

IBM Tivoli Storage Manager  
for Linux  
Version 7.1

*Installation Guide*





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for Linux  
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**Note:**

Before using this information and the product it supports, read the information in "Notices" on page 141.

**First edition (December 2013)**

This edition applies to version 7, release 1, modification 0 of IBM Tivoli Storage Manager (product numbers 5608-E01, 5608-E02, 5608-E03), and to all subsequent releases and modifications until otherwise indicated in new editions.

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# Contents

<b>Preface</b> . . . . .	<b>v</b>
Who should read this guide . . . . .	v
Installable components . . . . .	v

<b>New for Tivoli Storage Manager Version 7.1</b> . . . . .	<b>vii</b>
---	------------

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## Part 1. Installing and upgrading the server . . . . . 1

### Chapter 1. Planning to install the Tivoli Storage Manager server . . . . . 3

What you should know first . . . . .	3
System requirements. . . . .	4
Linux X86_64 server requirements . . . . .	5
Linux on System z server requirements . . . . .	8
Compatibility of the Tivoli Storage Manager server with other DB2 products on the system . . . . .	10
IBM Installation Manager. . . . .	11
Worksheets for planning details for the Tivoli Storage Manager server . . . . .	12
Capacity planning . . . . .	13
Estimating space requirements for the database . . . . .	13
Recovery log space requirements . . . . .	16
Monitoring space utilization for the database and recovery logs . . . . .	29
Server naming best practices. . . . .	30
Installation directories . . . . .	32

### Chapter 2. Installing the Tivoli Storage Manager server components . . . . . 33

Obtaining the Tivoli Storage Manager installation package . . . . .	33
Installing Tivoli Storage Manager by using the installation wizard . . . . .	35
Installing Tivoli Storage Manager by using console mode . . . . .	36
Installing Tivoli Storage Manager in silent mode . . . . .	37
Installing server language packages . . . . .	38
Server language locales . . . . .	38
Configuring a language package . . . . .	39
Updating a language package . . . . .	40

### Chapter 3. Taking the first steps after you install Tivoli Storage Manager . . . . . 41

Tuning kernel parameters. . . . .	42
Updating kernel parameters . . . . .	42
Suggested minimum values . . . . .	42
Creating the user ID and directories for the server instance . . . . .	45
Configuring Tivoli Storage Manager . . . . .	45
Configuring Tivoli Storage Manager using the configuration wizard . . . . .	46

Configuring the server instance manually . . . . .	47
Configuring server options for server database maintenance . . . . .	54
Starting the server instance . . . . .	55
Verifying access rights and user limits . . . . .	56
Starting the server from the instance user ID . . . . .	58
Starting the server from the root user ID . . . . .	58
Automatically starting servers on Linux systems . . . . .	58
Stopping the server. . . . .	60
Registering licenses. . . . .	60
Specifying a device class in preparation for database backups . . . . .	61
Running multiple server instances on a single system . . . . .	61
Monitoring the server . . . . .	62

### Chapter 4. Installing a Tivoli Storage Manager server fix pack . . . . . 65

### Chapter 5. Upgrading to Tivoli Storage Manager Version 7.1 . . . . . 69

Upgrading from Tivoli Storage Manager V6.2 or V6.3 to V7.1 . . . . .	70
Planning the upgrade . . . . .	71
Preparing the system . . . . .	72
Installing the V7.1 server and verifying the upgrade . . . . .	74
Upgrading from Tivoli Storage Manager V6.1 to V7.1 . . . . .	77
Upgrading Tivoli Storage Manager in a clustered environment . . . . .	78
Upgrading Tivoli Storage Manager to V7.1 in a clustered environment. . . . .	78

### Chapter 6. Reverting from Version 7.1 to the previous V6 server. . . . . 79

Steps for reverting to the previous server version. . . . .	79
Additional recovery steps if you created new storage pools or enabled data deduplication . . . . .	80

### Chapter 7. Reference: DB2 commands for Tivoli Storage Manager server databases . . . . . 83

### Chapter 8. Uninstalling Tivoli Storage Manager . . . . . 87

Uninstalling Tivoli Storage Manager by using a graphical wizard . . . . .	87
Uninstalling Tivoli Storage Manager in console mode . . . . .	88
Uninstalling Tivoli Storage Manager in silent mode . . . . .	88
Uninstalling and reinstalling Tivoli Storage Manager . . . . .	89

