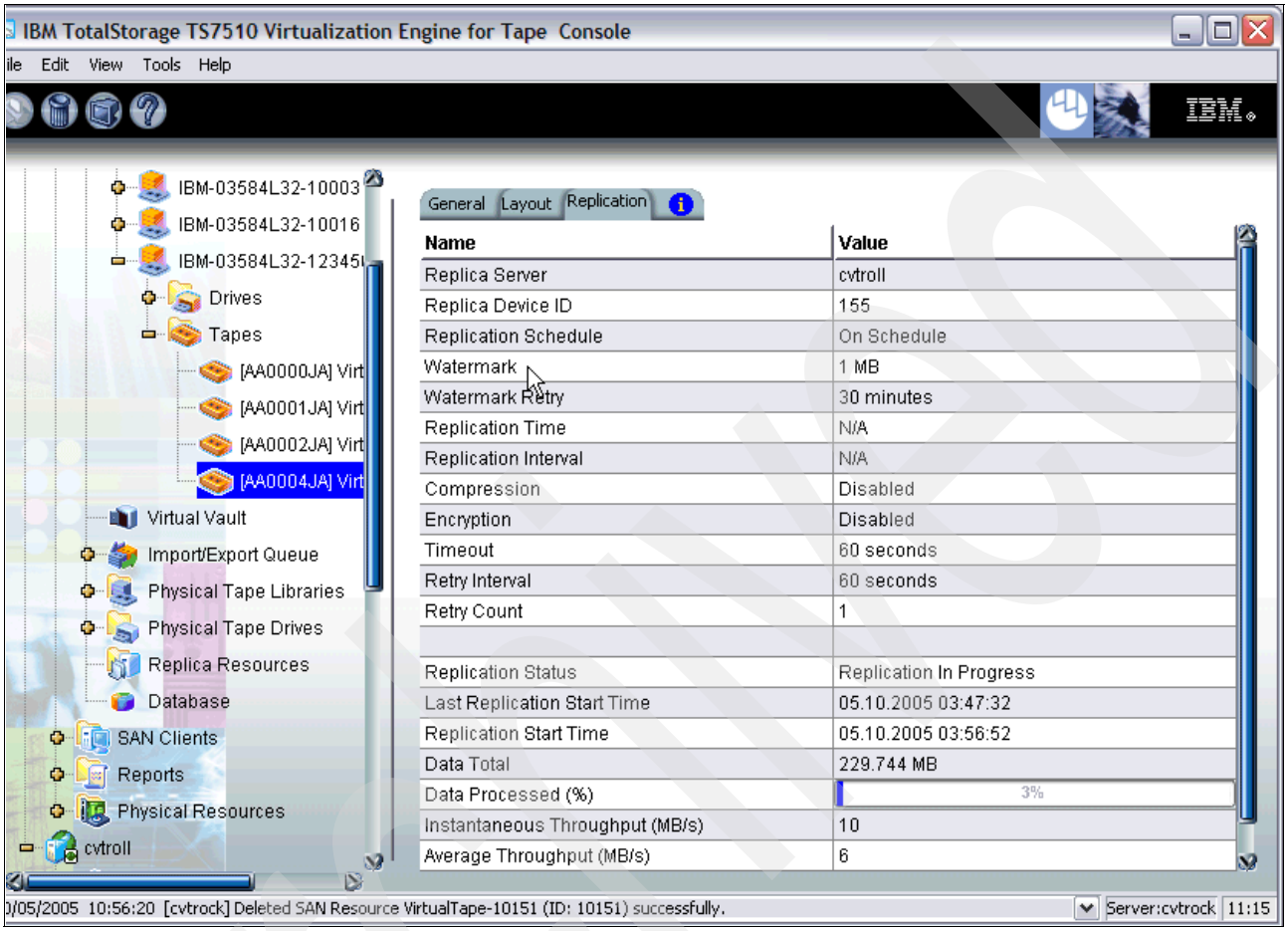

Figure 4-59 Replication status

On the target TS7510 server, you see the replicated volumes under Replica Resources, as shown in Figure 4-60.

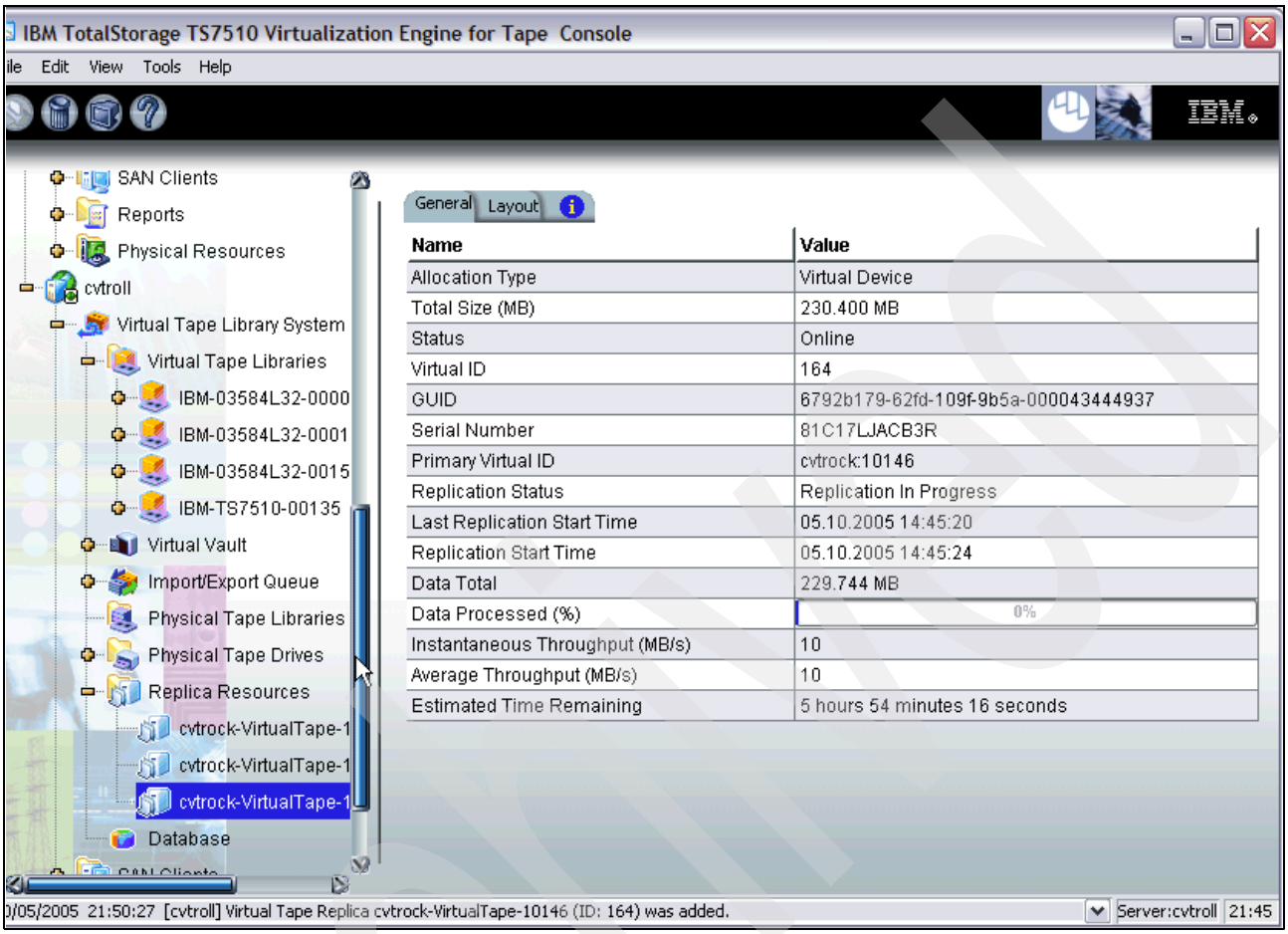

Figure 4-60 Replicated volumes under Replica Resources

The replicated volumes are not usable on the second TS7510 unless you promote a volume and break the replication link. To promote a replicated volume, right-click this volume and select **Promote** (as shown in Figure 4-61).

Figure 4-61 Promoting a replicated volume

With the promotion of a virtual volume, you break the replication link. No further replication occurs for this volume. The replicated volume is moved to the virtual vault after it is promoted. From the virtual vault, you may move this volume to any configured virtual library.

Auto Replication

Auto Replication is similar to Auto Archive. Volumes are moved or copied to a second TS7510 whenever this volume is moved to the I/O station of the virtual library. To enable Auto Replication, select **Auto Replication** during the creation of a virtual library or right-click the virtual library icon and select **Properties**.

In the Change Virtual Library Properties window (Figure 4-62), under Auto Replication, select either **Copy** or **Move**. Specify a grace period before the volume becomes deleted after it is copied. Then click **OK**.

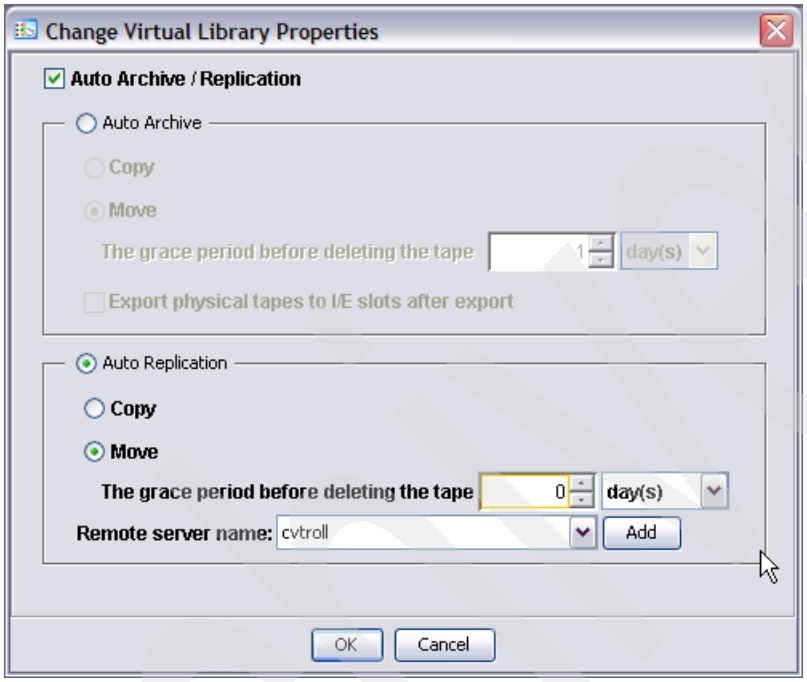

Figure 4-62 Auto Archive

4.4.13 Setting up High Availability Failover

The IBM Virtualization Engine TS7510 failover option provides high availability by eliminating the downtime that can occur if a TS710 server (software or hardware) fails.

Requirements

Follow these requirements when setting up a failover configuration:

- You must have two 3954 CV5 servers in a single 3952 Tape Frame Model F05.

  Failover to another CV5 in a different 3952 Tape Frame Model F05 is not possible, because both SV5 Controllers must have access to the same disks.

- You must use static IP addresses.

  Two IP addresses are needed for each adapter. One IP address is for management, which you use for your VE Console, called *server IP address*. The other IP address is used for a heartbeat connection, called *service IP address*.

  – Two IP addresses for the first heartbeat (service) connection and the management (server) connection on each node for eth1

– Two IP address for the second heartbeat connection and the management connection on each node for eth1 (It must be on a different subnet than the first heartbeat connection.)

- If a physical tape library is used, the SSR must connect it to both CV5 servers.
- No replication is allowed between both TS7510 servers.

Setup

To set up High Availability Failover, follow these steps:

1. Right-click one of the **TS7510** icons in the VE Console and select **Failover** → **Failover Setup Wizard** as shown in Figure 4-63.

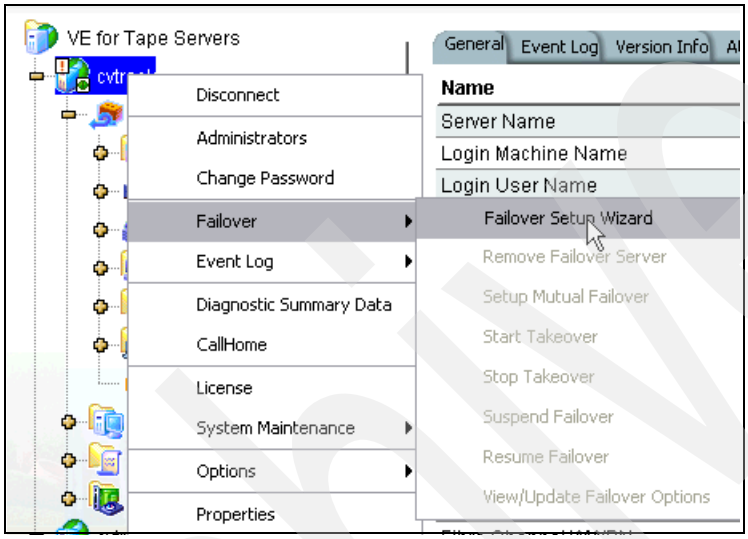

Figure 4-63 Starting the Failover Setup Wizard

Archived

2. In the panel that opens (Figure 4-64), select the secondary TS7510 server. Then click **Next**.

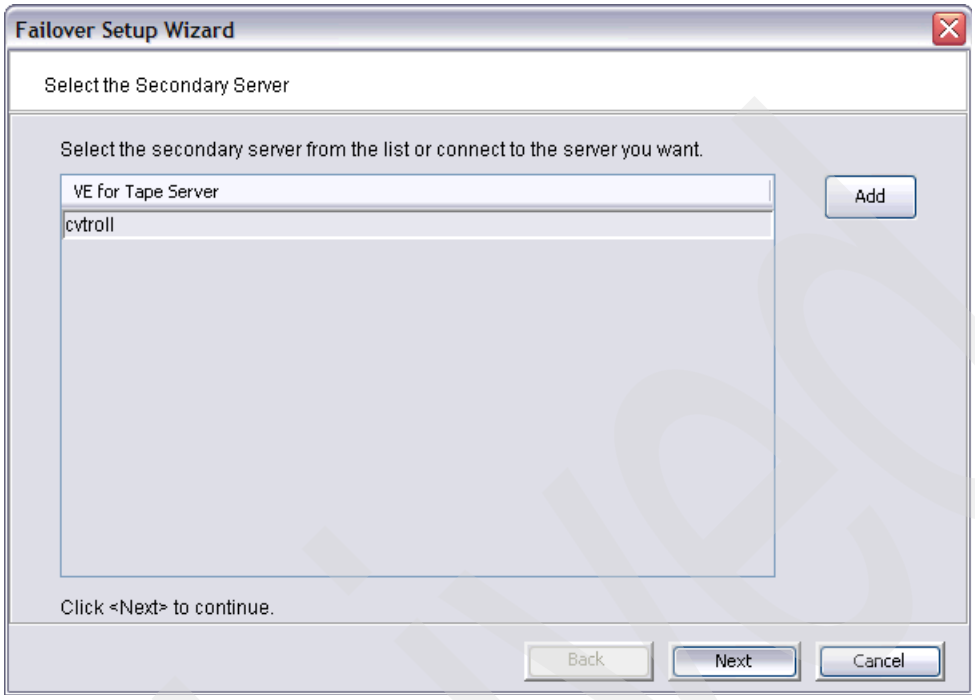

Figure 4-64 Selecting a secondary TS7510 server

3. Confirm the *server IP address* of eth1 (Adapter 1) for both TS7510 servers, as shown in Figure 4-65. The addresses were set up during installation. See 4.4.2, “Setting up the network” on page 44. Click **Next**.

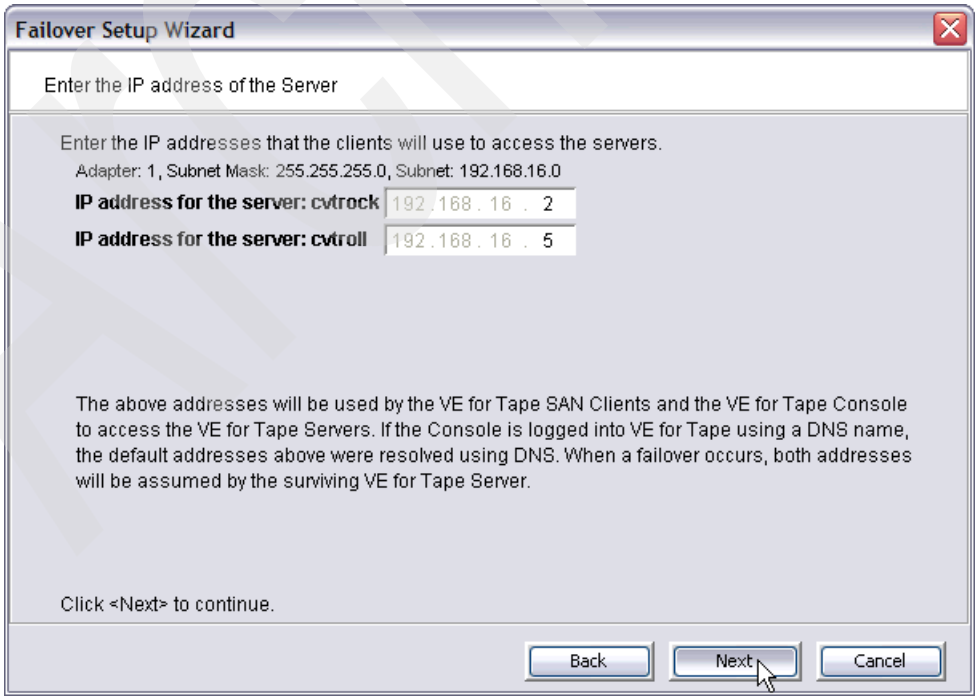

Figure 4-65 Server IP address for eth1

4. As shown in Figure 4-66, type both *service IP addresses* for eth1. This connection is used for the first heartbeat. Click **Next**.

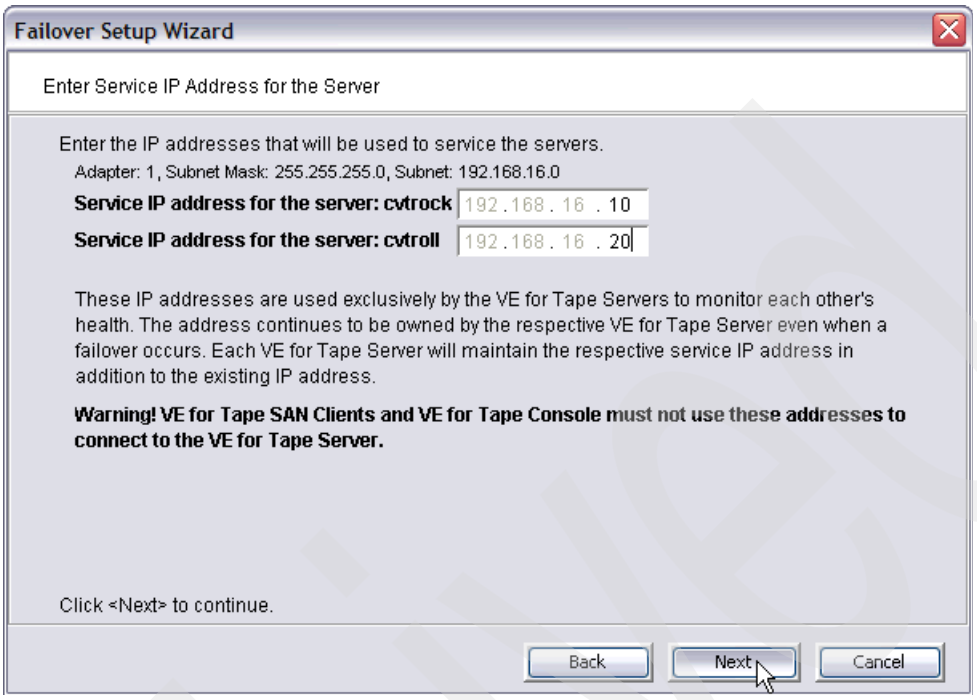

Figure 4-66 Service IP address for eth1

5. Confirm the *server IP address* of eth0 (Adapter 2) for both TS7510 servers, as shown in Figure 4-67. The addresses were set up during the installation. See 4.4.2, “Setting up the network” on page 44. This address is normally used if you connect to the TS7510 with the VE Console. Click **Next**.

