

Tivoli Storage Manager for Virtual Environments: Data Protection for VMware Solution Design Considerations

IBM Redbooks Solution Guide

IBM® Tivoli® Storage Manager for Virtual Environments (referred to as Data Protection for VMware®) provides a comprehensive solution for protecting virtual machines (VMs). Data Protection for VMware eliminates the impact of running back-ups on a VM by offloading backup workloads from a VMware ESX or ESXi-based host to a vStorage backup server. It works with the Tivoli Storage Manager backup-archive client (installed on the vStorage backup server) to complete full, incremental, and incremental forever snapshots of VMs. The intent of this IBM Redbooks® Solution Guide is to help with key decisions you must address when you are designing a solution to protect a virtual environment. This information is not intended to replace the analysis of your environment and is not a complete set of decisions. Figure 1 shows the Data Protection for VMware system components and the user environment.

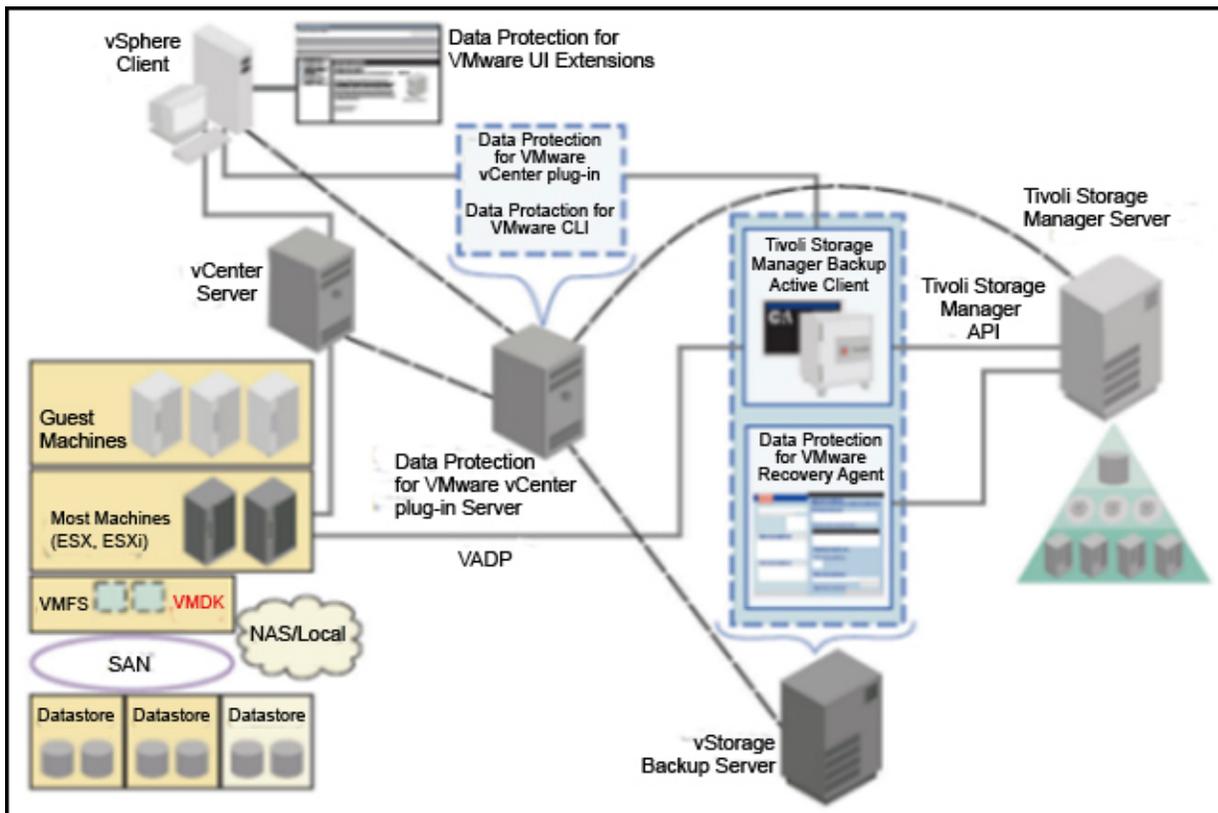


Figure 1. Data Protection for VMware system components and user environment

Did you know?