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**Part 2. Installing and upgrading Tivoli Monitoring for Tivoli Storage Manager . . . . . 91**

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**Part 3. Installing and upgrading the Operations Center . . . . . 93****Chapter 9. Planning to install the Operations Center . . . . . 95**

System requirements for the Operations Center . . . . .	95
Operations Center computer requirements . . . . .	96
Hub and spoke server requirements . . . . .	96
Operating system requirements . . . . .	99
Web browser requirements . . . . .	100
Language requirements . . . . .	100
Administrator IDs that the Operations Center requires . . . . .	101
IBM Installation Manager . . . . .	102
Installation checklist . . . . .	102

**Chapter 10. Installing the Operations Center . . . . . 105**

Obtaining the Operations Center installation package . . . . .	105
Installing the Operations Center by using a graphical wizard . . . . .	106
Installing the Operations Center in console mode . . . . .	106
Installing the Operations Center in silent mode . . . . .	106

**Chapter 11. Upgrading the Operations Center . . . . . 109****Chapter 12. Getting started with the Operations Center . . . . . 111**

Configuring the Operations Center . . . . .	111
Designating the hub server . . . . .	112
Adding a spoke server . . . . .	112
Sending email alerts to administrators . . . . .	113
Configuring for SSL communication . . . . .	115
Configuring for SSL communication between the Operations Center and the hub server . . . . .	116
Configuring for SSL communication between the hub server and a spoke server . . . . .	118
Resetting the password for the Operations Center truststore file . . . . .	120
Starting and stopping the web server . . . . .	121

**Chapter 13. Troubleshooting the Operations Center installation . . . . . 123**

Chinese, Japanese, or Korean fonts are displayed incorrectly . . . . .	123
--	-----

**Chapter 14. Uninstalling the Operations Center . . . . . 125**

Uninstalling the Operations Center by using a graphical wizard . . . . .	125
Uninstalling the Operations Center in console mode . . . . .	125
Uninstalling the Operations Center in silent mode . . . . .	126

**Chapter 15. Rolling back to a previous version of the Operations Center . . . . . 127**

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**Part 4. Appendixes . . . . . 129****Appendix A. Installation log files . . . . . 131****Appendix B. Tivoli support information . . . . . 133**

Communities and other learning resources . . . . .	133
Searching knowledge bases . . . . .	135
Searching the Internet . . . . .	135
Using IBM Support Assistant . . . . .	135
Finding product fixes . . . . .	136
Receiving notification of product fixes . . . . .	136
Contacting IBM Software Support . . . . .	136
Setting up and managing support contracts . . . . .	137
Determining the business impact . . . . .	137
Describing the problem and gathering background information . . . . .	137
Submitting the problem to IBM Software Support . . . . .	138

**Appendix C. Accessibility features for the Tivoli Storage Manager product family . . . . . 139****Notices . . . . . 141**

Trademarks . . . . .	143
Privacy policy considerations . . . . .	143

**Glossary . . . . . 145****Index . . . . . 147**

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## Preface

This publication contains installation and configuration instructions for the IBM® Tivoli® Storage Manager server, server languages, and other Tivoli Storage Manager components.

Instructions for installing the Tivoli Storage Manager license, device driver, storage agent, and the IBM Tivoli Storage Manager Operations Center are also included in this publication.

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## Who should read this guide

This publication is intended for a system administrator installing and configuring a Version 7.1 Tivoli Storage Manager server, the Operations Center, or upgrading from Tivoli Storage Manager Version 6.

If you are upgrading an existing 5.5.x Tivoli Storage Manager server to Tivoli Storage Manager Version 7.1, see the *Upgrade and Migration Guide for V5 Servers*.

If you are upgrading a Tivoli Storage Manager Version 6.1, Version 6.2, or Version 6.3 server to a newer version, see Chapter 5, “Upgrading to Tivoli Storage Manager Version 7.1,” on page 69.

If you are upgrading an existing Tivoli Storage Manager Version 7.1 server to a later level of Version 7.1, see Chapter 4, “Installing a Tivoli Storage Manager server fix pack,” on page 65.

If you are installing or upgrading the Operations Center, see Part 3, “Installing and upgrading the Operations Center,” on page 93.

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## Installable components

The IBM Tivoli Storage Manager server and licenses are required components.

You can install the following components for Tivoli Storage Manager V7.1.0 or later.