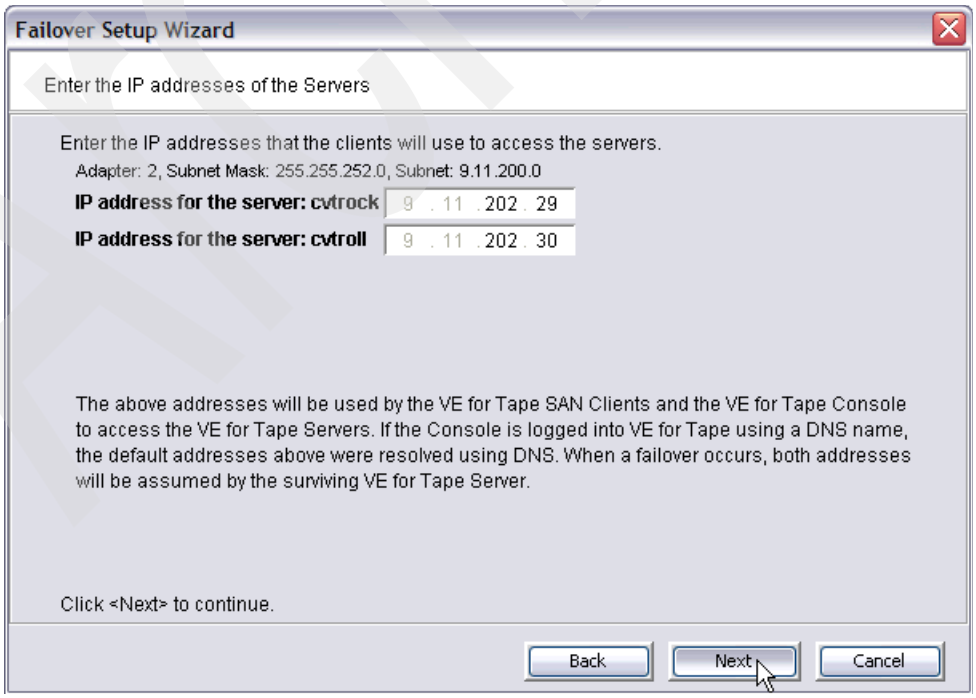

Figure 4-67 Server IP address for eth0

6. As shown in Figure 4-68, type both *service IP addresses* to be used for eth0. This connection is used for the second heartbeat. Click **Next**.

Figure 4-68 Service IP address for eth0

7. In the last panel (Figure 4-69), confirm the failover configuration. If you agree with the settings, click **Finish**. If not, click **Back** to make any necessary changes.

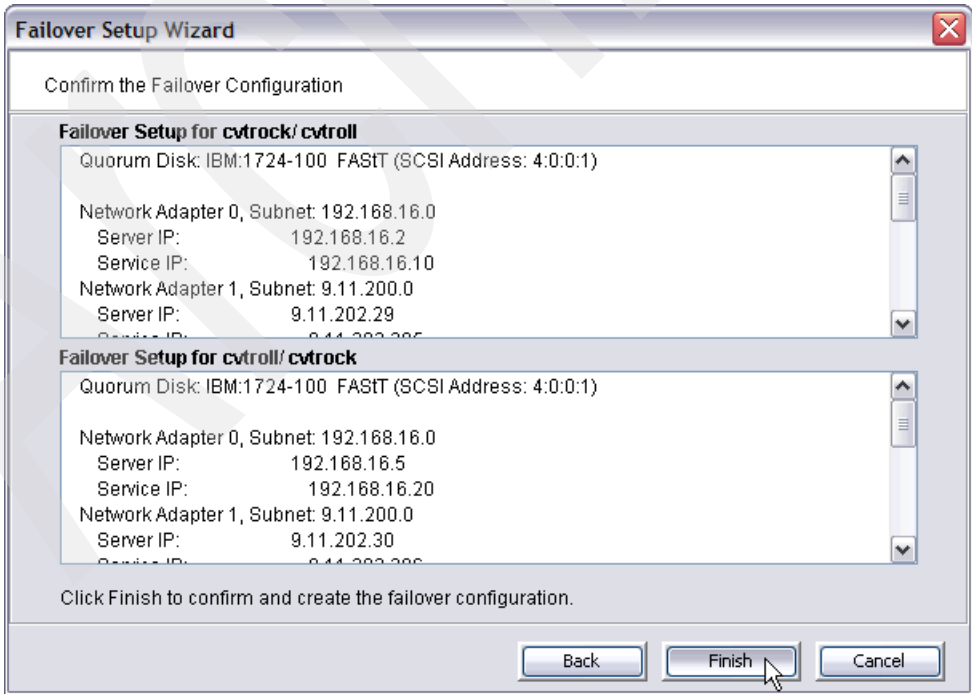

Figure 4-69 Confirming the settings of the Failover Setup Wizard

To change some failover properties, right-click a **TS7510 icon** and select **Failover → View/Update Failover Options**. The Failover Properties window (Figure 4-70) opens.

You may enable Auto Recovery, which recognizes if the failing server is alive again and then starts a failback. However, you must clear the failback on the ISV, as explained in “Resuming backups after failover and failback” on page 96. Therefore we recommend that you *do not* use Auto Recovery.

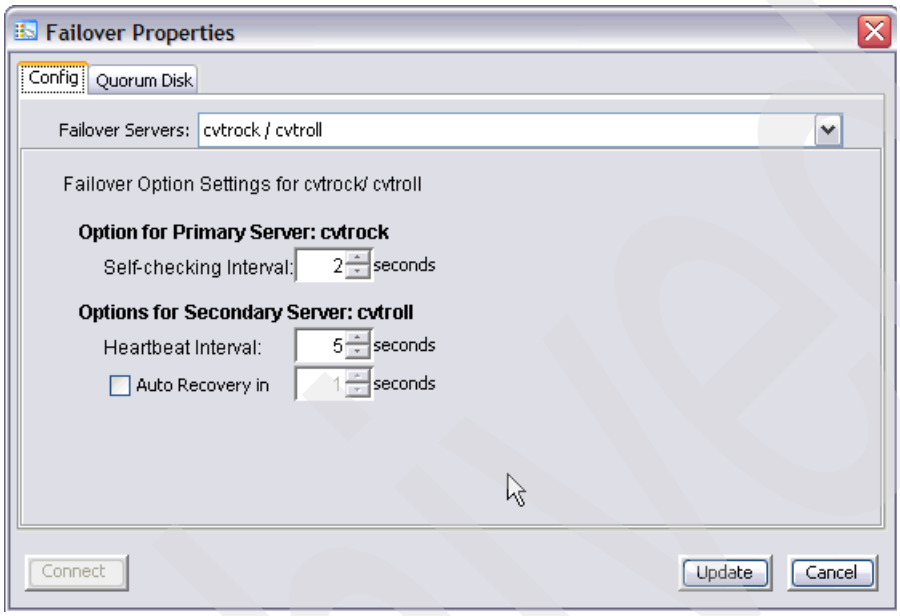

Figure 4-70 Failover Properties window

Failover monitoring

You can check the current status of your failover configuration, including all settings, by checking the Failover Information tab for the IBM Virtualization Engine TS7510.

The TS7510 uses different colors to indicate the failover status:

- A *black server name* indicates normal operations.
- A *red server name* indicates that the server is currently in failover mode and has been taken over by the second TS7510.
- A *green server name* indicates that the server is currently in failover mode and has taken over the other TS7510.
- A *yellow dot next to the server name* indicates that the user has suspended failover on this server. The current server will *not* take over the other TS7510 even if it detects an abnormal condition from the other TS7510.

As you see in Figure 4-71, cvtrock has taken over cvtroll.

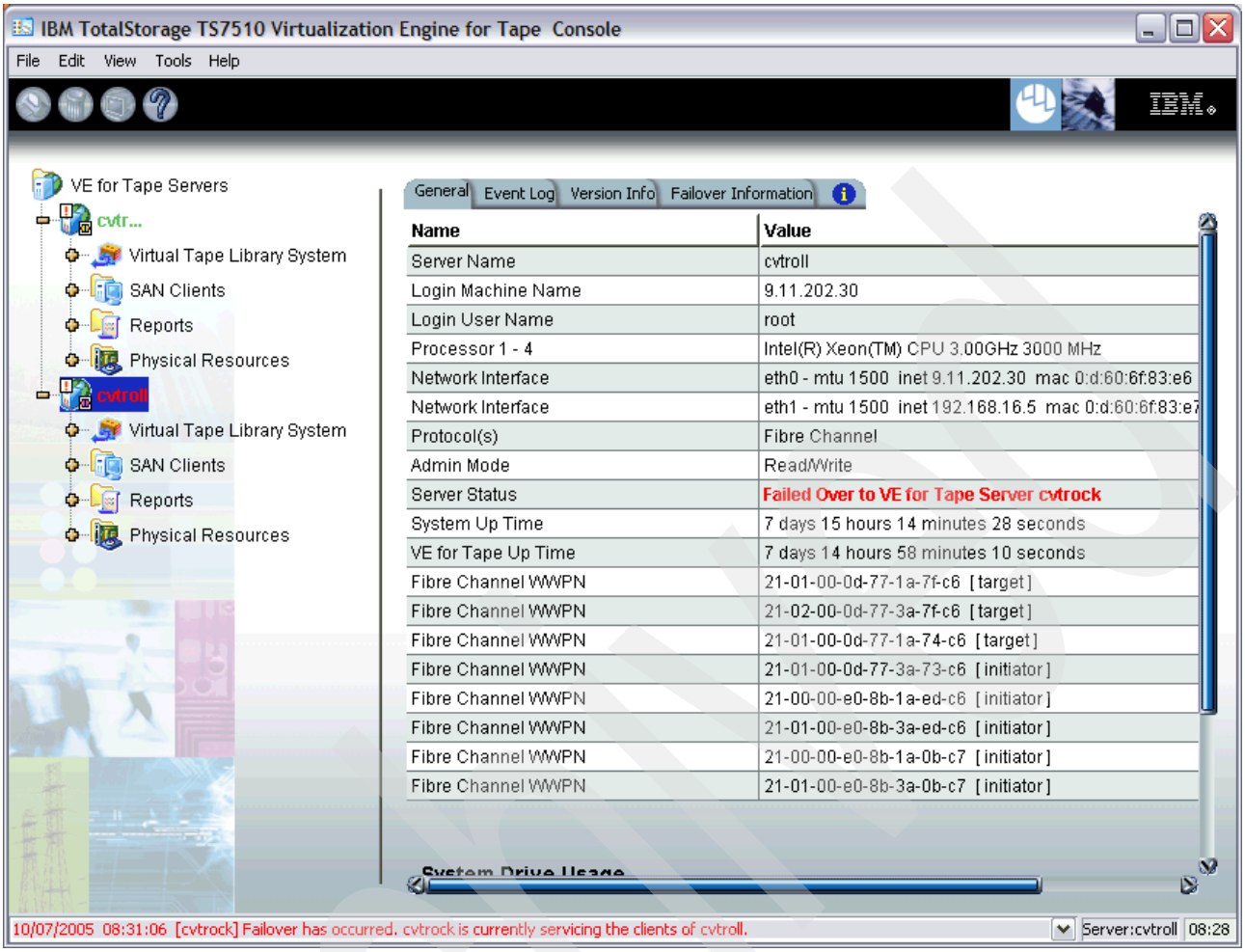

Figure 4-71 Failover status and information

Failover events are also written to the event log, where you can check for status and operational information, as well as any errors.

Failback and manual failover

To initiate a failback, select **Failover** → **Stop Takeover**. As you see in Figure 4-72, we select the **Stop Takeover cvtroll** option.

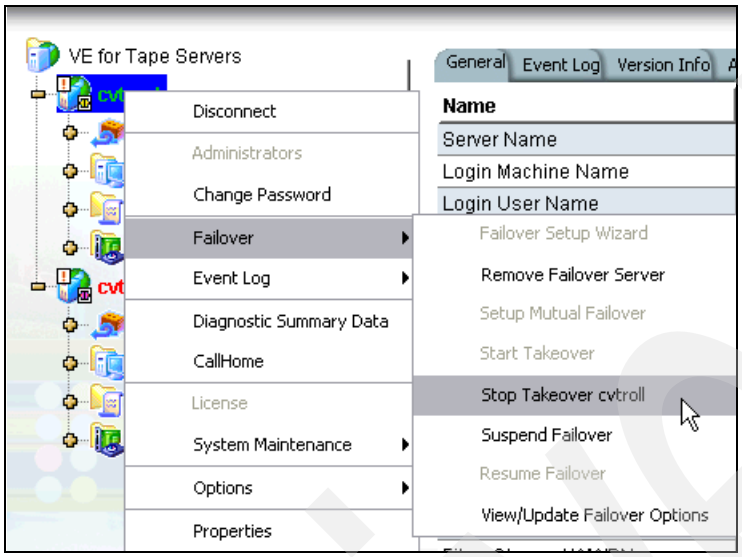

Figure 4-72 Selecting the Stop Takeover cvtroll option

From the TS7510, select the server that should take over. Select **Failover** → **Start Takeover** to initiate a failover from the second TS7510. You may want to do this if you are taking your second TS7510 offline, such as when you will perform maintenance on it.

We want to stop cvtrock, for example for maintenance, and have cvtroll take over. As shown in Figure 4-73, we right-click ***cvtroll*** and select **Failover** → **Start Takeover cvtrock**.

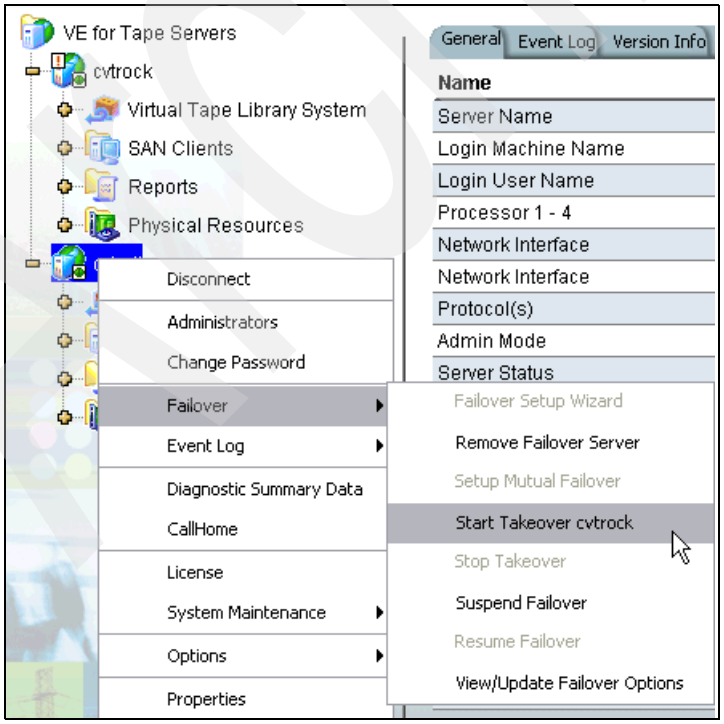

Figure 4-73 Selecting the Start Takeover cvtrock option

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Resuming backups after failover and failback

While failover and failback are transparent for the IBM Virtualization Engine TS7510, job that are running will fail. In addition, after failover and failback occur, you may need to take action in your backup application for it to work properly with the TS7510. The action you take varies by backup application and operating system.

In the following sections, we describe some of the actions that we use in our example. Your environment may differ. Refer to the documentation that came with your backup application for more details.

AIX

For a transparent failover on AIX V5.2 and later, enable Dynamic Tracking on the Fibre Channel HBAs, which are used for a TS7510 connection. Select **smit** → **Device** → **FC Adapter** → **FC SCSI Protocol Device**. In the Change/Show Characteristics of a FC SCSI Protocol Device panel (Figure 4-74), enable *Dynamic Tracking of FC Devices* by typing `yes`.

```
                 Change/Show Characteristics of a FC SCSI Protocol Device

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                                      [Entry Fields]
  FC SCSI virtual device                             fscsi0
  Description                                        FC SCSI I/O Controller Protocol Device
  Status                                             Available
  Location                                           10-78-02
  Adapter SCSI ID                                    0x30300
  How this adapter is CONNECTED                      switch
  FC Class for Fabric                               [3]                                      +
  Dynamic Tracking of FC Devices                     yes                                      +
  FC Fabric Event Error RECOVERY Policy              delayed_fail                             +
  Apply change to DATABASE only                      no                                       +

F1=Help                 F2=Refresh              F3=Cancel               F4=List
Esc+5=Reset             Esc+6=Command           Esc+7=Edit              Esc+8=Image
Esc+9=Shell             Esc+0=Exit              Enter=Do
```

Figure 4-74 Enabling Dynamic Tracking

IBM Tivoli Storage Manager

When failover occurs during an active backup or archive operation to the IBM Virtualization Engine TS7510, you need to restart the IBM Tivoli Storage Manager server task that was active. All data written to the virtual tape up to that last synchronization point will be valid. Tivoli Storage Manager marks the virtual tape as logically full and continues with a new tape, on task restart. After you make repairs to the previously failed server, we recommend that you initiate failback only when no jobs are active with the virtual drives which will be returned to the now repaired TS7510.

Veritas NetBackup

On Windows, if NetBackup has stalled jobs, reboot the NetBackup server. After rebooting, check the NetBackup tape drive and library status and restart NetBackup services, if needed. On Windows, if drives are failed or missing, starting the drives should be sufficient. However, if you cannot start one or more of the drives, reboot the NetBackup server. On Solaris, jobs usually fail gracefully and subsequent jobs start without any problems.

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4.5 Device driver installation on the host or server

After the SSR physically installs and connects the IBM Virtualization Engine TS7510 to the SAN and after basic setup, you must install the device drivers on each attached host (backup server and LAN-free clients). IBM provides the device drivers for TS7510 which are the *normal* IBM device drivers for physical IBM tape drives and IBM tape libraries. You can download the drivers from the following Web site for the desired operating systems:

`ftp://ftp.software.ibm.com/storage/devdrvr/`

However, some ISVs require their own, self-provided device drivers. For correct operation, follow the specific implementation instructions for the software that you are using to determine which device drivers are suitable for your installation.

> **Important:** The TS7510 is most likely used with vendor-provided software applications. These applications may work with the IBM provided device drivers, their own provided device drivers, or even native operating system device drivers for the tape drive and medium changer (or some combination of these, such as the IBM drive device driver and application-provided medium changer driver). For correct operation, follow the specific implementation instructions for the software that you are installing or using to determine if the IBM-supplied device drivers are suitable for installation.
>
> **Tip:** For IBM Tivoli Storage Manager, use IBM tape device drivers.

For more information and specific installation instructions for every platform, refer to *IBM Ultrium Device Drives: Installation and User's Guide,* GA32-0430, for LTO tape drives and libraries, and *IBM TotalStorage Tape Device Drivers Installation and User's Guide*, GC35-0154, for the 3592 Tape Drive. You can download both books from the Web at:

`ftp://ftp.software.ibm.com/storage/devdrvr/Doc/`

> **Note:** The manuals are different for LTO and 3592 drives. However, the device driver and the setup procedures for both types of drives are basically the same for the platforms mentioned in this publication. Unless otherwise noted, follow the procedures for both LTO and 3592 drives.

The following IBM Redbooks can also give you very useful information about installing IBM tape devices:

- *Implementing IBM Tape in UNIX Systems*, SG24-6502
- *Implementing IBM Tape in Linux and Windows*, SG24-6268

In this section, we guide you through an example of installing the driver and configuring the TS7510 under AIX. The following output was created with a single node TS7510 connected over an IBM TotalStorage SAN32B SAN switch to an IBM 7044-270 RS/6000® server running on AIX 5.2. We are using the Tivoli Storage Manager server ost36, which sees the library and six 3592-J1A Tape Drives, as created in 4.4, "Basic setup of IBM Virtualization Engine TS7510" on page 41.

The device driver used for pSeries or RS/6000 AIX platforms is called *Atape.driver*, and it includes both the tape drive (LTO and 3592) and the medium changer drivers. You must have AIX *root* authority to proceed with the installation of the driver. Use the **lslpp** command to determine if the Atape.driver is installed and to determine the version, as shown in Example 4-1.