Tivoli Storage Manager for Virtual Environments protects VMware® vSphere virtual machines by offloading backup workloads to a centralized Tivoli Storage Manager server for safe keeping. Administrators can create backup policies or restore virtual machines with just a few clicks. It enables your organization to protect data without the need for a traditional backup window. It allows you to safeguard the massive amounts of information that virtual machines generate without affecting the physical resources of the VMware server.

Business value

Tivoli Storage Manager for Virtual Environments integrates with and extends the role of Tivoli Storage Manager in providing data protection services to virtualized applications in production environments. These include backup and recovery, online database and application protection, disaster recovery, data reduction, bare-machine recovery, space management, and archiving and retrieval.

Faster, more frequent protection for virtual machines is enabled by offloading the backup workload from virtual machines and production VMware ESX hosts to vStorage backup servers. By providing an improved frequency of backups, the amount of data at risk in a virtualized environment is reduced. Tivoli Storage Manager for Virtual Environments also provides faster recovery of data to reduce downtime in a virtualized environment following a failure.

Overhead is eliminated with centralized vStorage backup. The VMware vStorage APIs for Data Protection technology is supported, which simplifies and optimizes data protection. This technology conducts operations on the backup and management servers rather than the virtual machines, greatly reducing system overhead and any disruption that backups might cause to virtualized applications. VMware vStorage APIs for Data Protection are used, including block-level incremental forever backups based on VMware Changed Block Tracking. Periodic full backups take a nondisruptive snapshot at the virtual machine image level. The need for traditional backup windows is eliminated by continuously capturing data changes at the block level.

Tivoli Storage Manager for Virtual Environments retrieves data from image-level backups. It provides flexible recovery options for file-level, volume-level, or VM image-level recovery using a single backup of a virtual machine image. Tivoli Storage Manager acts as a virtual datastore. Users can access virtual machines in the backup system for verification or to initiate recovery to the vSphere ecosystem. In a file restore operation, the administrator launches the Tivoli Storage Manager for Virtual Environments restore on the vStorage backup server, accesses a point-in-time view of the data in the storage pool using Tivoli Storage Manager, and performs a drag-and-drop of the desired files. Users can perform self-service object-level recovery for Exchange and SQL virtual machine backups. They can also get instant access and instant restores from full virtual machine backups.

Solution overview

Tivoli Storage Manager for Virtual Environments - Data Protection for VMware provides advanced data protection and flexible recovery options for VMware vSphere ESX and ESXi servers. Nondisruptive virtual machine backup is simplified and streamlined. VMware vSphere 4 and vSphere 5 environments are supported.

Tivoli Storage Manager for Virtual Environments protects VMware vSphere and vCloud virtual machines by offloading backup workloads to a centralized server and enabling near-instant recovery. It enables you to protect data without the need for a traditional backup window. You can protect the massive amounts of information that virtual machines generate without affecting the physical resources of the VMware server. Multiple virtual machines are supported with one Tivoli Storage Manager agent. LAN-free data transfer from the VMware server's storage to the backup server is supported. This preserves bandwidth for other users.

The management of the backup and restore processes for virtual machines is simplified. Tivoli Storage Manager for Virtual Environments provides an easy to use GUI that you can access from within the VMware vCenter. Tivoli Storage Manager for Virtual Environment - Data Protection for VMware V7.1 has introduced a stand-alone web-based user interface, in addition to the vCenter plug-in, to perform the same operation. This new interface has the advantage to be web-based and compatible with the VMware vSphere 5 and later web-based management interface. It allows backup administrators (or VMware administrators) to create a backup policy or restore a virtual machine with just a few clicks. Tivoli Storage Manager for Virtual Environments integrates with and extends the role of Tivoli Storage Manager in providing data protection services to virtualized applications in production environments. These include backup and recovery, online database and application protection, disaster recovery, data reduction, bare-machine recovery, space management, and archiving and retrieval.

Tivoli Storage Manager backup-archive client data mover

The Tivoli Storage Manager backup-archive client data mover is an instance of the backup-archive client program, and it is configured on a vStorage backup server. Therefore, you can install the backup-archive client on a single vStorage backup server and create several logical instances or data movers from this single installation. The backup-archive client data mover can run on a Windows or Linux vStorage backup server and cross-platform operations are supported. A Windows backup-archive client data mover can back up a Linux VM, and vice versa. A backup that is performed by a Linux proxy can be restored by a Windows proxy, and vice versa. The backup-archive client data mover is generally not provided as part of the Data Protection for VMware installation package, but it is a prerequisite. The exception is Tivoli Storage Manager for Virtual Environments V7.1 for Microsoft Windows 64-bit, which includes the Tivoli Storage Manager backup-archive client data mover features on the product DVD or download package.