- Tivoli Storage Manager server
- Tivoli Storage Manager server languages
- Tivoli Storage Manager licenses
- Tivoli Storage Manager devices
- Tivoli Storage Manager storage agent
- Tivoli Storage Manager Operations Center

Table 1 on page vi describes all the installable components.

Table 1. Tivoli Storage Manager installable components

Tivoli Storage Manager component	Description	Additional information
Server (required)	Includes the database, GSKit, and tools to help you configure and manage Tivoli Storage Manager.	See the Tivoli Storage Manager server overview in the <i>Administrator's Guide</i> .
Language package (optional)	Each language package (one for each language) contains language-specific information for the server.	See "Installing server language packages" on page 38.
Licenses (required)	Includes support for all Tivoli Storage Manager licensed features. After you install this package, you must configure the licenses you purchased.	See the chapter on managing server operations in the <i>Administrator's Guide</i> .
Devices (optional)	Extends Tivoli Storage Manager media management capability.	See the chapter on adding devices in the <i>Administrator's Guide</i> .  A list of devices that are supported by this driver is available from the Tivoli Storage Manager website, at <a href="http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager">http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager</a> .
Storage agent (optional)	Installs the component that allows client systems to write data directly to, or read data directly from, storage devices that are attached to a storage area network (SAN). <b>Remember:</b> The IBM Tivoli Storage Manager for Storage Area Networks is a separately licensed product.	See the <i>Storage Agent User's Guide</i> .
Operations Center (optional)	Installs the Operations Center, which is a web-based interface for managing your storage environment.	See Part 3, "Installing and upgrading the Operations Center," on page 93.



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## New for Tivoli Storage Manager Version 7.1

Many features in IBM Tivoli Storage Manager V7.1 are new for Tivoli Storage Manager users. These changes affect the Tivoli Storage Manager server, the Operations Center, the Administration Center, Tivoli Monitoring for Tivoli Storage Manager, and the upgrade to V7.1.

These installation-related features are new for Tivoli Storage Manager in V7.1. For a complete list of new V7.1 features, see the "What's new in the products" topic in the Tivoli Storage Manager information center at <http://pic.dhe.ibm.com/infocenter/tsminfo/v7r1>.

### **DB2® Version 10.5 database implementation**

Tivoli Storage Manager V7.1 is installed with the latest version of the IBM DB2 database software, V10.5. The DB2 technology provides management functions for the server database.

The previous Tivoli Storage Manager server release, V6.3, was packaged with a DB2 V9.7 database.

If you are upgrading the server, you must ensure that the correct version of DB2 is installed. If you are using a Tivoli Storage Manager V6.1 server, and you want to upgrade to V7.1, you must upgrade the V6.1 server to V6.2 or V6.3. Then, upgrade the server from V6.2 or V6.3 to V7.1. The Tivoli Storage Manager V6.1 server was packaged with a DB2 V9.5 database, which cannot be upgraded to V10.5. The Tivoli Storage Manager V6.2 and V6.3 servers were packaged with a DB2 V9.7 database, which can be upgraded to V10.5.

### **IBM Installation Manager**

In Tivoli Storage Manager V7.1, the server and Operations Center use IBM Installation Manager to install or update software. If the required version of IBM Installation Manager is not already installed, it is automatically installed or upgraded when you install the Tivoli Storage Manager server or Operations Center. It must remain installed on the system so that the server or Operations Center can be updated or uninstalled later as needed.

### **Operations Center updates**

The IBM Tivoli Storage Manager Operations Center is a web-based interface for managing your storage environment.

**Restriction:** The Operations Center cannot be installed on HP-UX or Oracle Solaris systems. However, you can use the Operations Center to manage Tivoli Storage Manager V6.3.4 or later servers that run on HP-UX or Oracle Solaris systems.

You can now do the following additional administrative tasks through the Operations Center:

- Customize the settings for servers and clients by editing the server and client properties.
- View or cancel the sessions and processes that are in progress by using the Active Tasks view for servers.
- View the sessions and processes that succeeded or failed by using the Completed Tasks view for servers.

- View activity log messages that are related to specific alerts, sessions, and processes. These activity log messages are available on the Alerts page and in the Active Tasks and Completed Tasks views.
- Manually back up clients, storage pools, and the server database.
- View the replication server configuration for a client.
- Register clients, and configure basic backup settings.
- Suppress risk warnings for specific clients.
- View the authority level of the administrator ID that is used to log in to the Operations Center.