Example 4-1 Checking if Atape.driver is installed on AIX

```
lslpp -l Atape.driver
  Fileset                      Level  State      Description
  ----------------------------------------------------------------------------
Path: /usr/lib/objrepos
  Atape.driver               9.3.9.0  COMMITTED  IBM AIX Enhanced Tape and
                                                  Medium Changer Device Driver
```

As you can see in Example 4-1, the currently installed driver is at level 9.3.9.0. If no driver is installed or a newer version is available, download the driver from the following Web site:

ftp://ftp.software.ibm.com/storage/devdrvr/AIX/

Be sure to check the readme file for the latest installation notes and prerequisites. In our example, we are installing Atape.drive version 9.5.2.0. We downloaded the file Atape.driver.9.5.2.0.bin and stored in the /home/redbook/ directory.

You can use either the command line or SMIT to install the driver. We are using only command line commands for installing the driver and configuring the TS7510.

To install or update the driver, use the following command:

```
installp -acXd /directory/filename Atape.driver
```

We downloaded the Atape.driver.9.5.2.0.bin file and stored it in the /home/redbook/ directory, using the following command string:

```
installp -acXd /home/redbook/Atape.9.5.2.0.bin Atape.driver
```

Example 4-2 shows the output of the **installp** command. We shortened the output and marked the important steps by emphasizing them in bold font. After the installation was successful, we checked the installed version using the **installp** command.

Example 4-2 AIX Atape installation output

```
installp -acXd /home/redbook/Atape.9.5.2.0.bin Atape.driver
+-----------------------------------------------------------------------------+
                    Pre-installation Verification...
+-----------------------------------------------------------------------------+
Verifying selections...done
Verifying requisites...done
Results...

SUCCESSES
---------
  Filesets listed in this section passed pre-installation verification
  and will be installed.

  Selected Filesets
  -----------------
  Atape.driver 9.5.2.0                        # IBM AIX Enhanced Tape and Me...

  << End of Success Section >>

<<shorten>>>
+-----------------------------------------------------------------------------+
                          Installing Software...
+-----------------------------------------------------------------------------+

installp: APPLYING software for:
        Atape.driver 9.5.2.0
```

```
<<shorten>>>
+-----------------------------------------------------------------------------+
                                Summaries:
+-----------------------------------------------------------------------------+

Installation Summary
--------------------
Name                        Level           Part        Event       Result
-------------------------------------------------------------------------------
Atape.driver                9.5.2.0         USR         APPLY       SUCCESS

ost36> lslpp -l Atape.driver
  Fileset                      Level  State      Description
  ----------------------------------------------------------------------------
Path: /usr/lib/objrepos
  Atape.driver               9.5.2.0  COMMITTED  IBM AIX Enhanced Tape and
                                                  Medium Changer Device Driver
```

After the driver is installed, use the **lsdev -Cc tape** command to check whether the tapes and library are already configured. If not, run the **cfgmgr** command to configure all new devices automatically.

To verify that the installation is done correctly and to collect information, such as the serial number of the drives and library, you can use the following commands:

- `lsdev -Cc tape`
- `lsattr -El` *device_name*
- `lscfg -vl` *device_name*

We show the output from these commands in the examples that follow.

With the **lsdev -Cc tape** command, you get a short overview of which tape devices were created. In Example 4-3, you see *rmt1* to *rmt6* are 3592 Tape Drives. *rmt0* is an internal 4mm tape drive. *smc0* is the library interface to a 3584 Tape Library, called *SCSI Medium Changer* (smc).

Example 4-3 Output from lsdev -Cc tape

```
lsdev -Cc tape
rmt0  Available 10-60-00-0,0 SCSI 4mm Tape Drive
rmt1  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt2  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt3  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt4  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt5  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt6  Available 10-78-02     IBM 3592 Tape Drive (FCP)
smc0  Available 10-78-02     IBM 3584 Library Medium Changer (FCP)
```

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Now we take a closer look at the devices. First we start with the smc0. With the **lscfg -vl *device_name*** command, we get the serial number of the library. As shown in Example 4-4, the serial number of the IBM 3584 Tape Library is 4CPQY00202. This is the virtual library which we created in 4.4.8, “Creating libraries, tape drives, and cartridges” on page 56.

Example 4-4 Output from lscfg -vl smc0

```
lscfg -vl smc0
  smc0             P2-I5/Q1-W2101000D771A93C6-L0  IBM 3584 Library Medium Changer (FCP)

        Manufacturer................IBM
        Machine Type and Model......03584L32
        Serial Number...............4CPQY00202
        Device Specific.(FW)........4.02
```

With the **lsattr -El *device_name*** command, we take a much closer look at the details, such as the WWPN which is displayed. You may recognize the WWPN 2101000d771a93c6 (see 4.4.10, “LUN masking: Assigning a host to a library and drives” on page 69) shown in Example 4-5. This is the WWPN of the target Fibre Channel HBA to which the host ost36 was assigned.

Example 4-5 Output from lsattr -El smc0

```
lsattr -El smc0
alt_pathing     no                 Enable Alternate Pathing Support                True
debug_trace     no                 Debug Trace Logging Enabled                     True
dev_status                         N/A                                             False
devtype         03584L32           Device Type                                     False
location                           Location                                        True
lun_id          0x0                Logical Unit Number                             True
new_name                           New Logical Name                                True
node_name       0x2001000d771a93c6 World Wide Node Name                            False
primary_device  smc0               Primary Logical Device                          False
reserve_support yes                Use Reserve/Release on Open and Close           True
retain_reserve  no                 Retain Reservation                              False
scsi_id         0x20802            SCSI Target ID                                  True
trace_logging   no                 Trace Logging Enabled                           True
tsm_barcode_len 6                  TSM Barcode Length for Ultrium 1/Ultrium 2 Media True
ww_name         0x2101000d771a93c6 World Wide Port Name                            False
```

Now let’s look at some sample output from tape drives. This output might be more important than the output from the library, because you normally have several tape drives and must determine which tape drive on the host system relates to the which tape drive on the virtual library. You must determine the relationships before you can configure your ISV software. For example, consider that rmt1 on your host system is not necessarily drive1 on your tape library, and rmt2 on your host systems is not drive2 on your tape library, and so on.

Therefore collect the serial number of each tape drive and match the numbers with the drives in the virtual library. Use the **lscfg -vl device_name** command to collect the serial number of each tape drive as shown in Example 4-6.

Example 4-6 Output from lscfg -vl rmt1

```
lscfg -vl rmt1
  rmt1            P2-I5/Q1-W2101000D771A93C6-L1000000000000  IBM 3592 Tape Drive (FCP)

        Manufacturer................IBM
        Machine Type and Model......03592J1A
        Serial Number...............4CPQY00203
        Device Specific.(FW)........044C
        Loadable Microcode Level....A0B00E26
```

With the **lsattr -El device_name** command, you get some additional information from the tape drive, such as the WWPN, as shown in Example 4-7. The WWPN of the tape drive is the same as for the SCSI Medium Changer, because we are using the same Fibre Channel HBA for the library and for all drives as discussed in 4.4.10, “LUN masking: Assigning a host to a library and drives” on page 69.

Example 4-7 Output from lsattr -El rmt1

```
lsattr -El rmt1
alt_pathing    no                Enable Alternate Pathing Support          True
block_size     0                 Block Size (0=Variable Length)            True
compress       yes               Use Hardware Compression on Tape          True
debug_trace    no                Debug Trace Logging Enabled               True
dev_status                       N/A                                       False
devtype        03592J1A          Device Type                               False
drive_port     0                 Drive Port Number                         False
drive_scsi_id  00                Drive SCSI ID                             False
location                         Location                                  True
logging        no                Activate volume information logging       True
lun_id         0x1000000000000   Logical Unit Number                       True
max_log_size   500               Maximum size of log file (in # of entries) True
mode           yes               Use Buffered Writes                       True
mtdevice                         Library Device Number                     True
new_name                         New Logical Name                          True
node_name      0x2001000d771a93c6 World Wide Node Name                     False
primary_device rmt1              Primary Logical Device                    False
retain_reserve no                Retain Reservation                        False
rew_immediate  no                Use Immediate Bit in Rewind Commands      True
scsi_id        0x20802           SCSI Target ID                            True
space_mode     SCSI              Backward Space/Forward Space Record Mode  True
trace_logging  no                Trace Logging Enabled                     True
trailer_labels no                Trailer Label Processing                  True
ww_name        0x2101000d771a93c6 World Wide Port Name                     False
```

4.6 ISV software setup

After creating and configuring the virtual library and installing the device drivers, we can start to configure the ISV software to use the virtual tape library and virtual tape drives. In general, there is no difference in configuring a virtual tape library compared to a real physical tape library. The IBM Virtualization Engine TS7510 should be treated like a SCSI Library or Autochanger Library.

4.6.1 Setting up Tivoli Storage Manager

In this section, we explain how to define the virtual library, which we created in 4.4.8, “Creating libraries, tape drives, and cartridges” on page 56, to a Tivoli Storage Manager server, called *ost36*. In addition we define three tape drives to one LAN-free client, called *dst66*. Because of the LUN masking, which we did in 4.4.10, “LUN masking: Assigning a host to a library and drives” on page 69, we assigned the virtual library and six tape drives to the server ost36 and three tape drives to LAN-free client dst66.

Tivoli Storage Manager uses IBM tape device drivers for all IBM tape products. We installed the IBM tape device driver already, as explained in 4.5, “Device driver installation on the host or server” on page 97.

Tivoli Storage Manager server and Tivoli Storage Manager client, including the Storage Agent software, were already installed, and the Tivoli Storage Manager server is already running. Tivoli Storage Manager Version 5, Release 3, Level 1.4 was used. In addition, the necessary definition for the Storage Agent was already made. We explain only how to define the library and tape drives. Both servers ost36 and dst66 are running on AIX 5.2. We show you how to configure the library and drives on AIX. However, there is only a little difference on the device files. You can find more information about how to configure Tivoli Storage Manager on different operating systems in the following IBM Redbooks:

- *Implementing IBM Tape in UNIX Systems*, SG24-6502
- *Implementing IBM Tape in Linux and Windows*, SG24-6268

Defining tape library and tape devices on the Tivoli Storage Manager server

Use the following commands to define the library, the library path, the drives, and the drive paths to Tivoli Storage Manager using the administrative command line. First we define the library and the library path:

```
DEFINE LIBRARY library_name LIBTYPE=SCSI SHARED=YES

DEFINE PATH server_name library_name SRCTYPE=SERVER DESTTYPE=LIBRARY DEVICE=dev_name
```

For *library_name*, enter a user-specified name of the library to be defined. For *server_name*, enter the name of your Tivoli Storage Manager server, and for *dev_name*, enter the full device name of library, such as /dev/smc0.

For library name, we choose cvtrock, and our Tivoli Storage Manager server is called ost36. The device path for the library is /dev/smc0 (see Example 4-3 on page 99). See Example 4-8.

Example 4-8 Defining the library and library path

```
tsm: TSM>DEFINE LIBRARY cvtrock LIBTYPE=SCSI SHARED=YES
ANR8400I Library CVTROCK defined.
tsm: TSM>DEFINE PATH TSM CVTROCK SRCTYPE=SERVER DESTTYPE=LIBRARY DEVICE=/dev/smc0
ANR1720I A path from TSM to CVTROCK has been defined
```

Next we define tape drives and tape paths using the following commands:

```
DEFINE DRIVE library_name drive_name CLEANFREQUENCY=none

DEFINE PATH server_name drive_name SCRTYPE=SERVER DESTTYPE=DRIVE LIBRARY=library_name
DEVICE=dev_name
```

For *library_name*, enter the name of your already defined library (`cvtrock` in our example). For *drive_name*, enter a user-specified name of the drive to be defined. Use the operating system device name of the tape drive being defined for *def_name*. Enter the full device name

for *dev_name*, such as /dev/rmt1. Since cleaning of a virtual library does not make sense, we choose `cleanfrequency=none`.

Example 4-9 shows you the output from the Tivoli Storage Manager command line during configuration of our six drives in our library cvtrock.

Example 4-9 Defining drives and drive paths

```
tsm: TSM>DEFINE DRIVE cvtrock drive_1 cleanfrequency=none
ANR8404I Drive DRIVE_1 defined in library CVTROCK.

tsm: TSM>DEFINE PATH TSM drive_1 srctype=server desttype=drive library=cvtrock
device=/dev/rmt1
ANR1720I A path from TSM to CVTROCK DRIVE_1 has been defined.

tsm: TSM>DEFINE DRIVE cvtrock drive_2 cleanfrequency=none
ANR8404I Drive DRIVE_2 defined in library CVTROCK.

tsm: TSM>DEFINE PATH TSM drive_2 srctype=server desttype=drive library=cvtrock
device=/dev/rmt2
ANR1720I A path from TSM to CVTROCK DRIVE_2 has been defined.

tsm: TSM>DEFINE DRIVE cvtrock drive_3 cleanfrequency=none
ANR8404I Drive DRIVE_3 defined in library CVTROCK.

tsm: TSM>DEFINE PATH TSM drive_3 srctype=server desttype=drive library=cvtrock
device=/dev/rmt3
ANR1720I A path from TSM to CVTROCK DRIVE_3 has been defined.

tsm: TSM>DEFINE DRIVE cvtrock drive_4 cleanfrequency=none
ANR8404I Drive DRIVE_4 defined in library CVTROCK.

tsm: TSM>DEFINE PATH TSM drive_4 srctype=server desttype=drive library=cvtrock
device=/dev/rmt4
ANR1720I A path from TSM to CVTROCK DRIVE_4 has been defined.

tsm: TSM>DEFINE DRIVE cvtrock drive_5 cleanfrequency=none
ANR8404I Drive DRIVE_5 defined in library CVTROCK.

tsm: TSM>DEFINE PATH TSM drive_5 srctype=server desttype=drive library=cvtrock
device=/dev/rmt5
ANR1720I A path from TSM to CVTROCK DRIVE_5 has been defined.

tsm: TSM>DEFINE DRIVE cvtrock drive_6 cleanfrequency=none
ANR8404I Drive DRIVE_6 defined in library CVTROCK.

tsm: TSM>DEFINE PATH TSM drive_6 srctype=server desttype=drive library=cvtrock
device=/dev/rmt6
ANR1720I A path from TSM to CVTROCK DRIVE_6 has been defined.
```

Defining the device class and storage pool

We now define the device class and storage pool for our library cvtrock. Configuring device classes and storage pools is the same for all operating systems.

For LTO drives, use LTO as the DEVTYPE parameter:

```
DEFINE DEVCLASS devclass_name LIBRARY=library_name DEVTYPE=LTO FORMAT=Ultrium2/Ultium3
MOUNTLIMIT=DRIVES
```

For 3592 drives, use 3592 as the DEVTYPE parameter:

```
DEFINE DEVCLASS devclass_name LIBRARY=library_name DEVTYPE=3592 FORMAT=3592
MOUNTLIMIT=DRIVES
```

The *library_name* must match the name of the library you previously defined. We recommend that you do not use compression on the IBM Virtualization Engine TS7510, because compression has performance impacts. For FORMAT, use either LTO2, LTO3, or 3592. However, if compression is more important than performance, you can use compression by selecting LTO2C, LTO3C, or 3592C for the FORMAT parameter.

Example 4-10 shows our device class definition.

Example 4-10 Device class definition

```
tsm: TSM>def dev cvt libr=cvtrock devtype=3592 Format=3592 mountlimit=drives
ANR2203I Device class CVT defined.
```

After defining the device class, we can now define the storage pool:

```
DEFINE STGPOOL stgpool_name devclass_name MAXSCRATCH=10
```

For *devclass_name*, specify the name of the just defined device class. For MAXSCRATCH, specify the number of tapes that you want to use in this storage pool. This means that you must use the number of tapes created on the virtual library that you are using in this configuration.

We define a storage pool called *cvt_stgpool* as shown in Example 4-11.

Example 4-11 Defining a storage pool

```
tsm: TSM>define stgpool cvt_stgpool cvt maxscratch=10
ANR2200I Storage pool CVT_STGPOOL defined (device class CVT).
```

For discussion about any additional parameters for the storage pool, such as migration to the next storage pool, see 5.4.1, “Only the TSM server has access to the tape library” on page 119.

Inserting and labeling cartridges

Now we can label the tape cartridges with the following command:

```
LABEL LIBVOLUME library_name SEARCH=yes LABELSOURCE=barcode CHECKIN=scratch
```

With this command, Tivoli Storage Manager labels all new cartridges. We start the labeling process as shown in Example 4-12.

Example 4-12 Label volumes

```
tsm: TSM>label libvol cvtrock search=yes labelsource=barcode checkin=scratch
ANS8003I Process number 5 started.
```

You may check the progress by using the **q proc** command as shown in Example 4-13.

Example 4-13 Progress of label libvolume

```
tsm: TSM>q proc

 Process     Process Description      Status
  Number
--------     --------------------     --------------------------------------------------
       5     LABEL LIBVOLUME          ANR8805I Labelling volumes in library CVTROCK; 4
                                       volumes(s) labelled.
```

After the label process is finished, you can check the result by using the **q libvol** command if all volumes are labeled, as shown in Example 4-14.

Example 4-14 q libvol

```
tsm: TSM>q libvol

Library Name Volume Name     Status         Owner          Last Use       Home        Device
                                                                          Element     Type
------------ -----------     ----------     ----------     ---------      -------     ------
CVTROCK      AA0000          Scratch                                       1,027       3592
CVTROCK      AA0001          Scratch                                       1,028       3592
CVTROCK      AA0002          Scratch                                       1,029       3592
CVTROCK      AA0003          Scratch                                       1,030       3592
CVTROCK      AA0004          Scratch                                       1,031       3592
CVTROCK      J1S348          Scratch                                       1,026       3592
CVTROCK      J1S387          Scratch                                       1,025       3592
```

Now you can start backups to the TS7510 by selecting the newly defined storage pool in your policies.

Defining tape drives for the LAN-free client (Storage Agent)

In this section, we assume that the Storage Agent is already defined at the Tivoli Storage Manager server. For more information about how to set up a Storage Agent, see the *IBM Tivoli Storage Manager for SAN for AIX Storage Agent User's Guide Version 5.3*, GC32-0771.

Now we define three tape drives, which are seen by the LAN-free client *dst66,* for use with Tivoli Storage Manager. Device drivers should already be installed and configured on the LAN-free client as explained in 4.5, “Device driver installation on the host or server” on page 97. The storage agent was already defined to the server *ost36* as *dst66agnt.* As explained in 4.4.10, “LUN masking: Assigning a host to a library and drives” on page 69, we assigned three tape drives (drive 4, drive 5, and drive 6) to our LAN-free client dst66.

On the Tivoli Storage Manager server, in our case ost36, we must define the drive path from the storage agent:

```
DEFINE PATH server_name drive_name SRCTYPE=SERVER DESTTYPE=DRIVE LIBRARY=library_name
DEVICE=device_name
```

For *server_name*, enter the name of the LAN-free client (Storage Agent), which in our case is `dst66agnt`, and for *library_name*, enter the name of your already defined library, which is `cvtrock`. For *device_name*, specify the name of the device special file on the Storage Agent.

First, check the device files on our Storage Agent, dst66, by using the **lsdev -Cc tape** command, as shown in Example 4-15.

Example 4-15 lsdev -Cc tape output from server dst66

```
dst66> lsdev -Cc tape
rmt0 Available 14-08-02 IBM 3592 Tape Drive (FCP)
rmt1 Available 14-08-02 IBM 3592 Tape Drive (FCP)
rmt2 Available 14-08-02 IBM 3592 Tape Drive (FCP)
```

Next define the device paths on the Tivoli Storage Manager server, as shown in Example 4-16. Keep in mind that we assigned drive4, drive5, and drive6 to the LAN-free client, dst66. Therefore we have to define those drives.

Example 4-16 Defining the derived paths on the Tivoli Storage Manager server

```
tsm: TSM>define path dst66agnt drive_4 srctype=server desttype=drive library=cvtrock
device=/dev/rmt0
ANR1720I A path from DST66AGNT to CVTROCK DRIVE_4 has been defined.

tsm: TSM>define path dst66agnt drive_5 srctype=server desttype=drive library=cvtrock
device=/dev/rmt1
ANR1720I A path from DST66AGNT to CVTROCK DRIVE_5 has been defined.

tsm: TSM>define path dst66agnt drive_6 srctype=server desttype=drive library=cvtrock
device=/dev/rmt2
ANR1720I A path from DST66AGNT to CVTROCK DRIVE_6 has been defined.
```

Now you can start a LAN-fee data transfer (backup and restore).