Data Protection for VMware Recovery Agent

The Data Protection for VMware Recovery Agent is part of the Data Protection for VMware installation package and provides the file restore and instant restore of a volume functions:

- File restore can be performed in-guest or off-host on supported Windows and Linux machines. File restore is accomplished by using the Data Protection (DP) for VMware Recovery Agent Mount function to expose a virtual disk snapshot from a Tivoli Storage Manager storage pool and copy the required files. The user chooses whether to expose a complete disk as an iSCSI LUN or a single partition from the selected disk as a local volume.
- Instant restore of a volume is a method of restoring the contents of a single volume that provides the user or application on-demand access to data while a background process restores the entire volume contents. To the user or application, the volume appears to contain all the restored data, even though the restore process is in-progress. Instant restore can be done from a full or incremental virtual machine backup. Instant restore is performed by using the DP for VMware Recovery Agent's Instant Restore function. Mount and instant restore can use full or incremental backups that were created with the backup-archive client data mover.

Data Protection for VMware vCenter plug-in

Data Protection for VMware vCenter plug-in is the Tivoli Storage Manager extension to VMware vSphere Windows client. This extension enables management of full VM backup and restore operations for multiple backup-archive client data mover nodes. This plug-in is part of the Data Protection for VMware installation package. The VM command-line interface (VMCLI) for the vCenter plug-in also is provided. The plug-in is powered by the IBM WebSphere® Application Server engine and Derby database. Those components are installed on the vStorage backup server or a separate machine.

Tivoli Storage Manager Server

The Tivoli Storage Manager Server provides the backup repository for the virtual machines that are protected.

Usage scenarios

This section describes several implementation scenarios that are based on different environments. The scenarios described here are intended to be a design starting point only. To build a strong, robust, and comprehensive solution, see the IBM Redpaper™ publication, *Tivoli Storage Manager for Virtual Environment Deployment Solution Guide*, REDP-4991.

Scenario 1: Small environment

In this scenario, we describe the implementation of Tivoli Storage Manager Virtual Environment to protect virtual machines in a small environment. The small environment has the following characteristics:

- 10 TB total storage space
- Up to 150 virtual machines (70 GB average size)
- 6% daily change rate
- Incremental forever backup strategy

In this case, and according to the preferred practices, the design includes the following components:

- One virtual vStorage backup server (Proxy)
- One Tivoli Storage Manager server
- Estimated disk storage space required is based on the following policy:
10 TB initial full + 614 GB Daily * NB days to be retained on Tivoli Storage Manager server where NB is the first full backup of the virtual machine that must be spread over several days, or another virtual proxy can be set up temporarily.

Tivoli Storage Manager deduplication (client-side or server-side) can be enabled. If it is, the Tivoli Storage Manager server must meet the minimum hardware requirement and the data must be stored on FILE-based volumes on the Tivoli Storage Manager server side. Carefully consider the Tivoli Storage Manager deduplication limitation, as described at the following website:

<https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Tivoli%20Storage%20Manager/page/Deduplication>

Also, with deduplication, you must refine the storage pool space estimation. The design is shown in Figure 3.