#### **Tivoli Monitoring for Tivoli Storage Manager availability**

IBM Tivoli Monitoring for Tivoli Storage Manager is not delivered with V7.1.

You can use Tivoli Monitoring for Tivoli Storage Manager V6.3.4 with any Tivoli Storage Manager V5.5 or later server. For more information about Tivoli Monitoring for Tivoli Storage Manager, see the Tivoli Storage Manager V6.3 Information Center at: <http://pic.dhe.ibm.com/infocenter/tsminfo/v6r3/index.jsp>

#### **Administration Center availability**

Although the Tivoli Storage Manager Administration Center is not delivered with V7.1 or later versions, you can instead use the Operations Center, which is a web-based interface for managing your storage environment.

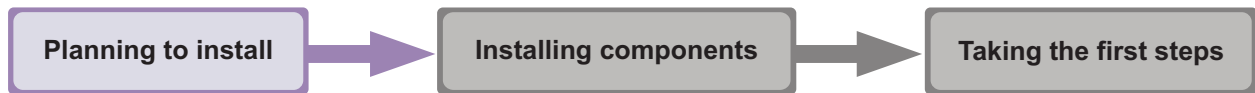
You can use the V6.3.4 Administration Center with any Tivoli Storage Manager V6.3 or later server, including to automatically update backup-archive clients. For more information about the Tivoli Storage Manager Administration Center, see the Tivoli Storage Manager V6.3 Information Center at: <http://pic.dhe.ibm.com/infocenter/tsminfo/v6r3/index.jsp>.

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## Part 1. Installing and upgrading the server

Install and upgrade the Tivoli Storage Manager server.

### Before you begin



*Figure 1. As highlighted in the figure, you are in the planning to install the Tivoli Storage Manager server section. Review this section carefully to ensure that you have the system and other requirements needed to install Tivoli Storage Manager.*



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# Chapter 1. Planning to install the Tivoli Storage Manager server

Install the Tivoli Storage Manager server software on the computer that manages storage devices and install the Tivoli Storage Manager client software on every workstation that transfers data to Tivoli Storage Manager server-managed storage.

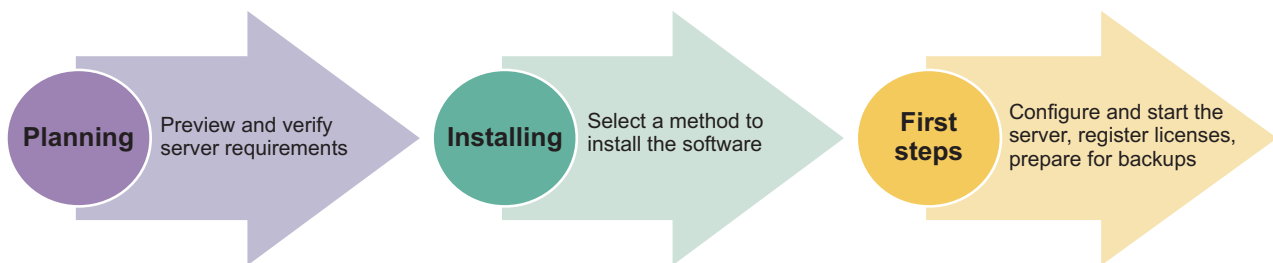
## About this task

Tivoli Storage Manager server maintenance releases, client software, and publications are available from the Tivoli Storage Manager website at [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager).

Allow approximately 30 - 45 minutes to install a Tivoli Storage Manager Version 7.1 server, using this guide.

An upgrade from V6.1.x, V6.2.x, or V6.3.x to V7.1 takes approximately 20 - 50 minutes. Your environment might produce different results than that obtained in the labs.

The following figure illustrates the main parts for installing a new Tivoli Storage Manager server.



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## What you should know first

Before installing IBM Tivoli Storage Manager, be familiar with your operating systems, storage devices, communication protocols, and system configurations.