Performance hints for Tivoli Storage Manager and IBM Virtualization Engine TS7510

Because Tivoli Storage Manager writes a record of each file backed up to its database for tracking, it performs better with large file workloads than with small file workloads. This performance is a result of the proportion of time spent doing database writes and updates as a fraction of the total backup time. Therefore, to get the best performance with Tivoli Storage Manager and TS7510, be sure to raise the *TXNGroupmax* parameter on the server to its maximum value of 256. This parameter controls the number of files that are transferred as a group between the client and server.

On the client, also set the *TXNBytelimit* parameter to its maximum of 2097152. This parameter specifies the number of kilobytes that the client program can buffer together in a transaction before it sends data to the server.

To set TXNGroupmax, edit the dsmserv.opt file on the Tivoli Storage Manager server and enter or edit the following value:

```
TXNGroupmax 256
```

If you are using the Storage Agent for LAN-free backup, you should also set this parameter to the same value in the dsmsta.opt options file. You must restart the server process, which is required to enable this change. For Storage Agent, you must also restart the Storage Agent process.

To set the client TXNBytelimit parameter, edit the dsm.sys (for UNIX® clients) or dsm.opt entry:

```
TXNByte 2097152
```

4.6.2 Setting up Veritas NetBackup

For Veritas NetBackup, use virtual library emulation with the product ID TS7510 and with tape drive emulation LTO2 or 3592. Create the library as shown in Figure 4-75.

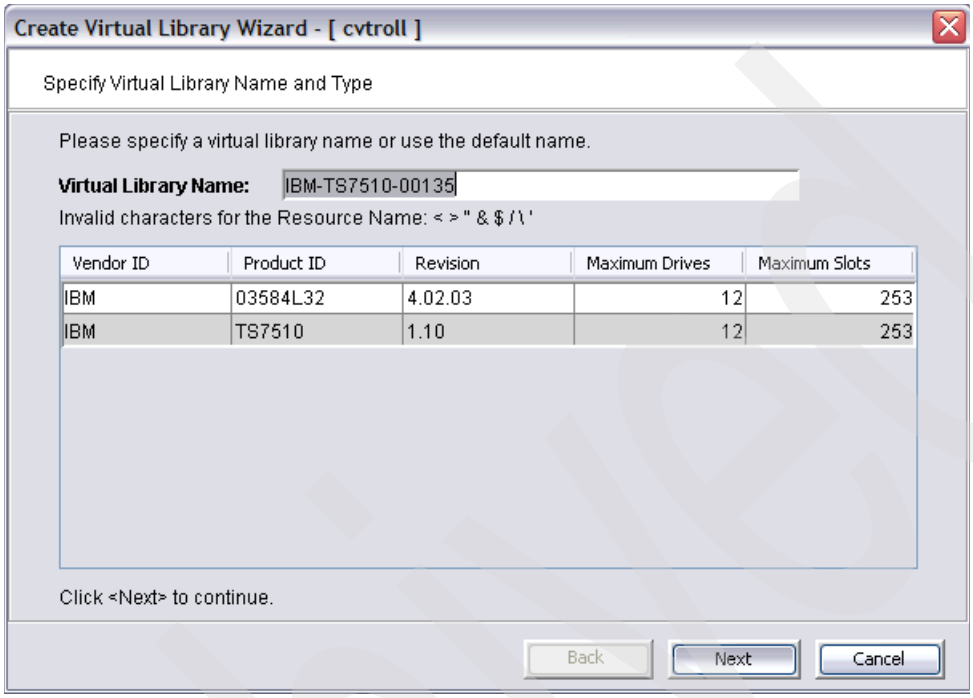

Figure 4-75 Virtual library TS7510 for Veritas NetBackup

Veritas NetBackup does not support Import/Export on any virtual library, and therefore neither is the TS7510 supported. Use the Veritas tape device driver for connection to the TS7510.

The installation of the TS7510 is like the installation of a real physical tape library.

1. Install the latest available tape device driver on the Veritas Master Server or on the Veritas Media Server, where the TS7510 will be connected. Check the Veritas support Web site to see whether newer tape drivers are available:

   http://www.support.veritas.com

2. Check the Veritas support Web site for a newer *device_mappings.txt* file, and copy the new file into the appropriate folder:
   - UNIX: .. /usr/openv/share/
   - Windows: .. install_path\VERITAS\NetBackup\share\

3. If you previously installed IBM tape device driver, select the **Use VERITAS tape drivers for all tape devices** option when installing the Veritas device drivers as shown in Figure 4-76. With this option, all tape devices will be assigned a Veritas driver, regardless of whether an IBM driver was installed. Click **Next**.

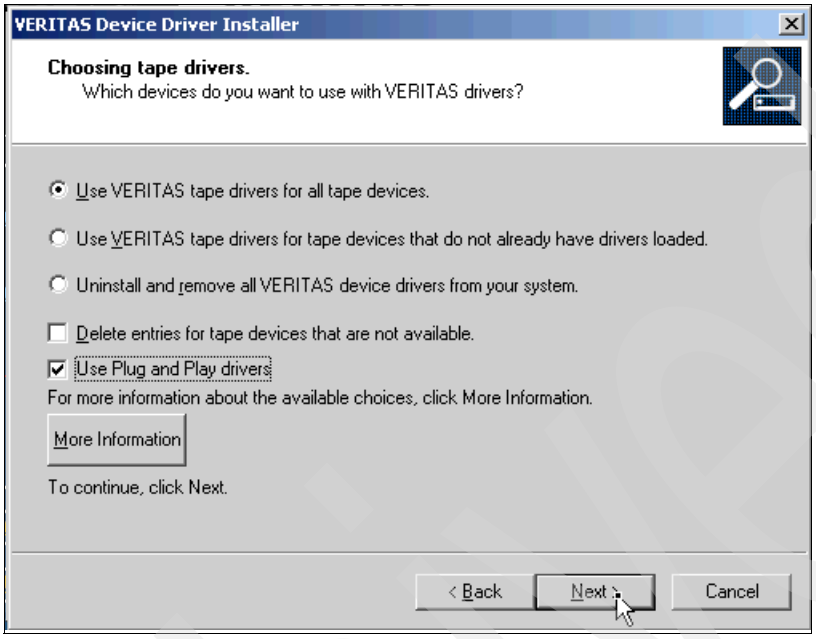

Figure 4-76 Installing the Veritas device driver

4. You might need to reboot after you update the device drivers.
5. Run the device wizard to configure the library and the tape devices as explained in the Veritas documentation.

Archived

5

IBM Tivoli Storage Manager usage considerations

In this chapter, we explain how to use the IBM Virtualization Engine TS7510 together with IBM Tivoli Storage Manager and with a physical tape library. We discuss the differences, the advantages, and disadvantages of disk and tape backup. We also demonstrate the advantages of the IBM Virtualization Engine TS7510 over a Tivoli Storage Manager native disk buffer.

Furthermore, we explain how to use the IBM Virtualization Engine TS7510 and a physical tape library together in different environments:

- Tape library directly connected to a TS7510
- TS7510 and tape library connected to Tivoli Storage Manager (TSM) server
- LAN-free clients with access to the tape library

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5.1 Tivoli Storage Manager and TS7510 Virtualization Engine

Most virtual tape libraries on the market are only disk backup devices with tape emulation. Vendors claim that there are advantages of disk backup over tape backup, but compare old tape technology with lower throughput and less reliability than the currently available tape technology from IBM.

IBM tape drives, Linear Tape-Open (LTO) Ultrium 3 and TS1120, have such a high throughput, 80 MB/sec. and 100 MB/sec. (native), that they can easily handle all backup or restore streams. Not many disk subsystems and servers are available which can deliver a higher single throughput. Also most virtual tape libraries do not have a higher throughput than approximately 100 MB/sec. for a single stream. In addition IBM tape drives use highly efficient compression algorithms which make the throughput of LTO Ultrium 3 and IBM 3592 even higher. And tape has the lowest cost for storing large amounts of data.

The advantage of disk compared to tape is the fast and random access to data. This means that all incremental and differential backups can be restored faster on disk than on tape. Incremental and differential backups tend to create fragmented tape cartridges. Tape is a sequential media, and to access a file on tape media, the tape drive has to locate the file. For the restore of a total server that was incrementally or differentially backed up, the tape drives spend most of the time locating to the next file. Therefore having incremental or differential backups on disk may reduce the restore time, compared to tape.

Figure 5-1 illustrates how the restore of incremental or differential data works. On the first day, files 1, 2, and 3 were backed up and stored on tape in continuous order. On the second day, files 1 and 2 were modified and backed up. Files 1 and 2 on the tape are now invalid. On the third day, file 1 was backed up, which made file 1 from the second day invalid on the tape.

If a restore starts now, the tape drive has to locate file 1 first before it can restore. Then another locate of file 2 is required before it can be read. A final locate for file 3 is performed from the tape drive before file 3 is restored. A random locate takes an average of 44 seconds for an LTO Ultrium 3 drive. In our example, the total data transfer time is a couple of seconds, but the total restore takes a couple of minutes due to the tape drive file locate time.

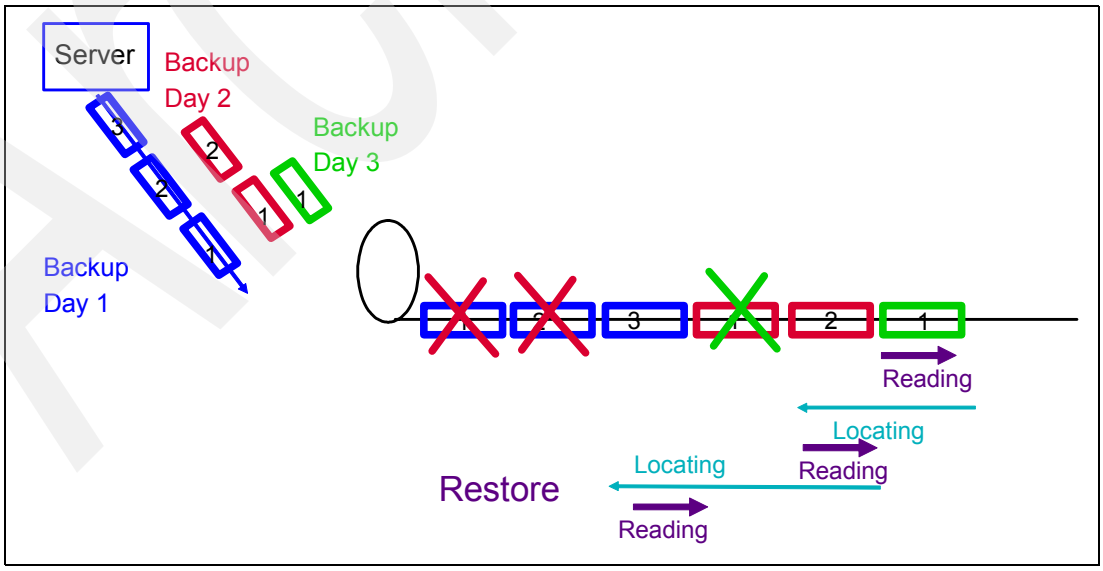

Figure 5-1 Restoring incremental or differential backup

In most cases, incremental and differential backups are not sufficient for disaster recovery for a large amount of data, even it is stored on disk. For a fast restore of a large amount of data, a full image backup is the appropriate way. For an image backup, there is no difference between restoring from tape or from disk.

Another advantage for a disk subsystem, when compared to a tape drive, is that multiple input/output (I/O) operations can run simultaneously. For a tape device, you can have one single stream. This is the biggest advantage for a disk subsystem compared to tape, especially if you have many slow streaming backups to run at the same time. For this reason, we recommend that you use a large disk buffer and keep at least one daily backup on the disk.

Tivoli Storage Manager has handled disk base backup very well for many years. Why should you use IBM Virtualization Engine TS7510?

The IBM Virtualization Engine TS7510 is a disk backup device with tape emulation. All advantages of disk compared to tape are also valid for the IBM Virtualization Engine TS7510. Compared to the Tivoli Storage Manager disk storage pool, the advantage of the IBM Virtualization Engine TS7510 is the tape emulation, which enables LAN-free backup to disk without having a shared SAN file system, such as SANergy® or SAN File System (SFS).

There is some advantage, although small, for some large environments with several TSM servers in place in that you don't need to assign a dedicated disk pool for every server. With the IBM Virtualization Engine TS7510, you can either share a virtual library or you can create several virtual libraries for every server. You don't need to assign a specific capacity to every server, because the TS7510 assigns capacity as required.

How do you use IBM Virtualization Engine TS7510 with Tivoli Storage Manager? You use it like your disk pool and as a replacement of your disk pool. As mentioned already, the IBM Virtualization Engine TS7510 has one big advantage over a native Tivoli Storage Manager storage pool, that LAN-free backup to TS7510 is possible. Therefore if you have many LAN-free clients, then you might see the biggest benefit from the IBM Virtualization Engine TS7510.

The IBM Virtualization Engine TS7510 does not replace real, physical tape drives and tape libraries, because tape media is much cheaper on a per GB price point of view than any available disk. The TS7510 is a complementary backup device to the tape environment, which may give your tape drives better bandwidth utilization.

If you are using high performance tape drives, such as LTO Ultrium 3 or 3592, then use the IBM Virtualization Engine TS7510 for all backup streams that may not fully utilize the tape drive. This releases the physical tape drives and makes them available for really high-speed backups, which fully utilize the tape drive.

Migrate data from the TS7510 to physical tape after most of the backups are done. This means that you migrate the data from IBM Virtualization Engine TS7510 to physical tape in a time frame with low workload on the TSM server. Before you migrate the data from the IBM Virtualization Engine TS7510 to physical tape, consider creating the copy pools, if desired, from the TS7510.

For better restore performance for some kinds of data, consider keeping data on the IBM Virtualization Engine TS7510 longer (see 3.2, "Backup practices and recommendations" on page 27). Also, as explained in 5.4, "TS7510 and a physical tape library connected to TSM server" on page 119, you might not want to use different data paths for backup and restore. Therefore, you might want to keep data longer in your IBM Virtualization Engine TS7510.

There are different ways to use an IBM Virtualization Engine TS7510 and real, physical tape library together with Tivoli Storage Manager. You might connect the physical tape library to the TS7510 and use the Import/Export function from the TS7510 (see Figure 5-2). As already discussed and shown in 5.3, “Using Import/Export with Auto Archive for vaulting” on page 115, this is a rudimentary approach and should be used for vaulting reasons only.

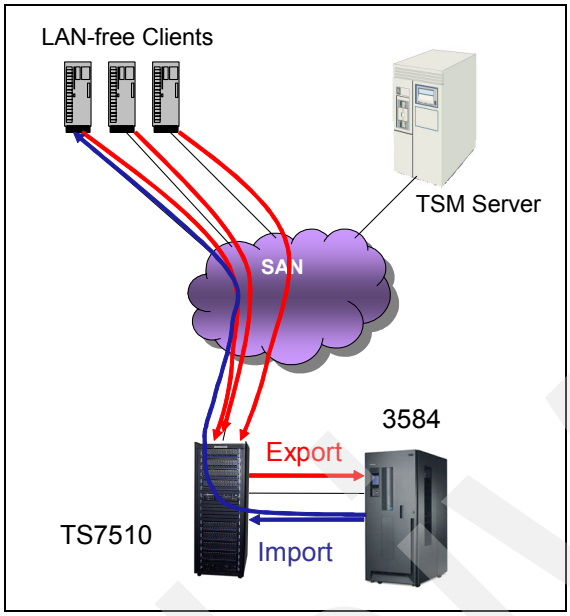

Figure 5-2 TS7510 with a direct attached tape library

Therefore, we recommend that you connect the tape library to the TSM server in parallel with the IBM Virtualization Engine TS7510 (see Figure 5-3). The TSM server then sees two tape libraries, one IBM Virtualization Engine TS7510 and one physical library, such as an IBM 3584. Define the physical library as the next storage pool to the TS7510. Allow Tivoli Storage Manager to manage the migration from TS7510 to physical tape, depending on your requirements.

After migration, the restore path is different. In case of a restore, you need to restore the data over LAN or migrate the needed data back to TS7510 with the MOVE NODEDATA command.

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As shown in Figure 5-3, the LAN-free clients back up to the IBM Virtualization Engine TS7510. The TSM server migrates the data from the TS7510 to the 3584 Tape Library. LAN-free clients can restore data from the TS7510 as long as the data is still in the TS7510. After migration, the restore goes through the TSM server and over the LAN, because the LAN-free clients do not have access to the physical tape. LAN-free clients with large amounts of backup data (large DB) and with high throughput, which can fully utilize a physical tape drive, can directly backup and restore to and from physical tape. We discuss the Tivoli Storage Manager configuration in 5.4.1, “Only the TSM server has access to the tape library” on page 119.

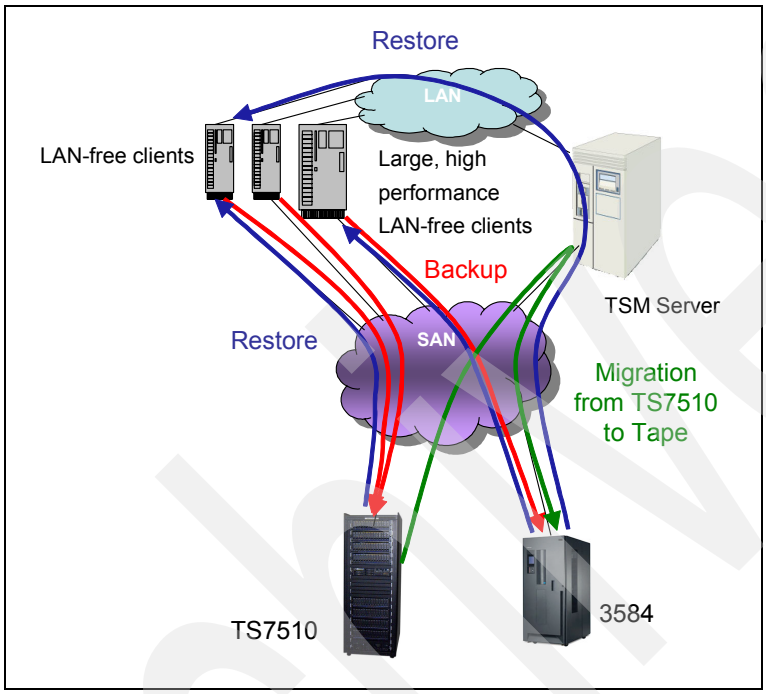

Figure 5-3 TS7510 and physical tape library connected to a TSM server

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You might size the capacity of the IBM Virtualization Engine TS7510 that most restores come from (as discussed in 3.2.3, “Time at which the majority of restores occurs: Restore pattern” on page 29). Alternatively you might consider that the LAN-free clients also have access to the physical tape library (see Figure 5-4), which means that the LAN-free clients can also restore over the SAN from the physical tape drives.

We discuss the Tivoli Storage Manager configuration in 5.4.2, “The TSM server and LAN-free clients have access to the tape library” on page 123.

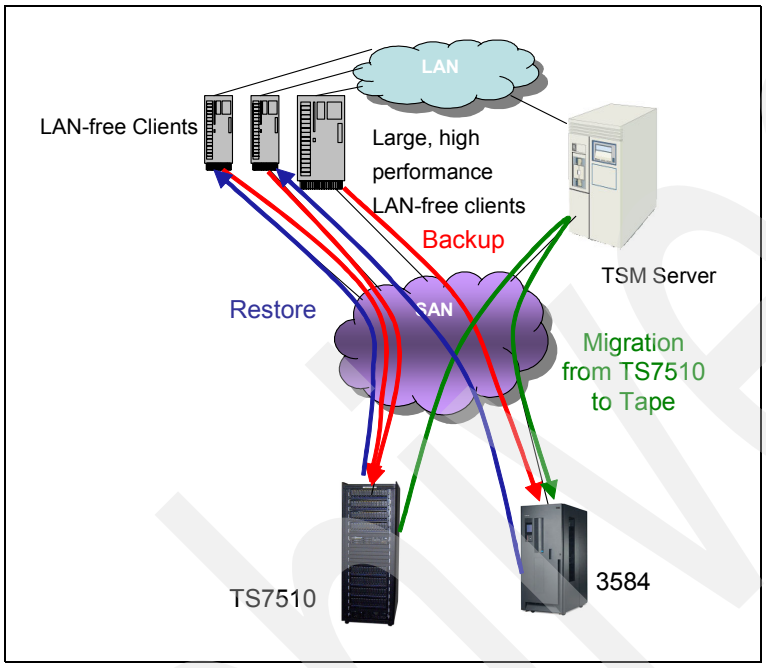

Figure 5-4 LAN-free clients with access to a physical library

5.2 Sizing and usage considerations

Before we provide suggestions for sizing the disk capacity of the IBM Virtualization Engine TS7510, we must discuss which data should go to disk (Tivoli Storage Manager disk buffer or TS7510) and which should go directly to physical tape.