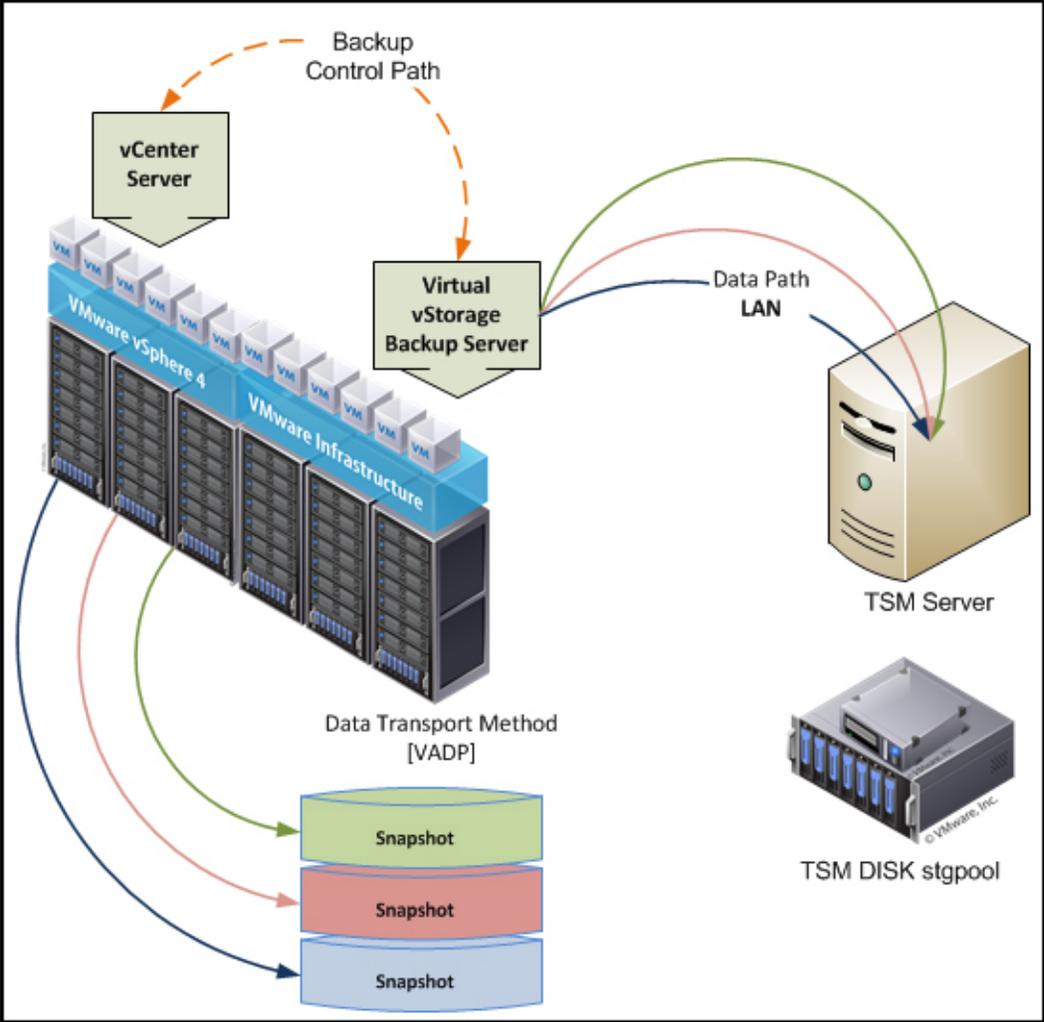


Figure 3. Tivoli Storage Manager: Virtual Environment small environment overview

Scenario 2: Big environment

In this scenario, we describe the implementation of Tivoli Storage Manager Virtual Environment to protect virtual machines in a big environment. The big environment has the following characteristics:

- 80 TB total storage
- Up to 1,500 virtual machines (50 GB average size)
- 6% daily change rate
- Incremental forever backup strategy

In this scenario and according to the preferred practices, the design includes the following components:

- Three virtual vStorage backup servers (Proxy)
- One Tivoli Storage Manager server
- Estimated disk storage space required is based on the following policy:

80 TB initial full + 5 TB daily * NB days to be retained on the Tivoli Storage Manager server

At the time of this writing, we do not suggest the use of Tivoli Storage Manager deduplication in this environment, according to the Tivoli Storage Manager deduplication limit that is described at this website: <http://bit.ly/1gzvJy6>

This increases the number of virtual vStorage backup servers that is required, therefore, limiting the design scalability and increasing the number of Tivoli Storage Manager servers. It also requires high-performance disks to drive the Tivoli Storage Manager database.

Instead, consider the implementation of an appliance, such as IBM ProtecTIER® solutions, to offload the deduplication process out of the Tivoli Storage Manager servers. Also, consider the implementation of a physical proxy with which you can use storage area network (SAN) and LAN-free transport to move the data from the datastore to virtual tapes (ProtecTIER). Figure 4 shows the possible design (including a physical or virtual vStorage backup server) and the deduplication implication.

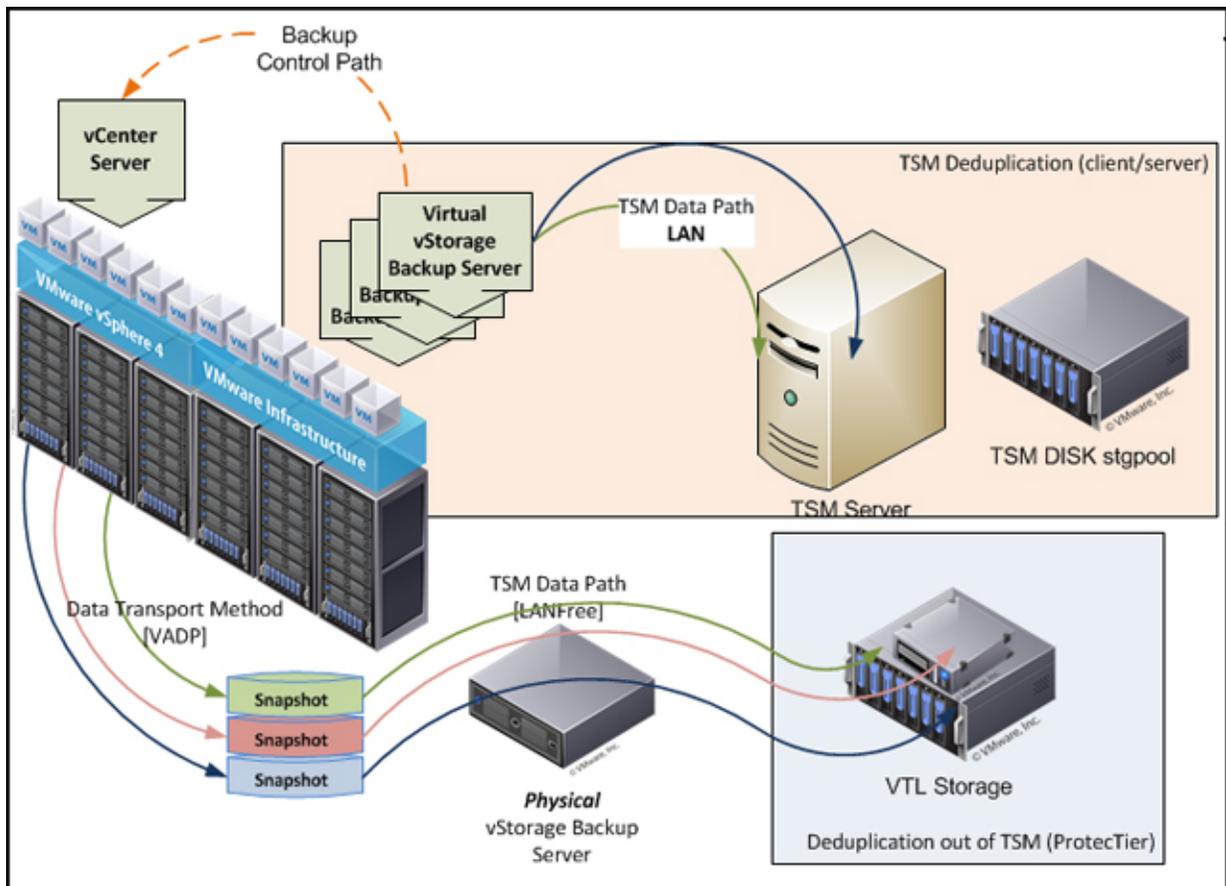


Figure 4. Tivoli Storage Manager: Big environment overview

In Figure 4, the area at the top includes the Tivoli Storage Manager server. The vStorage backup server represents the area where the deduplication load exists.

The bottom area includes the ProtecTIER appliance or gateway, and represents the area where the deduplication load exists. In this case, the Tivoli Storage Manager server and the vStorage backup server machines are free of any load that is required by deduplication tasks.

Scenario 3: Shared environment

Tivoli Storage Manager for Virtual Environment - Data Protection for VMware can be implemented in a dedicated environment and in a shared one. A shared environment includes the following examples:

- Virtual machine to be managed separately (for example, multiple entities within the same office)
- ESXi clusters to be managed separately (for example, one cluster per entity)
- Multiple vCenter servers

In a shared environment, the small and big environment information that was provided previously is still valid. In addition to this information, we describe several considerations and the design effects when the solution is implemented in a shared environment:

- Depending on your environment, you might need to consider the implementation of Tivoli Storage Manager for Virtual Environment components as shared resources, for example, between different entities.
- In a shared environment, two of the challenges are the security for connecting the VMware infrastructure and the capability to access the data after it is stored in the Tivoli Storage Manager server. Some configuration can be done on the data mover node (the one that is accessing the VMware data and datastores) and on the data center node (the one that is managing the data after it is backed up to the Tivoli Storage Manager server).