Backups with a large amount of data (a couple of hundred GBs), which come from server (LAN-free clients) that can fully use a physical tape drive, should go to physical tape. Physical tape can create backups at about 60 MB/sec or more for a single stream. There is no advantage for backup or restore whether this data is stored on disk or on tape.

All other full backups (one data stream) should be directed first to disk, because you can have multiple backup streams to disk at the same time. After the backups are done, the data can be migrated with high throughput from disk to tape. Because this data is in one stream, there is no disadvantage during restore if the data comes from tape, since no locate must be done during restore. The whole backup is a single file.

Incremental backups should go first to disk and might be migrated to tape later, depending on the restore needs and the service-level agreements (SLAs). See 3.2.4, “Service-level agreements” on page 30.

Figure 5-5 illustrates the decision tree.

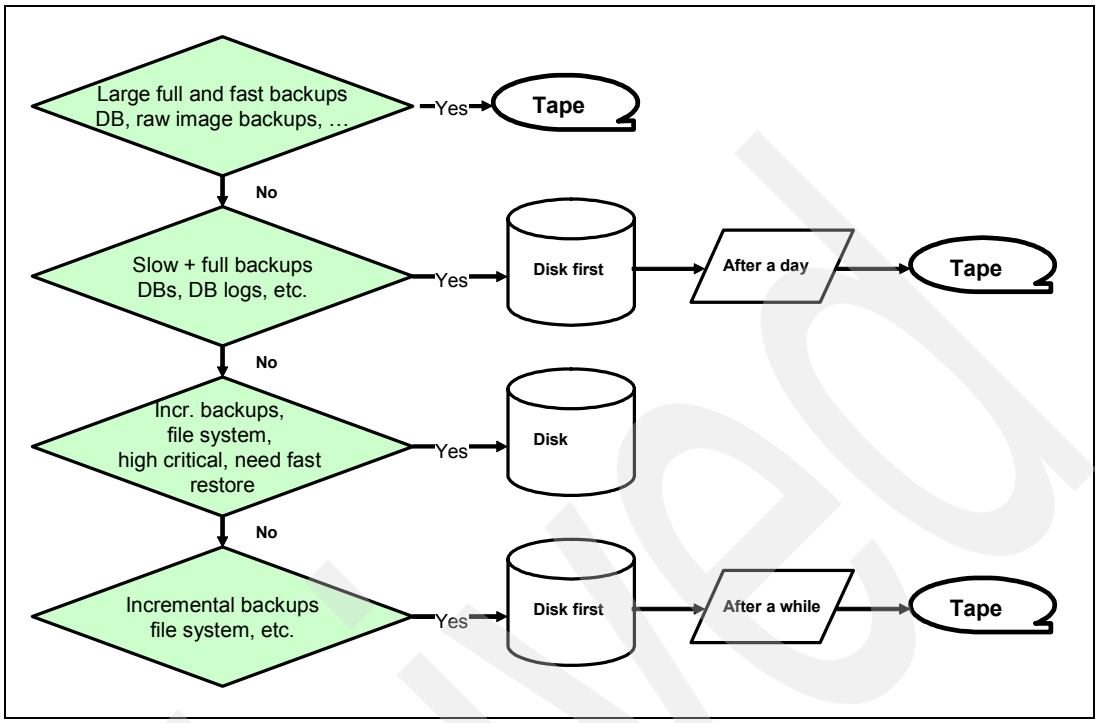

Figure 5-5 Decision tree for data placement

Now we can size the capacity. We assume a daily backup amount of 10 TB. Four TB are huge databases which go directly to tape. Another four TB are databases which go first to disk and then are migrated to tape on the same day. There are 1.5 TB from clients with incremental backups. This data has low priority for restore, and therefore, will also be migrated to tape on the same day. Finally there is 0.5 TB of incremental data which has high restore priority. You should keep this data on disk for one week. See Table 5-1. For this example, we need a disk capacity of at least 9 TB.

Table 5-1 Capacity sizing example

Kind of data	Goes first to	Amount in TB	Kept on disk for *x* number of days	Capacity on disk in TB
DB, high throughput	Tape	4		0
DBs	Disk	4	1	4
Incremental, low restore priority	Disk	1.5	1	1.5
Incremental, high restore priority	Disk	0.5	7	3.5
Total				**9 TB**

5.3 Using Import/Export with Auto Archive for vaulting

Import/Export with Auto Archive is a helpful function for vaulting. If you want to send cartridges offsite, you can use the Export function from IBM Virtualization Engine TS7510 to create a physical tape. You should not use the Import/Export function for data movement from virtual tape to physical tape, because the data is not accessible from the TSM server without invoking a manual Import function.

5.3.1 Export

As discussed in 4.4.11, “Importing and exporting virtual volumes” on page 73, you can use the Move or Copy function with Auto Archive. You can change the settings for your virtual library by right-clicking the virtual library icon and selecting Properties. In the Change Virtual Library Properties window (Figure 5-6) that opens, we select the Move function and specify a grace period of 0 days. This means that the virtual volume will be deleted after all data is copied to physical tape.

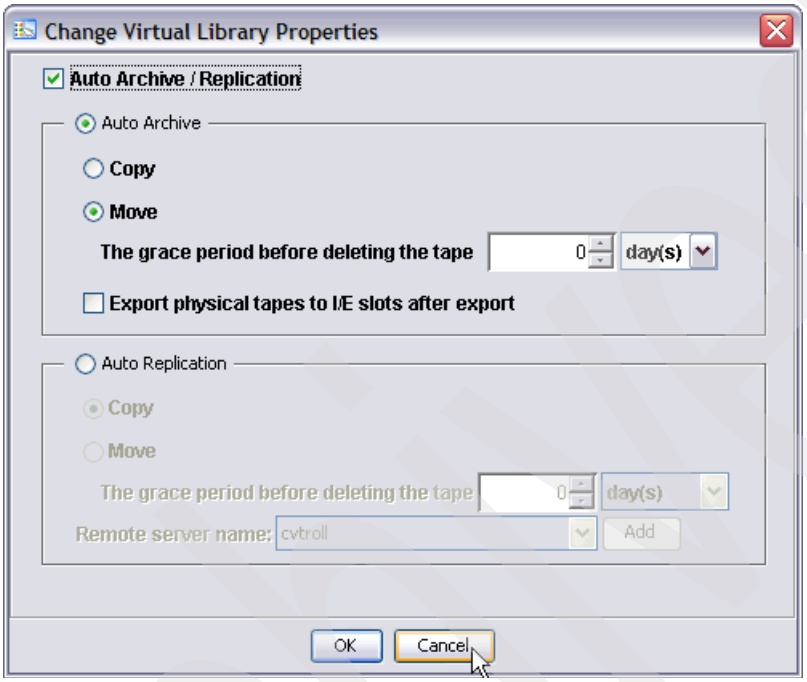

Figure 5-6 Change Virtual Library Properties window

To export a volume, use the Tivoli Storage Manager command:

```
CHECKOUT LIBVOL lib_name volume
```

We export the volume J1S387 from the library cvtrock:

```
CHECKOUT LIBVOL cvtrock J1S387
```

The IBM Virtualization Engine TS7510 then moves the volume to the virtual vault. If a physical volume with the same barcode label exists in the physical library, the IBM Virtualization Engine TS7510 starts to copy the data from the virtual volume to the physical volume. You can check the progress of the export job by clicking the job icon.

As you can see in Figure 5-7, the export job is not finished yet. Therefore, the virtual volume is still in the virtual vault. After all data is copied from the virtual volume, the virtual volume is deleted, because we selected Move with a grace period of 0 days.

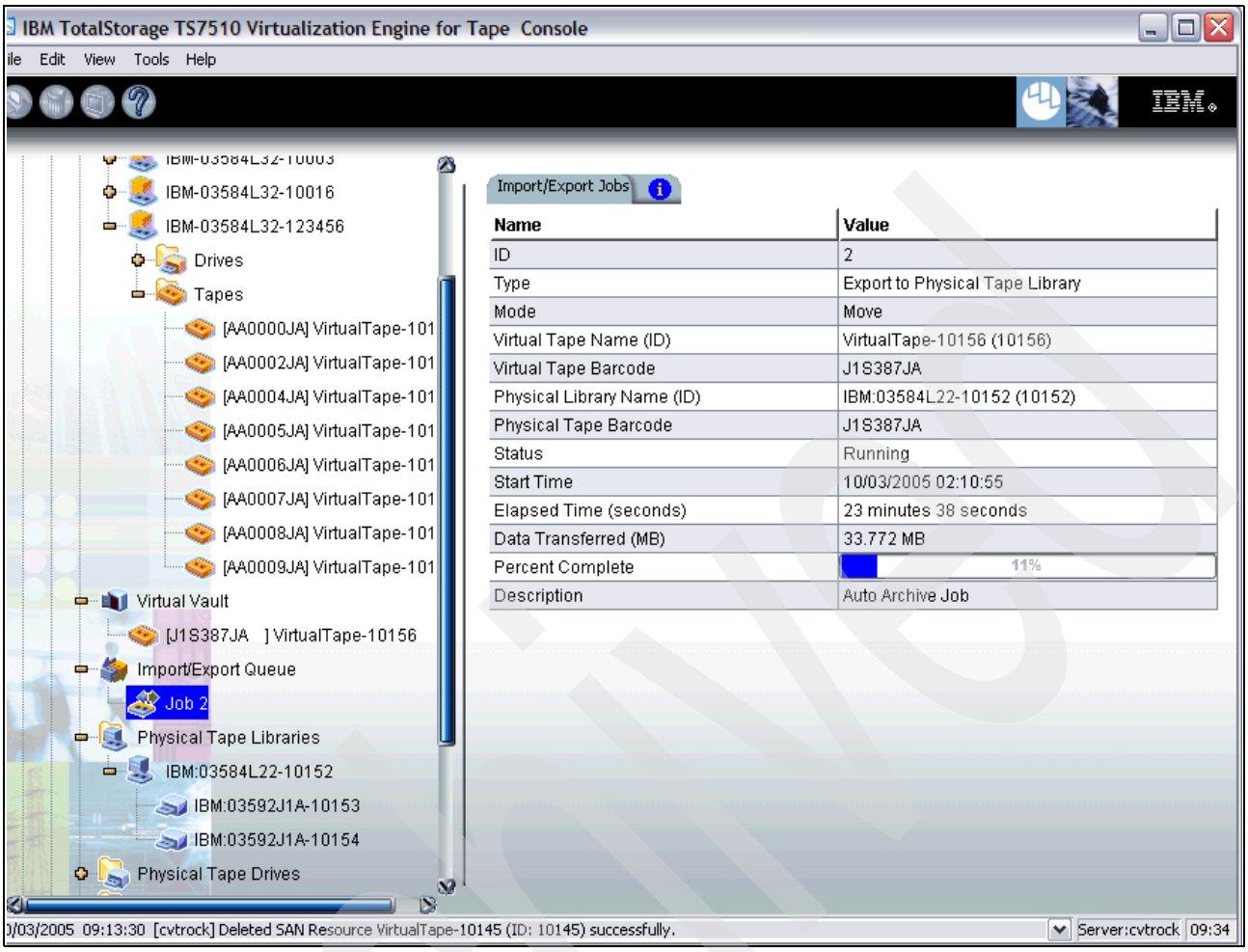

Figure 5-7 Progress of the export job

5.3.2 Import

You can import a physical volume to a virtual library by copying all the data from the physical tape to the TS7510 disk cache, or you can obtain direct physical access to this physical cartridge.

Direct Access

You can use Direct Access mode for data restoring only, because it gives only read access to the cartridge. Before Tivoli Storage Manager can access a direct access cartridge, you must update the volume access:

```
UPDATE VOLUME volume_name access=readonly
```

If a Tivoli Storage Manager process is already waiting for this cartridge, you cannot update the volume. You need either to cancel the Tivoli Storage Manager process or to import the volume in Copy mode. For details about how to import a volume, see 4.4.11, “Importing and exporting virtual volumes” on page 73.

After the import is done from the TS7510, you need to check in the volume:

```
CHECKIN LIBVOL library_name SEARCH=YES VOLLIST=volume_name STATUS=PRIVATE
```

Copy mode

If you import a cartridge in Copy mode, all contents of the physical cartridge are copied to the disk cache of the IBM Virtualization Engine TS7510. This may take a while (a couple of hours) until the whole cartridge (LTO2 = 200 GB, LTO3 = 400 GB or 3592 = 300 GB) is copied. If you want to import a volume after a Tivoli Storage Manager process requests the volume, set the *mountwait* parameter to a higher value to reflect the copy time. We update our device class with a mountwait of 300 minutes:

```
update dev cvt mountwait=300
```

We started a restore that needs data from volume J1S387, which we already exported in 5.3.1, “Export” on page 116. When querying the activity log (see Example 5-1), you recognize that volume J1S387 is required.

Example 5-1 Activity log

```
09/22/05   20:13:26      ANR8308I 004: 3592 volume J1S387 is required for use in
                          library CVTROCK; CHECKIN LIBVOLUME required within 300
                          minutes. (SESSION: 86)
```

Now we import this cartridge using the VE Console as explained in 4.4.11, “Importing and exporting virtual volumes” on page 73. Because Tivoli Storage Manager is already requesting this cartridge, an update volume cannot be done. Therefore, you need to import this cartridge in Copy mode (see Figure 5-8).

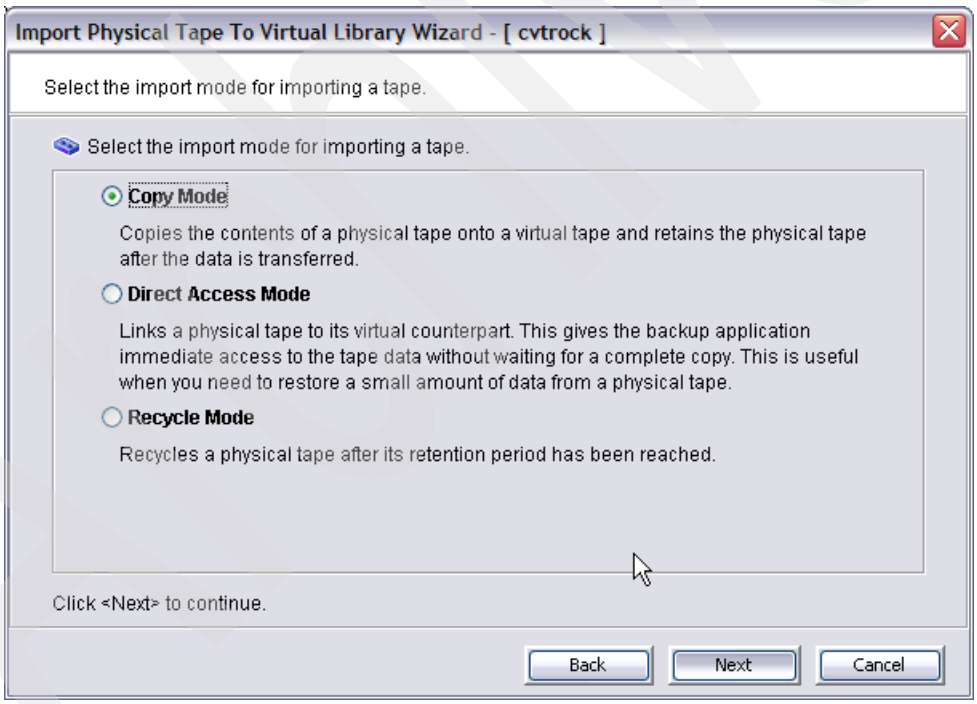

Figure 5-8 Importing the cartridge using Copy Mode

After the import job is finished, you must reply to the Tivoli Storage Manager message. In our Example 5-1, we respond by typing:

```
reply 004
```

5.4 TS7510 and a physical tape library connected to TSM server

In this section, you see how to use a physical library connected to the TSM server. We explain how to use it, how to migrate data from TS7510 to the physical library, and how to restore data from the physical library.

5.4.1 Only the TSM server has access to the tape library

Now we need to change our setup, which we used in this redbook, and connect the IBM 3584 Tape Library to the TSM server *ost36* (see Figure 5-9). We define the storage pool of the 3584 as a next storage pool to the cvt_rock storage pool. We let the TSM server manage the data and the migration from TS7510 to the physical tape library.

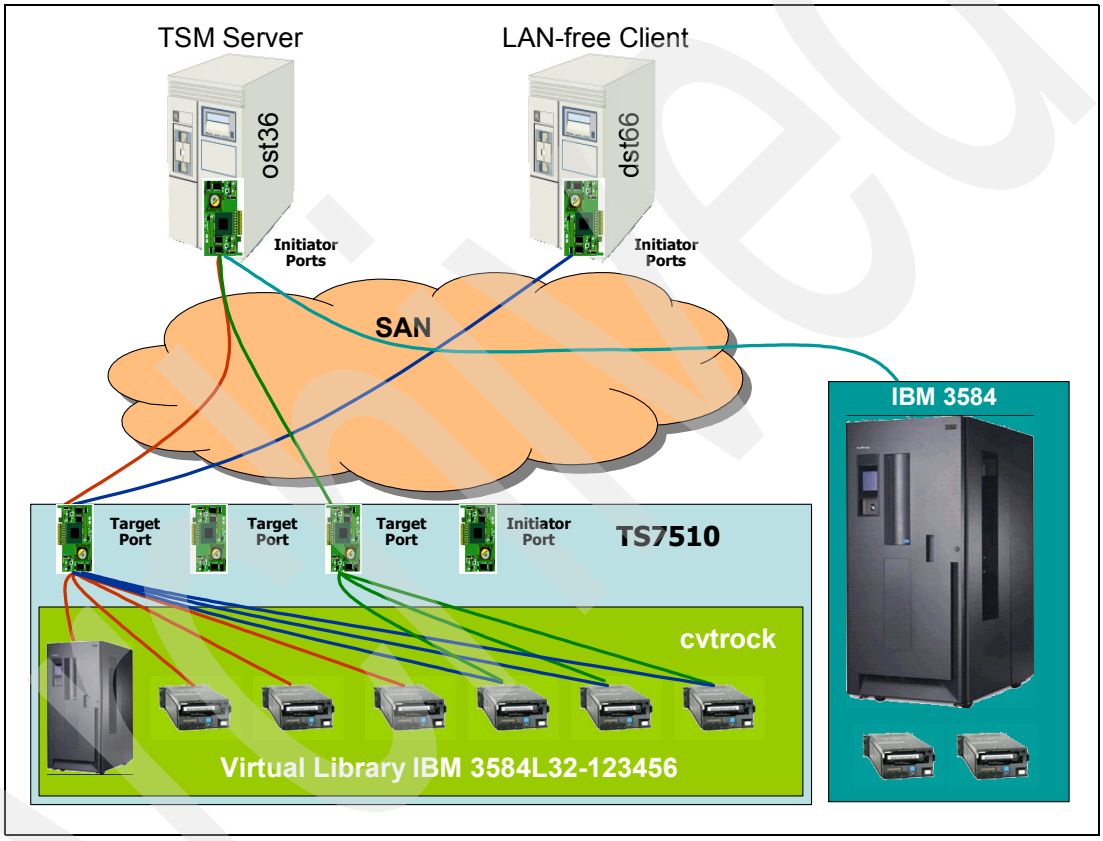

Figure 5-9 The new setup

Setup

After we change the SAN zoning to connect both physical 3592 Tape Drives to the TSM server ost36 and run the **cfgmgr** command, we see the tape drives on our server as shown in Example 5-2. rmt1 through rmt6 are the virtual tape drives in cvtrock. rmt6 and rmt7 are the physical 3592-J1A Tape Drives in the 3584 Tape Library. smc1 is the medium changer for the physical 3584 Tape Library.

Example 5-2 lsdev -Cc tape output from ost36 after connecting the 3584 library with 3592 drives

```
ost36> lsdev -Cc tape
rmt0  Available 10-60-00-0,0 SCSI 4mm Tape Drive
rmt1  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt2  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt3  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt4  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt5  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt6  Available 10-78-02     IBM 3592 Tape Drive (FCP)
rmt7  Available 10-78-02     IBM 3592 Tape Drive (FCP)
smc0  Available 10-78-02     IBM 3584 Library Medium Changer (FCP)
smc1  Available 10-78-02     IBM 3584 Library Medium Changer (FCP)
```

With this information, we configure the new tape library and drives on the TSM server. We named the library *3584*, the drives *dr3592*, the device class *3592* and the storage pool *3592stgpool.* Example 5-3 shows the output of the configuration.

Example 5-3 3584 library configuration

```
tsm: TSM>DEFINE LIBRARY cvtrock LIBTYPE=SCSI SHARED=YES
ANR8400I Library CVTROCK defined.

tsm: TSM>define path tsm   3584 srctype=server desttype=library device=/dev/smc1
ANR1720I A path from TSM to 3584 has been defined.

tsm: TSM>define drive 3584 dr3592_1
ANR8404I Drive DR3592_1 defined in library 3584.

tsm: TSM>define drive 3584 dr3592_2
ANR8404I Drive DR3592_2 defined in library 3584.

tsm: TSM>define path tsm dr3592_1 srctype=server desttype=drive library=3584
device=/dev/rmt7
ANR1720I A path from TSM to 3584 DR3592_1 has been defined.

tsm: TSM>define path tsm dr3592_2 srctype=server desttype=drive library=3584
device=/dev/rmt8
ANR1720I A path from TSM to 3584 DR3592_2 has been defined.

tsm: TSM>define devclass 3592 library=3584 devtype=3592 format=3592C mountlimit=drives
ANR2203I Device class 3592 defined.

tsm: TSM>define stgpool 3592stgpool 3592 maxscratch=10
ANR2200I Storage pool 3592STGPOOL defined (device class 3592).

tsm: TSM>label libvolume 3584 search=yes labelsource=barcode checkin=scratch
ANS8003I Process number 36 started.
```

Then we label the cartridges in the 3584 library, as shown in Example 5-4.

Example 5-4 Label cartridges in 3584

```
tsm: TSM>label libvolume 3584 search=yes labelsource=barcode checkin=scratch
ANS8003I Process number 36 started.
```

Next we check our LAN-free clients settings that restore can also transfer over LAN. You might need to update the clients setting and change at least the DATAREADPATH parameter to ANY. We updated our LAN-free client DST66 so that restores (DATAREADPATH) can be over any path (LAN or SAN) and backups (DATAWRITTEDPATH) can still go over SAN only:

```
UPDATE NODE DST66 DATAWRITEPATH=LANFREE DATAREADPATH=ANY
```

With this change, a restore now either goes over the SAN, if the needed data is still in the TS7510, or over the LAN, if the data had been migrated to the physical library.

Configuration options

The new configured storage pool *3592stgpool* should be the next storage pool to the primary storage pool on the TS7510. Therefore we update the storage pool cvt_stgpool and add the NEXTSTGPOOL parameter:

```
UPDATE STGPOOL cvt_stgpool NEXTSTGPOOL=3592stgpool
```

To tune the migration behavior, you can choose from several parameters as explained in the following sections. You can change all of the parameters by using the UPDATE STGPOOL command.

HIghmig

The HIghmig parameter specifies that the server starts migration for this storage pool when the number of volumes containing data reaches this percentage of the total number of volumes in the storage pool. The total number of volumes includes the maximum number of scratch volumes.

You can specify an integer from 1 to 100. The default value is 90. When the storage pool exceeds the high migration threshold, the server can start the migration of files by volume to the next storage pool defined for the pool. You can set the high migration threshold to 100 to prevent migration for the storage pool, for example during the peak workload, and decrease this value for times where a lower workload is expected.

LOwmig

The LOwmig parameter specifies that the server stops migration for this storage pool when the number of volumes containing data reaches this percentage of the total number of volumes in the storage pool. The total number of volumes includes the maximum number of scratch volumes. This parameter is optional.

You can specify an integer from 0 to 99. The default value is 70. When the storage pool reaches the low migration threshold, the server does not start migration of files from another volume. You can set the low migration threshold to 0 to permit migration to empty the storage pool.

MIGDelay

The MIGDelay parameter specifies the minimum number of days since a file was stored in the storage pool before the file becomes eligible for migration from the storage pool. This parameter is optional.

You can specify an integer from 0 to 9999. The default is 0, which means that you do not want to delay migration. If you sized the disk capacity of the TS7510 properly to keep the backup data long enough to get most of the restores done from the TS7510 (as discussed in 3.2.3, “Time at which the majority of restores occurs: Restore pattern” on page 29), you might use this parameter to keep your data in the TS7510.

MIGContinue

The MIGContinue parameter specifies whether you allow the server to migrate files that do not satisfy the migration delay time. This parameter is optional.

The default is YES. Because you can require that files remain in the storage pool for a minimum number of days, the server may migrate all eligible files to the next storage pool, but not meet the low migration threshold. This parameter allows you to specify whether the server is allowed to continue the migration process by migrating files that do not satisfy the migration delay time. There are two possible values:

- Yes

  This value specifies that, when necessary to meet the low migration threshold, the server continues to migrate files that do not satisfy the migration delay time. If you allow more than one migration process for the storage pool, some files that do not satisfy the migration delay time might be migrated unnecessarily.

  As one process migrates files that satisfy the migration delay time, a second process could begin migrating files that do not satisfy the migration delay time to meet the low migration threshold. The first process that is still migrating files that satisfy the migration delay time might have, by itself, caused the low migration threshold to be met.

- No

  This value specifies that the server stops migration when no eligible files remain to be migrated, even before reaching the low migration threshold. The server does not migrate files unless the files satisfy the migration delay time.

MIGPRocess

The MIGPRocess parameter specifies the number of parallel processes to use for migrating the files from the volumes in the storage pool. This parameter is optional.

You enter a value from 1 to 999. The default value is 1. When calculating the value for this parameter, consider the number of sequential storage pools involved with the migration, and the number of logical and physical drives that can be dedicated to the operation.

To access a sequential-access volume, Tivoli Storage Manager uses a physical drive. The number of available mount points and drives depends on other Tivoli Storage Manager and system activity and on the mount limits of the device classes for the sequential access storage pools that are involved in the migration. For example, our 3584 configuration has two drives installed. Therefore we cannot start more than two migration processes at the same time, and the MIGProcess value cannot be higher than 2.

MOVE NODEDATA

If you want restore data that is already migrated to physical tape, you can use the MOVE NODEDATA command to migrate data back from the physical library to the IBM Virtualization Engine TS7510. After the migration is done, you can start the restore.

Use the MOVE NODEDATA command to move data located in a sequential-access storage pool. You can move data for one or more nodes or for a group of collocated nodes. You can also move selected file spaces for a single node. The data can be located in either a primary or copy storage pool.

The MOVE NODEDATA command takes two forms, depending on whether you are moving data only for selected file spaces or for all file spaces. Refer to the Tivoli Storage Manager manuals for further information.

We move data that is already migrated to 3592stgpool, from our LAN-free client dst66 back to TS7510. We want to move only one file space with file space ID 5 (see Example 5-5).

Example 5-5 MOVE NODEDATA

```
tsm: TSM>move nodedata dst66 fromstgpool=3592STGPOOL tostgpool=CVT_STGPOOL fsid=5
ANR1649W MOVE NODEDATA:This command will move data for nodes stored in storage pool
3592STGPOOL to
storage pool CVT_STGPOOL; the data will be inaccessible to users until the operation
completes.

Do you wish to proceed? (Yes (Y)/No (N)) y
ANR2110I MOVE NODEDATA started as process 15.
ANS8003I Process number 15 started.
```

5.4.2 The TSM server and LAN-free clients have access to the tape library

If restore data should only be transferred over the SAN, even the data migrated to physical tape, and the MOVE NODEDATA approach is not sufficient, you need to give your LAN-free clients access to the physical library. We changed our sample setup and changed the SAN zoning so that our LAN-free client dst66 also gets access to the two physical tape drives in the 3584 library (see Figure 5-10).

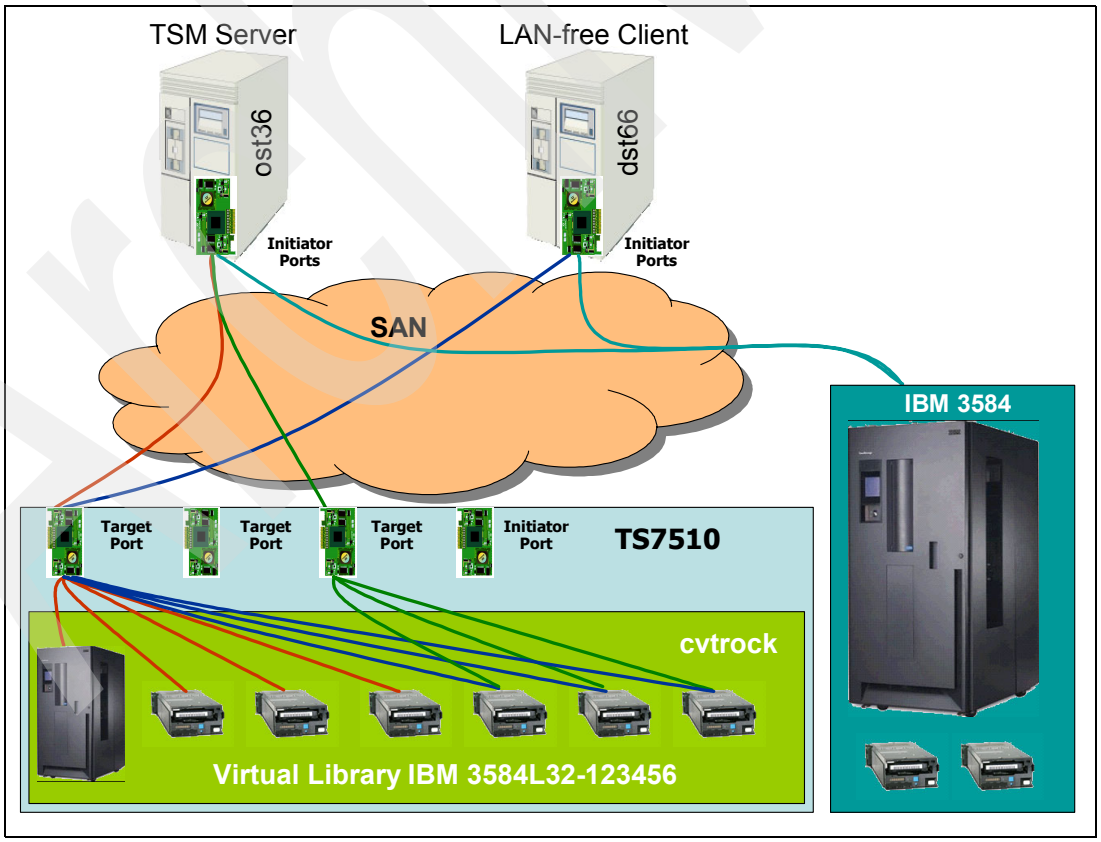

Figure 5-10 LAN-free client with access to the physical library

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After we run the **cfgmgr** command on the server dst66, we see the list of tape drives on our server as shown in Figure 5-6. rmt0 to rmt2 are the virtual tape drives in cvtrock. rmt3 and rmt4 are the physical 3592-J1A Tape Drives in the 3584 Tape Library. smc0 is the medium changer for the physical 3584 Tape Library.

Example 5-6 lsdev -Cc tape output on dst66

```
dst66> lsdev -Cc tape
rmt0 Available 14-08-02 IBM 3592 Tape Drive (FCP)
rmt1 Available 14-08-02 IBM 3592 Tape Drive (FCP)
rmt2 Available 14-08-02 IBM 3592 Tape Drive (FCP)
rmt3 Available 14-08-02 IBM 3592 Tape Drive (FCP)
rmt4 Available 14-08-02 IBM 3592 Tape Drive (FCP)
smc0 Available 14-08-02 IBM 3584 Library Medium Changer (FCP)
```

With this information, we configure the new tape paths on the TSM server ost36. Figure 5-7 shows the output of the configuration.

Example 5-7 Configuration output

```
tsm: TSM>define path dst66agnt dr3592_1 srctype=server desttype=drive library=3584 device=/dev/rmt3
ANR1720I A path from DST66AGNT to 3584 DR3592_1 has been defined.

tsm: TSM>define path dst66agnt dr3592_2 srctype=server desttype=drive library=3584 device=/dev/rmt4
ANR1720I A path from DST66AGNT to 3584 DR3592_2 has been defined.
```

Now restores are fulfilled either from the IBM Virtualization Engine TS7510 or from the physical library 3584, depending where the data is currently stored.

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6

Reporting and monitoring

In this chapter, we explain the different types of reports that you can run on the Virtualization Engine Console (VE Console). We also present the monitoring aspects of the IBM Virtualization Engine TS7510.

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6.1 Reporting

IBM Virtualization Engine TS7510 offers a variety of reports that can provide valuable information. For example, you can review reports that indicate when most of the backups are performed, specify which adapters are heavily used, and show virtual tape library layouts. This section introduces you to the types of reports that are available and explains the reporting process.

6.1.1 Types of reports

The IBM Virtualization Engine TS7510 console has the ability to generate a series of reports that all depend on the options that are installed on the unit. The following list covers the wide variety of reports that are available:

- Server Throughput Report

  The Server Throughput Report displays the overall throughput of the IBM Virtualization Engine TS7510 model 3954 CV5 server or servers.

- SCSI/Fibre Channel Throughput Report

  The SCSI/Fibre Channel Throughput Report shows the data that goes through fibre adapter on the IBM Virtualization Engine TS7510 model 3954 CV5 server or servers.

- SCSI Device Throughput Report

  The SCSI Device Throughput Report shows the utilization of the physically attached fibre storage.

- Physical Resources Configuration Report

  The Physical Resources Configuration Report lists all of the physical resources on IBM Virtualization Engine TS7510 model 3954 CV5 server or servers, including each physical adapter and physical device.

- VE for Tape Disk Space Usage Report

  The VE for Tape Disk Space Usage Report shows the amount of disk space that is used by each fibre adapter.

- Physical Resources Allocation Report

  The Physical Resources Allocation Report shows the disk space usage and layout for all the physical resources. Physical resources are all of your SCSI adapters, Fibre Channel (FC) host bus adapters (HBAs), and storage devices. Storage devices include hard disks, tape drives, and tape libraries. Hard disks are used for creating virtual tape libraries or drives and virtual tapes.

- Physical Resource Allocation Report

  The Physical Resource Allocation Report shows the disk space usage and layout for a specific physical device.

- Fibre Channel Adapters Configuration Report

  The Fibre Channel Adapters Configuration Report shows worldwide port names (WWPNs) and port information for each Fibre Channel adapter. It is also useful for matching WWPNs with server clients.

- Replication Status Report

  The Replication Status Report displays information about replication activity. It also provides a centralized view for displaying real-time replication status for all drives enabled for replication. The report can be generated for the source server or target server, for all specific resources, and for date ranges.

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- Virtual Library Information

  The Virtual Library Information report shows information about each tape being emulated, including the number of drives, tapes, and slots.

- Virtual Tape Information

  The Virtual Tape Information report shows information about each virtual tape, including the barcodes, size, and virtual tape location.

- Job Report

  The Job Report lists each import and export job that has been run during the specified time frame, including the job type, status, and start and end time.

6.1.2 Creating reports

To create a report, follow these steps:

1. As shown in Figure 6-1, right-click the **Reports** object and select **New**.

   The different types of reports depend on which features are installed on the IBM Virtualization Engine TS7510. The report options in our configuration include all reports that are described in 6.1.1, “Types of reports” on page 126.

Figure 6-1 Starting a new report

2. In the Select a Report Type panel (Figure 6-2), select a report type and click **Next**.

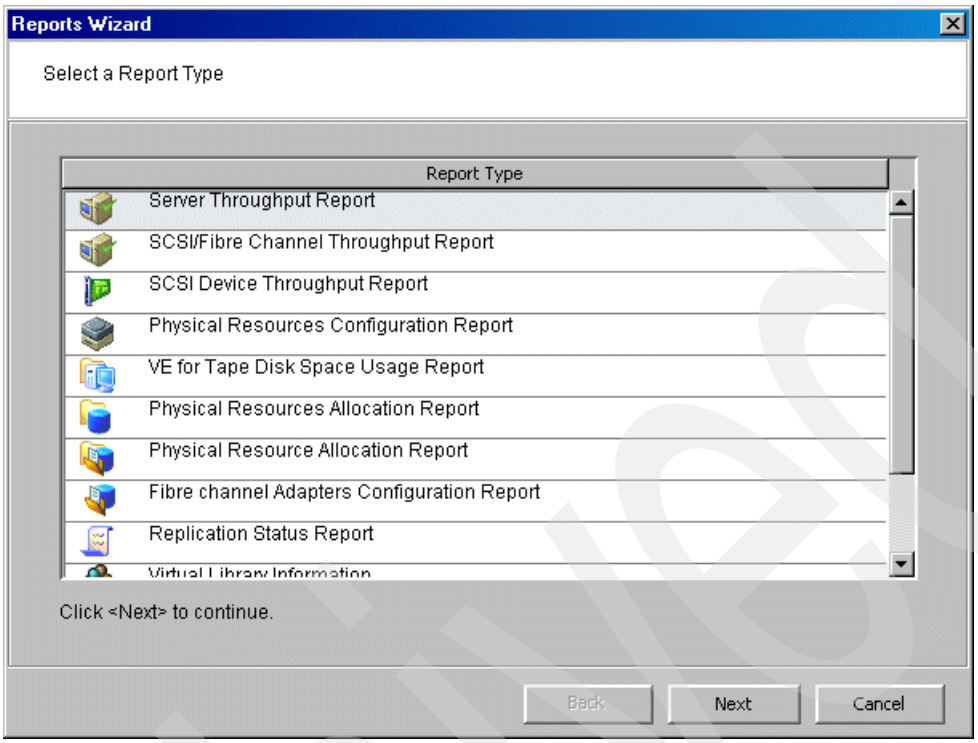

Figure 6-2 Select a Report Type panel

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3. Depending upon which report you select, additional panels are displayed from which you can filter the information for the report. Figure 6-3 shows the Select the Report Options panel. If applicable, select the date or date range for the report. Selecting Past 30 Days or Past 7 Days creates reports that generate data that is relative to the time selected.

   Click **Next**.

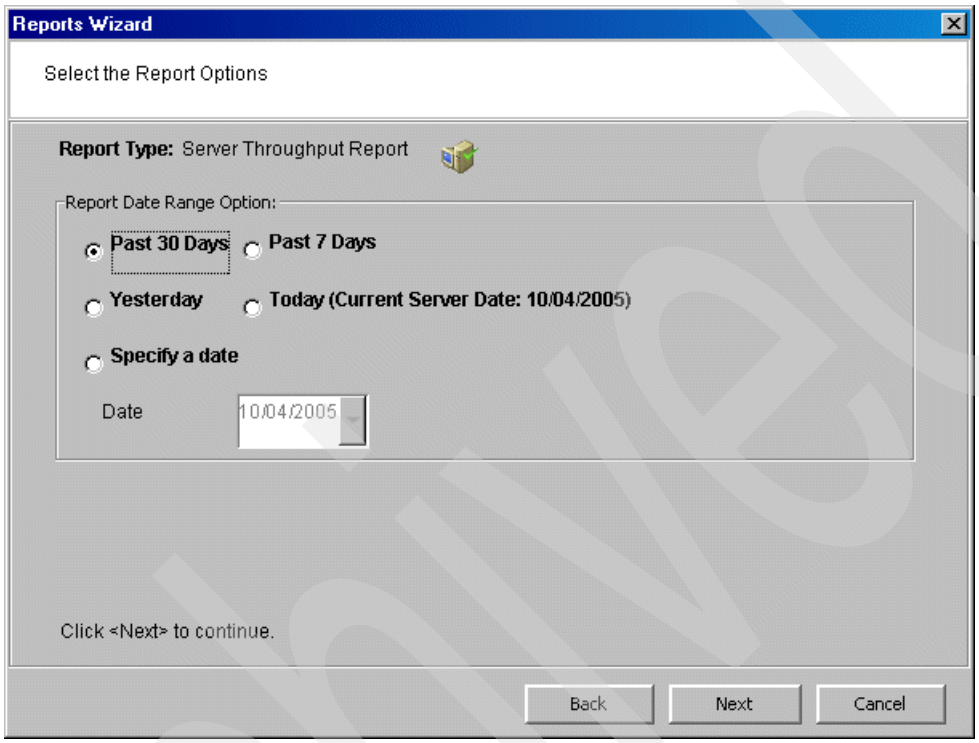

Figure 6-3 Select the Report Options panel

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4. In the Enter the Report Name panel (Figure 6-4), you can change the name of the report or choose to keep the default name. To rename the report, in the Report Name field, type a new name. Otherwise, leave it as is. Then click **Next**.