Integration

IBM provides off-host block-level incremental backup and file recovery and instant restore from a full-VM backup for Windows and Linux guest machines. In addition, Data Protection for VMware allows the backup-archive client to perform block-level incremental backups.

Tivoli Storage Manager and Tivoli Storage IBM FlashCopy® Manager products provide storage management solutions for multivendor computer environments. The products provide automated, centrally scheduled, and policy-managed backup, archive, and space-management capabilities for file servers, workstations, virtual machines, and applications. Tivoli Storage Manager for Virtual Environments is part of the Tivoli Storage Manager product family. The following list shows the Tivoli Storage Manager product family with a brief description of each product's primary function:

- **Tivoli Storage Manager and Tivoli Storage Manager Extended Editions** - The Tivoli Storage Manager and Tivoli Storage Manager Extended Edition products offer the core components for automated and centralized backup and restore operations. The server and backup-archive client provide basic functions, such as backup and restore operations, and archive and retrieve operations for files, directories, and disk images.
- **Tivoli Storage Manager space management products** - These products provide space management for disks. The Tivoli Storage Manager space management products can help you move seldom-used files automatically to Tivoli Storage Manager server storage.
- **Tivoli Storage FlashCopy Manager** - This product protects data with integrated, application-aware snapshot backup and restore capabilities.
- **Tivoli Storage Manager and Tivoli Storage FlashCopy Manager** - These products provide data protection that is tailored for applications.
- **Tivoli Storage Manager for Storage Area Networks** - This product works with servers and client computers to transfer data over a SAN instead of a LAN.
- **Tivoli Storage Manager for z/OS Media** - You can use storage that is managed by Tivoli Storage Manager for z/OS® Media for Tivoli Storage Manager servers that run on IBM AIX® or Linux on IBM System z® systems.
- **Tivoli Storage Manager Suite for Unified Recovery** - This product is a bundle of Tivoli Storage Manager products that can satisfy a wide range of data protection and recovery requirements. Licensing is based on the amount of data that is being managed.
- **System Storage Archive Manager** - This product is a software solution that provides long-term, retention protection when you archive business records, files, or data. The product can help you to comply with regulations for data retention.

Supported platforms

The Tivoli Storage Manager for Virtual Environments: Data Protection for VMware requirements vary by high-level functional component. The high-level functional components of Data Protection for VMware are Data Protection for VMware GUI, Data Mover, Recovery Agent, and Recovery Agent Command Line Interface.

The Preventive Service Planning document that details the hardware and software requirements for Tivoli Storage Manager for Virtual Environments: Data Protection for VMware 7.1 is at this website:
<http://www-01.ibm.com/support/docview.wss?uid=swg21652843>

A detailed list of product and platform support for Tivoli Storage Manager for Virtual Environments is at the IBM Support web page:
<http://www-01.ibm.com/support/docview.wss?uid=swg21386446>

The IBM support portal for Tivoli Storage Manager contains many useful links, such as product downloads, tools and resources, common support links, and product support documentation:
<http://bit.ly/1gk9hyl>

Ordering information

This section describes the licensing and ordering information for IBM Tivoli Storage Manager for Virtual Environments V7.1.

IBM Software license agreement for Tivoli Storage Manager for Virtual Environments is at the following website:
<http://www-03.ibm.com/software/sla/sladb.nsf/displaylis/2A383FBF4B106CAD85257C120074EB88?OpenDocument>

Ordering information is shown in the following table.

Table 1. Ordering part number

Program name	PID number	Version
IBM Tivoli Storage Manager for Virtual Environments	5725-AA4	7.1

Related information

For more information, see the following resources:

- *Tivoli Storage Manager for Virtual Environments - Data Protection for VMware Deployment Guide*, REDP-4991:
<http://www.redbooks.ibm.com/abstracts/redp4991.html?Open>
- IBM Knowledge Center for Tivoli Storage Manager V7.1:
<http://bit.ly/1sqiANh>
- IBM Offering Information page (to search on announcement letters, sales manuals, or both):
http://www.ibm.com/common/ssi/index.wss?request_locale=en

On this page, enter Tivoli Storage Manager for Virtual Environments Data Protection for VMware, select the information type, and then click **Search**. On the next page, narrow your search results by geography and language.

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