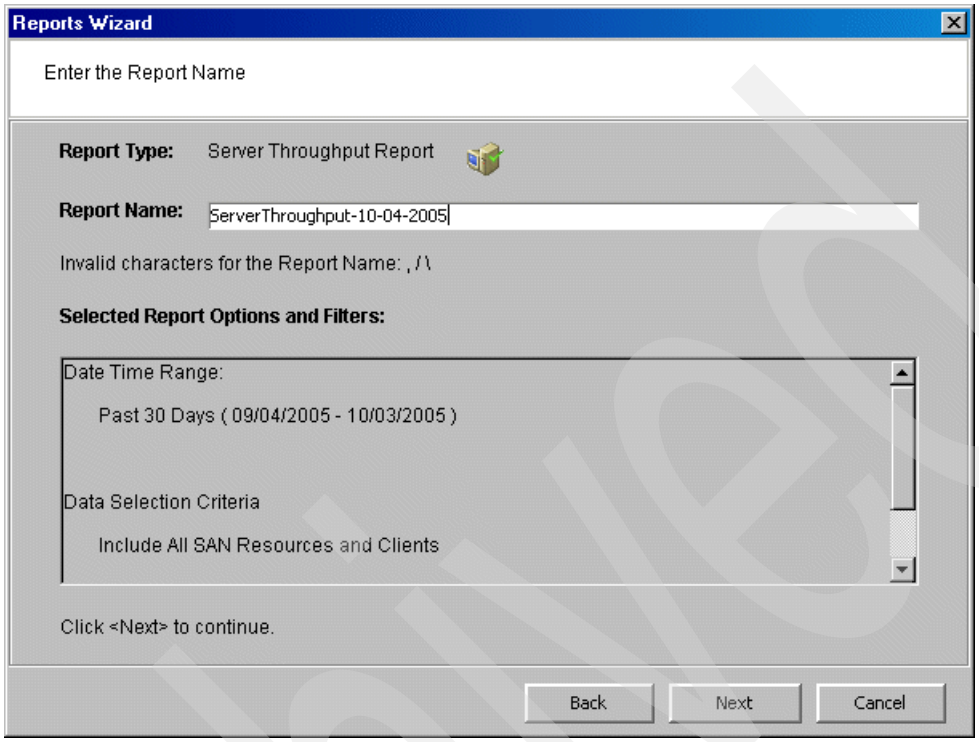

Figure 6-4 Enter the Report Name panel

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5. In the Create the Report panel (Figure 6-5), scroll through and confirm all the information that is displayed. If you need to make a correction, click **Back** and return to the panel where you need to make the change. When you are satisfied with the report options, return to the confirmation panel and click **Finish** to create the report.

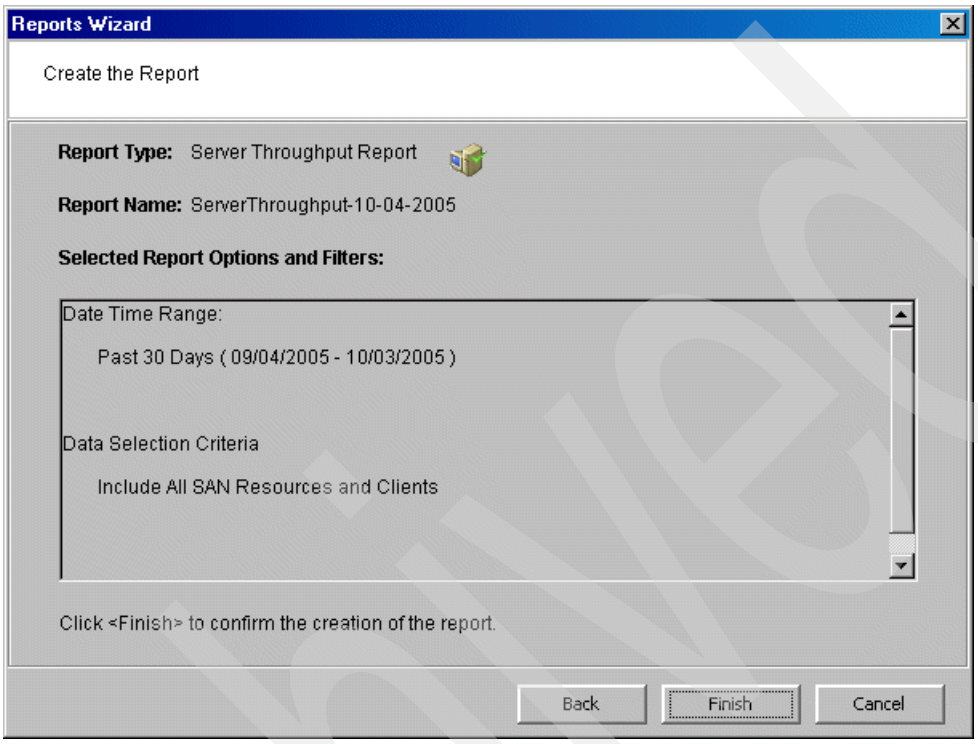

Figure 6-5 Create the Report (confirmation) panel

This completes the report creation phase.

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6.1.3 Viewing a report

When you create a report, it is displayed in the right pane, beneath the Reports object. To view the report, expand the **Reports** object, and you see the existing reports available for this server. When you select an existing report, it is displayed in the right pane in the configuration tree as shown in Figure 6-6.

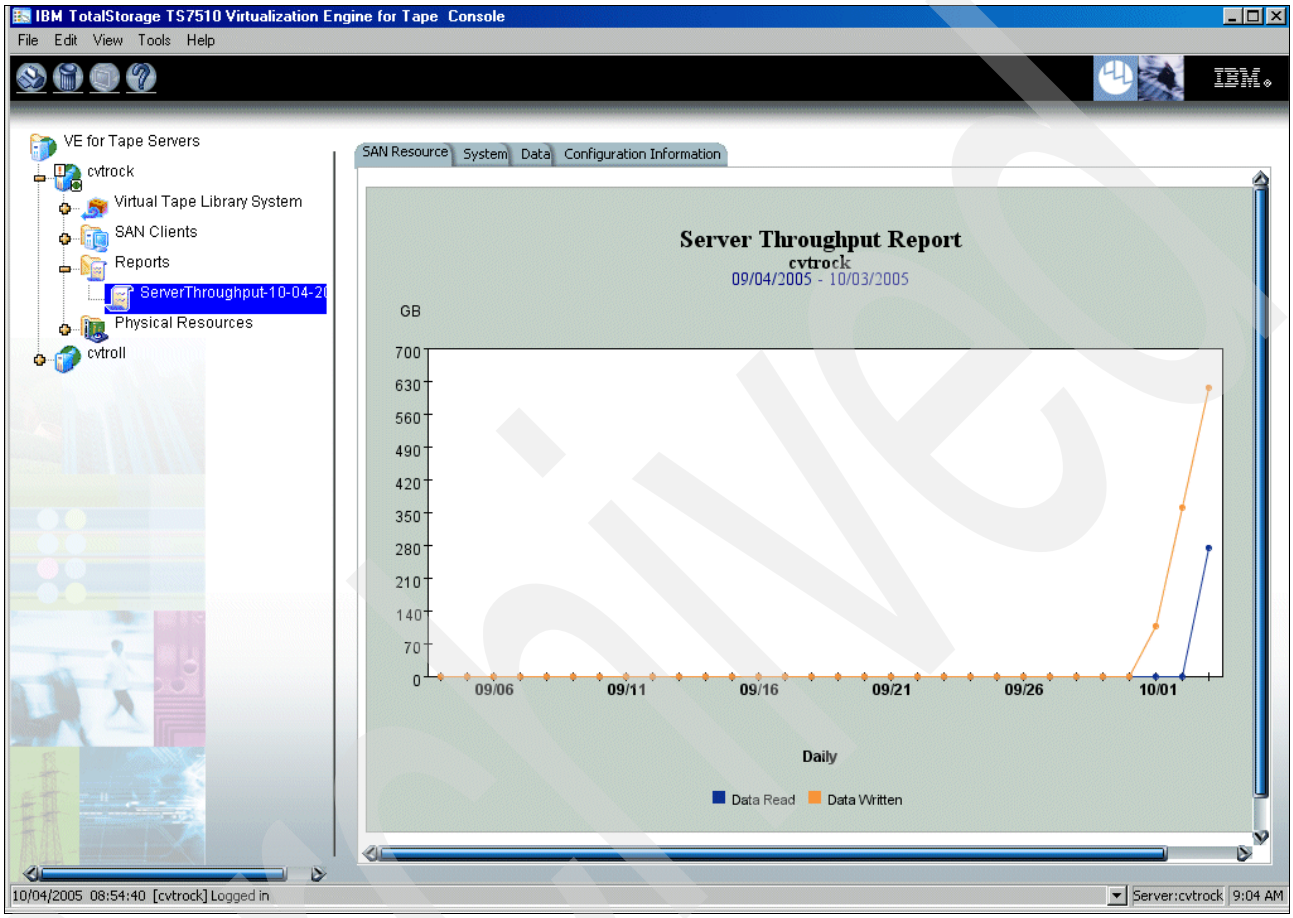

Figure 6-6 Location of a created report

With most of the reports, multiple tabs are located in the right pane just above the report view. You can specify to generate more than one report and keep them permanently on the VE Console.

After you view the report, if you right-click the specified report as in Figure 6-7, you see the options to print, export, and delete the report. The printed report goes to a previously installed printer. When a report is exported, you can save the data in a comma delimited (.csv) or tab delimited (.txt) text file. You also have the option to delete the report permanently.

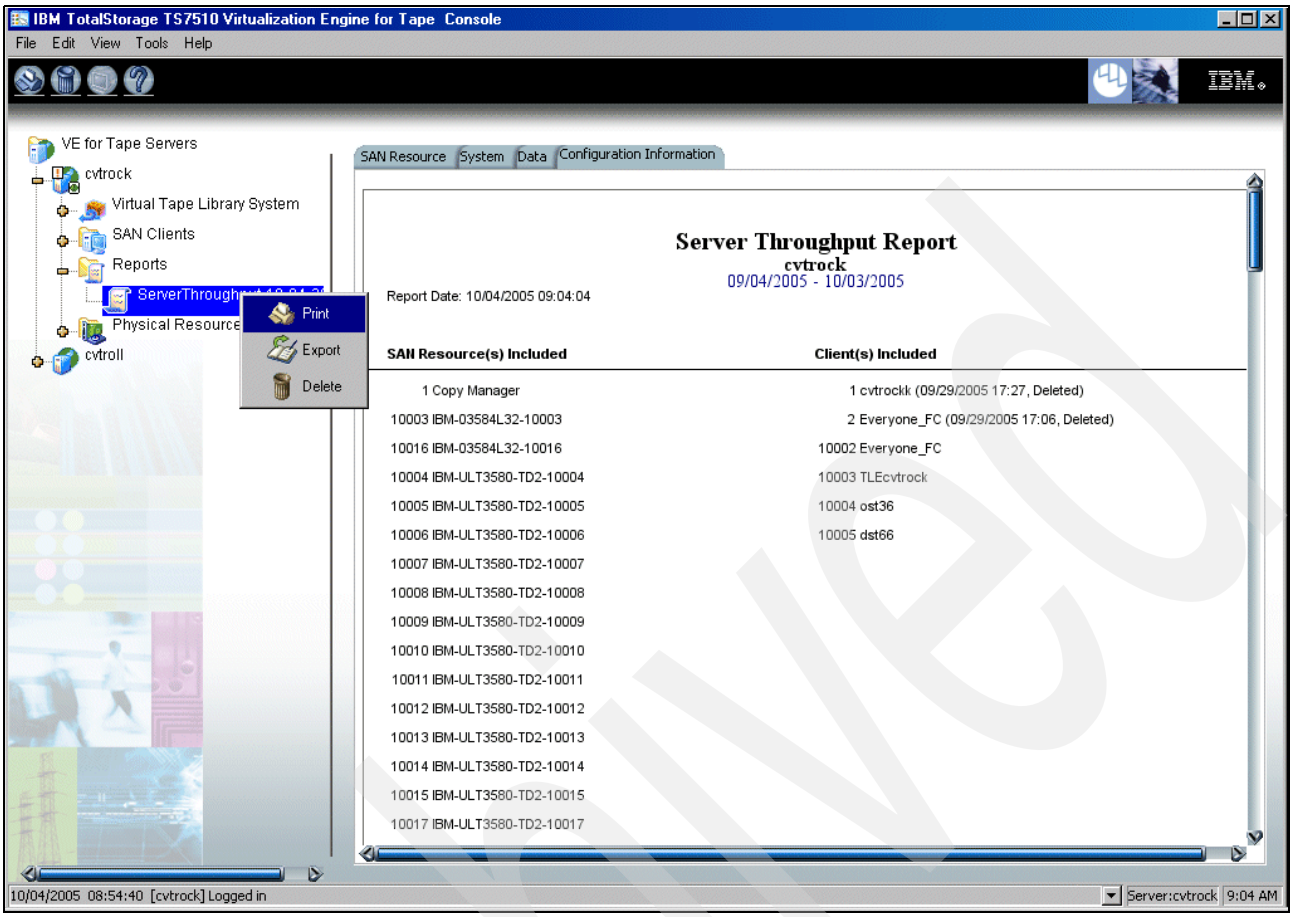

Figure 6-7 Options for printing, exporting, and deleting a report

6.2 Monitoring

The IBM Virtualization Engine TS7510 uses Simple Mail Transfer Protocol (SMTP) to perform its proactive monitoring of tasks and functions. This proactive monitoring is referred to as *Call Home*. You can monitor the logs manually by using the event log. In this section, we describe the different monitoring processes and explain how to configure proactive monitoring.

6.2.1 Simple Mail Transfer Protocol

SMTP is a protocol for sending e-mail messages between servers. Most e-mail systems that send mail over the Internet use SMTP to send messages from one server to another. The messages can then be retrieved with an e-mail client using either Post Office Protocol (POP) or Internet Message Access Protocol (IMAP).

In addition, SMTP is generally used to send messages from a mail client to a mail server. This is why you need to specify both the POP, or IMAP, server and the SMTP server when you configure your e-mail client applications.

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6.2.2 Call Home

In regard to the IBM Virtualization Engine TS7510, Call Home is the process that the device uses to communicate hardware and software failures. These failures are discovered by periodically scanning through the system logs of the IBM Virtualization Engine TS7510.

When a failure occurs, the TS7510 sends an e-mail alert using SMTP. This e-mail is either directed to a person or group depending on how it is configured. In this section we explain how to properly configure the Call Home reporting capability.

Configuring Call Home using SMTP

The Call Home functions of the IBM Virtualization Engine TS7510 use SMTP. To configure SMTP, you right-click the **IBM Virtualization Engine TS7510** server icon and select **Call Home** as shown in Figure 6-8.

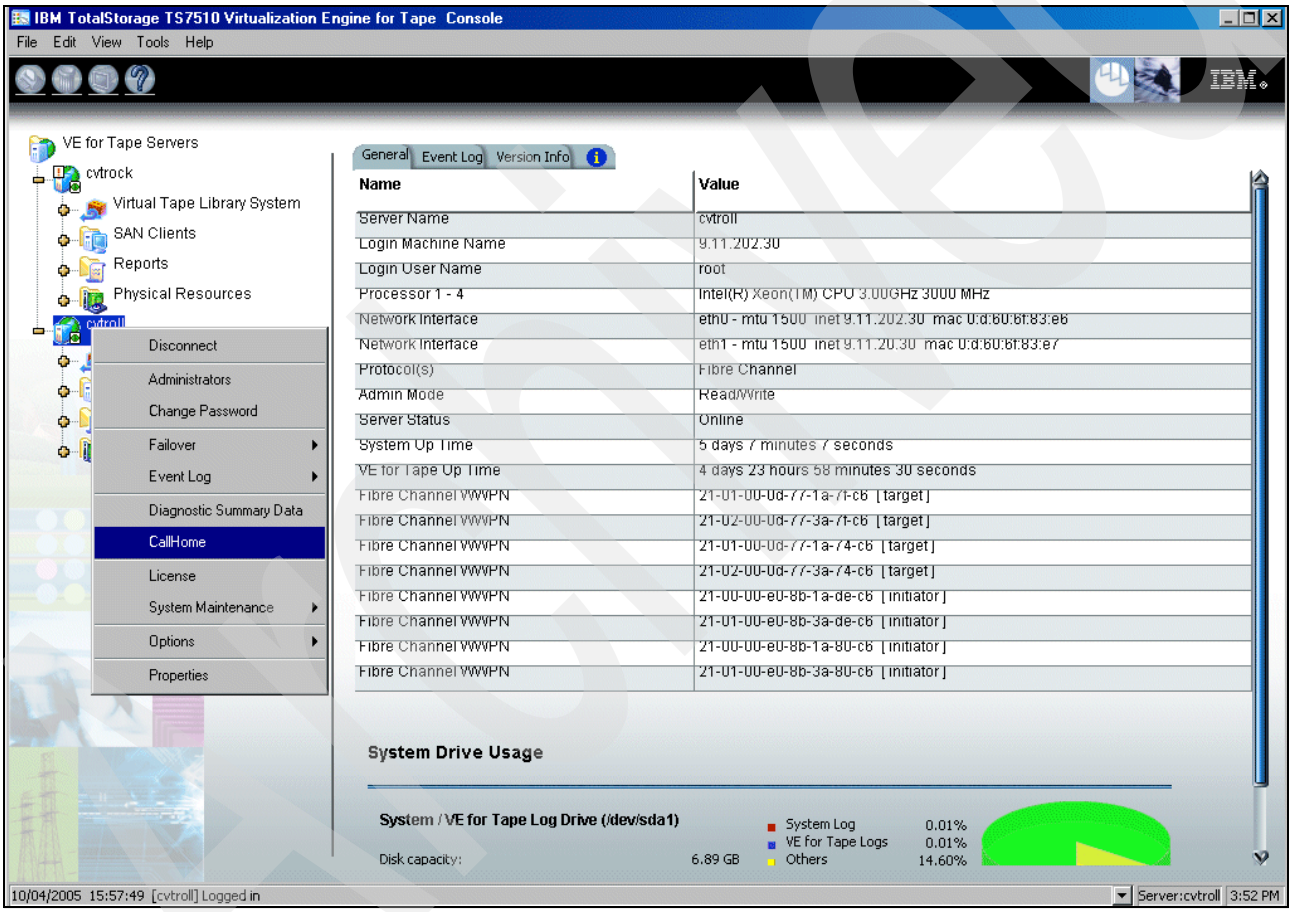

Figure 6-8 Starting the Call Home configuration

The Set Call Home Properties window (Figure 6-9) opens. It shows several options that you must consider.

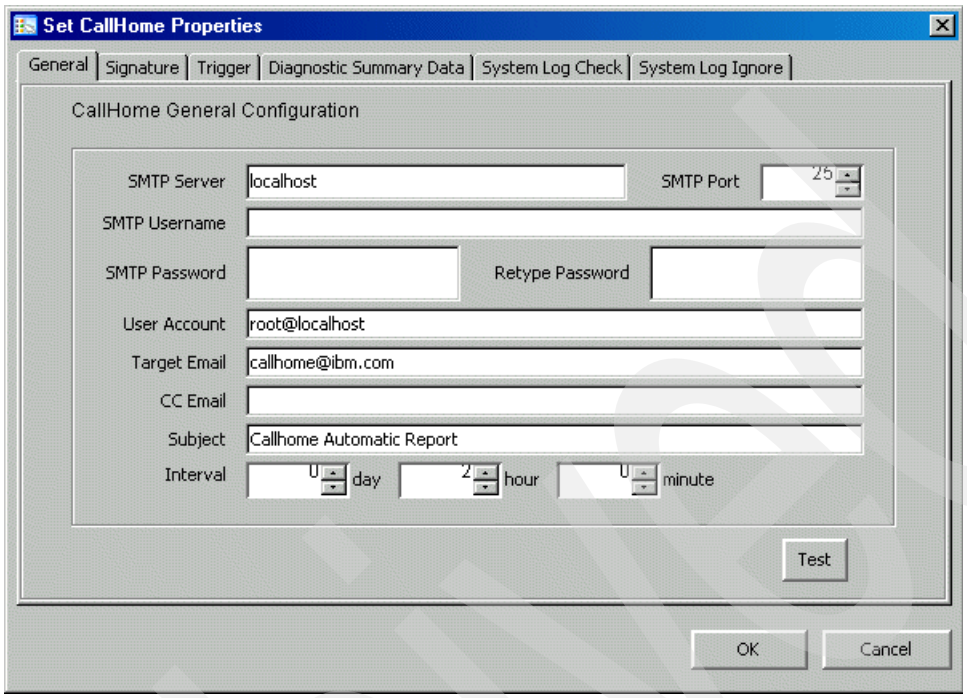

Figure 6-9 Set Call Home Properties window

Contact the e-mail administrator of your environment to gather the following information:

- SMTP Server

  The SMTP server is the machine that is configured in your environment to accept incoming SMTP messages. Contact your e-mail administrator for assistance on this.

- SMTP Port

  The SMTP port is the communications channel used by your SMTP server. A port in Transmission Control Protocol/Internet Protocol (TCP/IP) and User Datagram Protocol (UDP) networks is an endpoint to a logical connection. The port number identifies the type of port it is. For example, port 80 is used for HTTP traffic, and port 21 is used for File Transfer Protocol (FTP) traffic.

- SMTP Username

  The SMTP username is the account that has access to send SMTP messages. Contact your e-mail administrator for assistance with this.

- SMTP Password

  The SMTP password is for the account that has access to send SMTP messages. Contact your e-mail administrator for assistance with this.

- User Account

  The user account is the account that is listed in the From section of the received e-mail.

- Target E-mail Address

  The target e-mail address is where you want the e-mail alerts to go.

- CC E-mail

  The CC E-mail field is the second e-mail address to which you want the alerts to be sent.

- Subject

  Subject refers to the subject of the e-mail sent by the IBM Virtualization Engine TS7510. Choose a subject that will not be marked as junk e-mail (spam). Contact your e-mail administrator for assistance with this.

- Interval (in which you want to check for errors)

  The Interval defines how often you want the IBM Virtualization Engine TS7510 to check for errors. For this option, you must specify the interval in the day, hour, and minute field that are provided. We recommend that you set the interval clock for every 0 days, 0 hours, and 10 minutes. This way the SMTP monitor checks for errors every 10 minutes. You may reduce or increase this time to any interval you want.

After you configure Call Home for transmitting, five additional tabs require your attention:

- In the *Signature tab* (Figure 6-10), you place critical contact information. This information is included in the e-mail that is sent with the alerts.

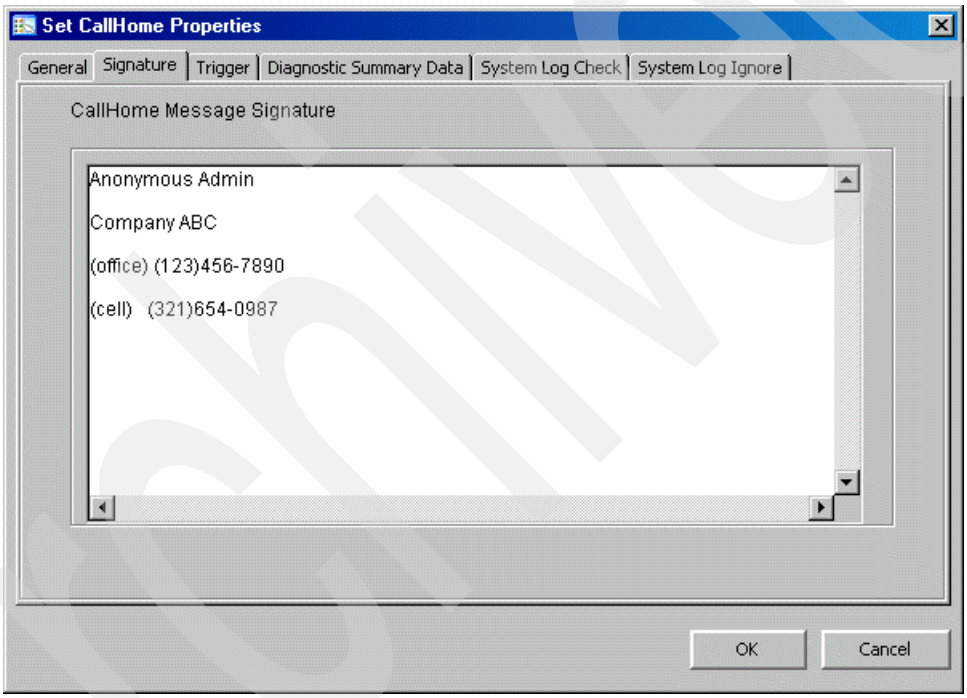

Figure 6-10 Signature tab

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- The *Trigger tab* (Figure 6-11) contains the alert triggers. You configure the triggers by selecting (enable) or deselecting (disable) the corresponding check boxes listed under the Enabled column. We recommend that you leave all the check boxes enabled. Then disable them as you determine which events are not important to your environment.

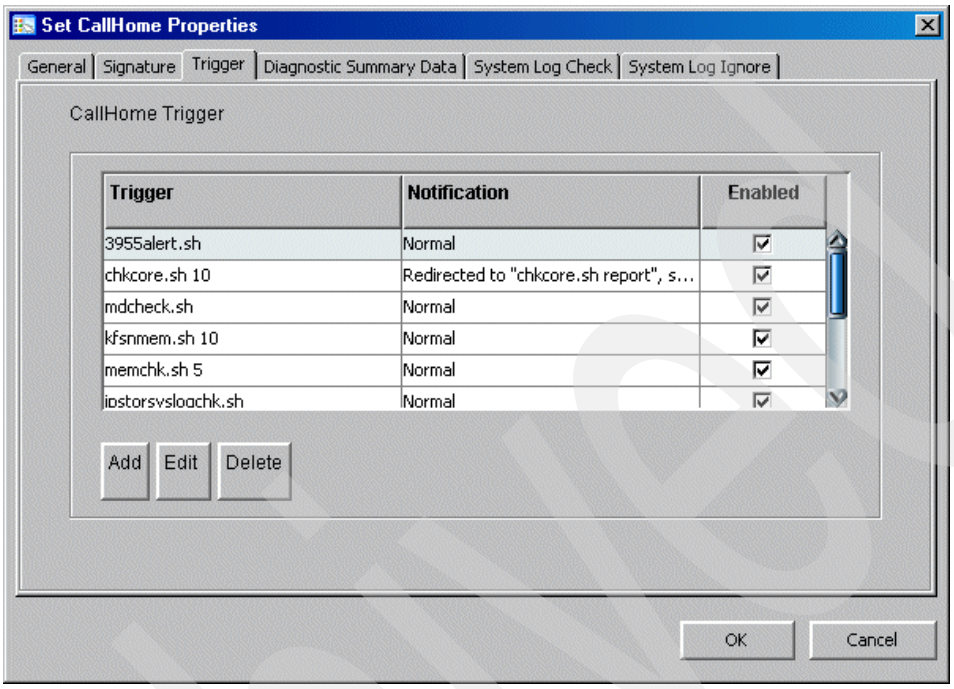

Figure 6-11 Trigger tab

- The *Diagnostic Summary Data tab* (Figure 6-12) gives you alerts based on diagnostic summary data. We recommend that you select (enable) all of options on this tab and monitor which alerts are necessary for your environment before you disable them.

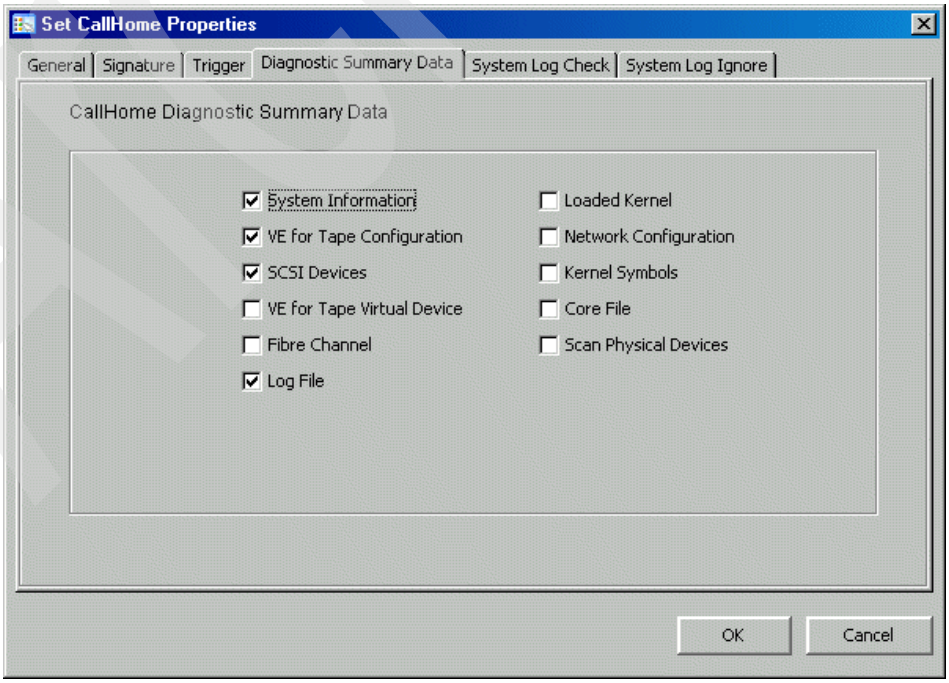

Figure 6-12 Diagnostic Summary Data tab

- The *System Log Check tab* (Figure 6-13) is where you check the system log. Do not edit this page. However, if there are events in the system log that you are asked to monitor, you can add all tasks to monitor on this page.

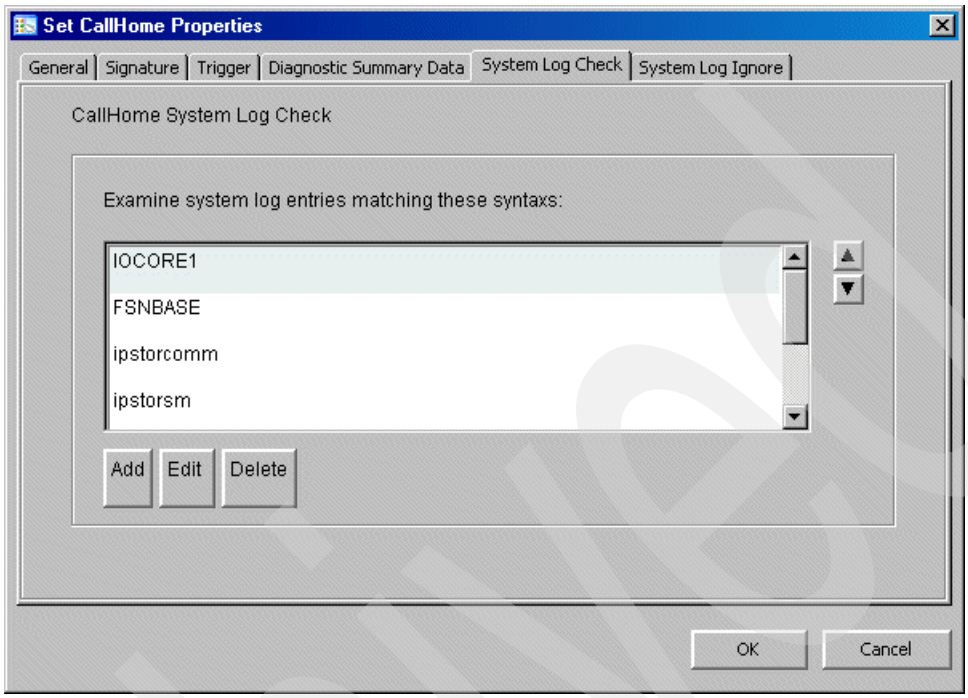

Figure 6-13 System Log Check tab

- In the *System Log Ignore tab* (Figure 6-14), you can enter phrases for which you don't want alerts. For example, if you receive an e-mail alert every time a job is successful, such alerts can overload your inbox. To avoid this, you can add an entry to ignore all successful events.

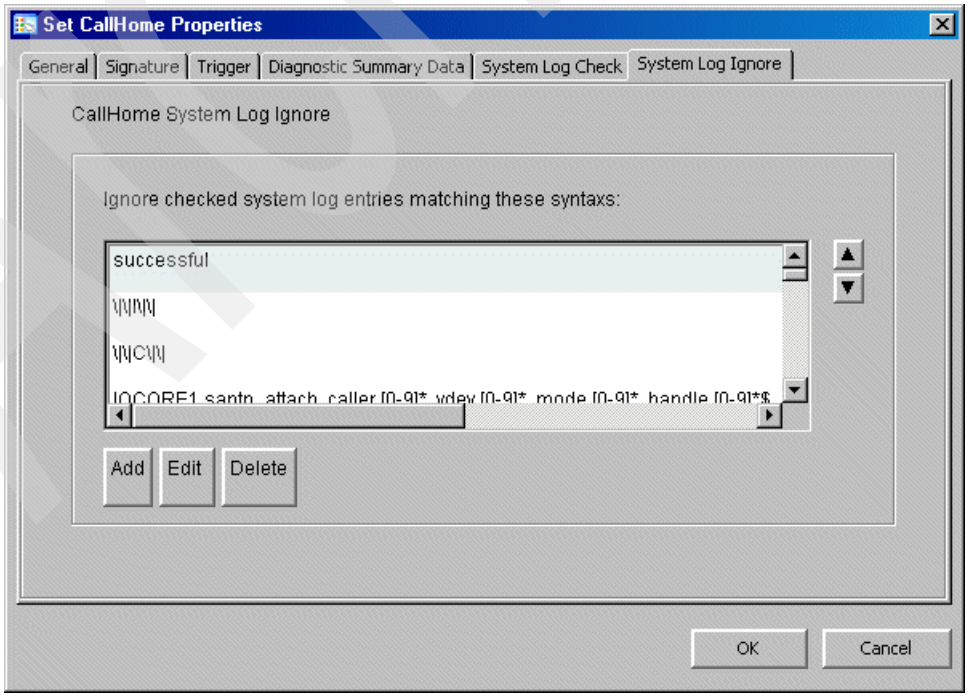

Figure 6-14 System Log Ignore tab

6.2.3 Event log monitoring

Within the VE Console, the event log is where all operations and tasks that the IBM Virtualization Engine TS7510 has performed are written. The event log is a good place to see if operations that were executed completed or failed.

The Event Log tab is located on the main page of the VE Console. Figure 6-15 shows an example of the event log.

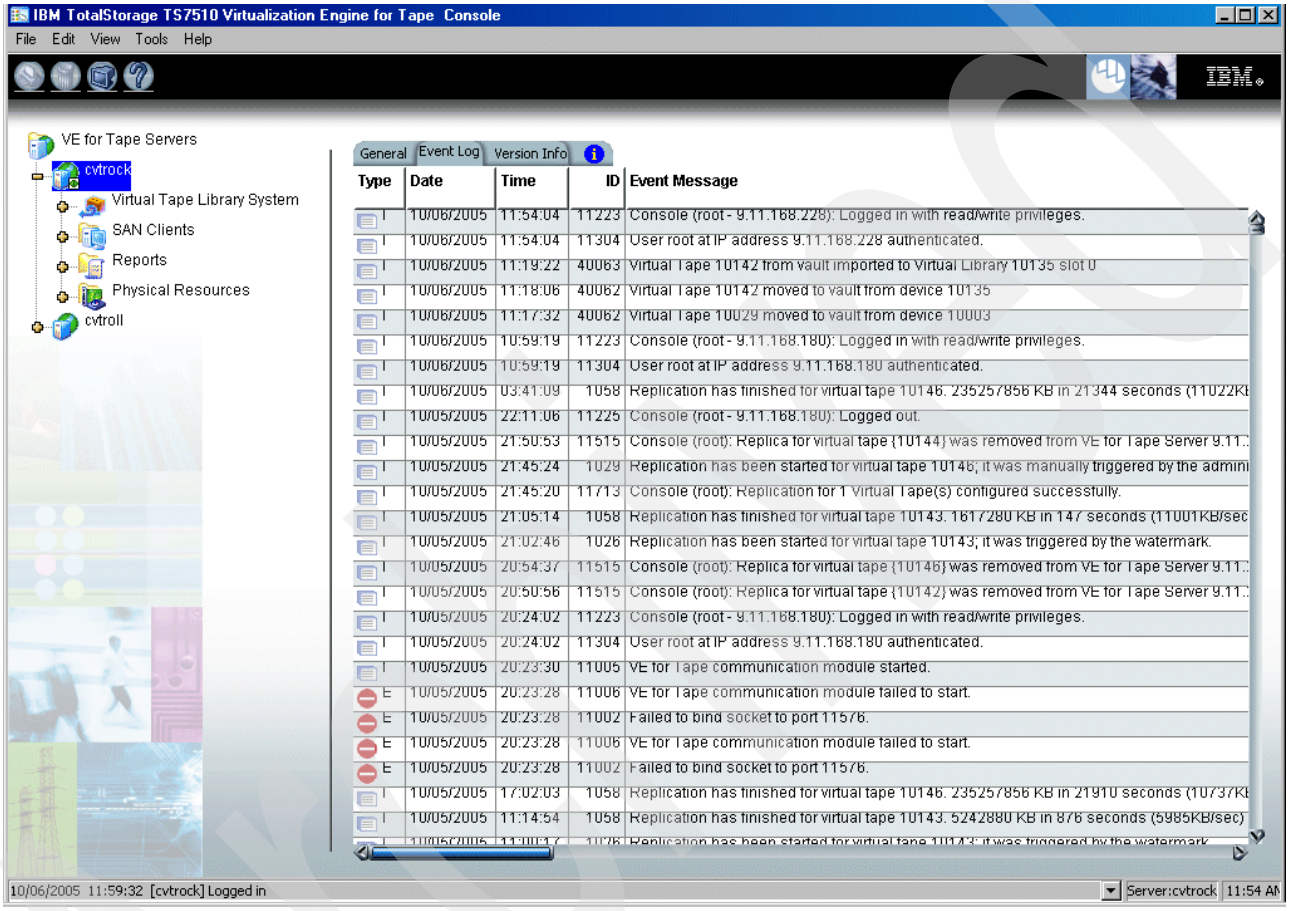

Figure 6-15 Event Log tab on the main page of the VE Console

Important: We recommend that you use Call Home proactive monitoring. Use the method of manually looking through the event logs only as a *backup* to Call Home.

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Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information about ordering these publications, see “How to get IBM Redbooks” on page 142. Note that some of the documents referenced here may be available in softcopy only.

- *Implementing IBM Tape in UNIX Systems*, SG24-6502
- *Implementing IBM Tape in Linux and Windows*, SG24-6268
- *The IBM TotalStorage Solutions Handbook*, SG24-5250
- *Introducing IBM TotalStorage FAStT EXP100 with SATA Disks*, REDP-3794

Other publications

These publications are also relevant as further information sources:

- *IBM Ultrium Device Drives: Installation and User’s Guide,* GA32-0430
- *IBM Virtualization Engine TS7510 Introduction and Planning Guide*, GC26-7767
- *IBM Virtualization Engine TS7510 - User’s Guide*, GC26-7769
- *IBM Tivoli Storage Manager for SAN for AIX Storage Agent User's Guide Version 5.3*, GC32-0771
- *IBM TotalStorage Tape Device Drivers Installation and User's Guide*, GC35-0154

Online resources

These Web sites and URLs are also relevant as further information sources:

- Serial ATA

  http://www.serialata.org
- Tape backup and information management systems

  http://www.ibm.com/servers/storage/tape
- Supported host bus adapter (HBA) firmware levels and SAN fabric components

  http://www-03.ibm.com/servers/storage/support/config/hba/index.wss
- *Independent Software Vendor (ISV) matrix for IBM Virtualization Engine TS7510*

  http://www-03.ibm.com/servers/storage/tape/compatibility/pdf/ts7510_isv_matrix.pdf
- IBM device driver download

  ftp://ftp.software.ibm.com/storage/devdrvr/

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- Atape.driver download for AIX

  ftp://ftp.software.ibm.com/storage/devdrvr/AIX/

- Veritas support

  http://www.support.veritas.com

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