Table 2. Upgrade information

To upgrade from this version	To this version	See this information
V7.1	V7.1 fix pack or interim fix	Chapter 4, "Installing a Tivoli Storage Manager server fix pack," on page 65
V6.2 or V6.3	V7.1	"Upgrading from Tivoli Storage Manager V6.2 or V6.3 to V7.1" on page 70
V6.1	V7.1	"Upgrading from Tivoli Storage Manager V6.1 to V7.1" on page 77

## Installing the Tivoli Storage Manager server

Table 2. Upgrade information (continued)

To upgrade from this version	To this version	See this information
V5.5	V7.1	<i>Upgrade and Migration Guide for V5 Servers</i>

If you are migrating a Tivoli Storage Manager server, see the following documentation:

- V5 server on a z/OS<sup>®</sup> operating system to V7.1 on an AIX<sup>®</sup> or Linux on System z<sup>®</sup> operating system, see the *Upgrade and Migration Guide for V5 Servers*
- V5 server on an AIX, HP-UX, or Solaris operating system to V6.3.4 or later on a Linux x86\_64 operating system, see the *Upgrade and Migration Guide for V5 Servers*.

**Restriction:** You can install and run the Version 7.1 server on a system that already has DB2 installed on it, whether DB2 was installed independently or as part of some other application, with some restrictions. For details, see “Compatibility of the Tivoli Storage Manager server with other DB2 products on the system” on page 10.

Experienced DB2 administrators can choose to perform advanced SQL queries and use DB2 tools to monitor the database. Do not, however, use DB2 tools to change DB2 configuration settings from those that are preset by Tivoli Storage Manager, or alter the DB2 environment for Tivoli Storage Manager in other ways, such as with other products. The Tivoli Storage Manager Version 7.1 server has been built and tested extensively using the data definition language (DDL) and database configuration that Tivoli Storage Manager deploys.

**Attention:** Do not alter the DB2 software that is installed with Tivoli Storage Manager installation packages and fix packs. Do not install or upgrade to a different version, release, or fix pack of DB2 software because doing so can damage the database.

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## System requirements

To install Tivoli Storage Manager server on a Linux system, it is necessary to have a minimum level of hardware and software, including a communication method and the most current device driver.

These tables list the minimum hardware and software requirements for the installation of a Tivoli Storage Manager server. Use these requirements as a starting point. You can find the most current information about system requirements at Tivoli Storage Manager Supported Operating Systems.

See *Tivoli Storage Manager Optimizing Performance* for server configuration guidelines and best practices.

The Tivoli Storage Manager device driver package does not contain a device driver for this operating system because a SCSI generic device driver is used. Configure the device driver before using the Tivoli Storage Manager server with tape devices. The Tivoli Storage Manager driver package contains driver tools and ACSLS daemons. You can locate IBM driver packages at the Fix Central website.

Requirements, supported devices, client installation packages, and fixes are available at the Tivoli Storage Manager website. After you have installed Tivoli Storage Manager and before you customize it for your use, go to this website and download and apply any applicable fixes: [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager).

### Linux X86\_64 server requirements

The Tivoli Storage Manager server on Linux X86\_64 has hardware and software requirements.

#### Hardware requirements

Table 3 describes the minimum hardware requirements that are needed for your Tivoli Storage Manager Linux X86\_64 system. For more details about planning disk space, see “Capacity planning” on page 13.

*Table 3. Hardware requirements*

Type of hardware	Hardware requirements
Hardware	An AMD64 or Intel EMT-64 processor
Disk space	<p>The following minimum values for disk space:</p> <ul style="list-style-type: none"> <li>• 512 MB for the /var directory</li> <li>• 4 GB for the installation directory</li> <li>• 2 GB for the /tmp directory</li> <li>• 300 MB for the /usr directory</li> <li>• 2 GB in the home directory</li> </ul> <p><b>Tip:</b> Expect to use more space for problem determination.</p> <ul style="list-style-type: none"> <li>• 2 GB for the shared resources area</li> </ul> <p>Significant additional disk space is required for database and log files. The size of the database depends on the number of client files to be stored and the method by which the server manages them. The default active log space is 16 GB, the minimum that is needed for most workloads and configurations. Allocate at least three times the active log space for the archive log (48 GB). Ensure that you have sufficient resources if you are using data deduplication or expect a heavy client workload.</p> <p>For optimal performance and to facilitate I/O, specify at least two equally sized containers or Logical Unit Numbers (LUNs) for the database. See <i>Optimizing Performance</i> for more information about the configuration of directories for the database. In addition, each active log and archive log should have its own container or LUN.</p> <p>Ensure that you see the capacity planning section for more details about disk space.</p>

## Installing the Tivoli Storage Manager server

Table 3. Hardware requirements (continued)

Type of hardware	Hardware requirements
Memory	<p>The following minimum values for memory:</p> <ul style="list-style-type: none"><li>• 12 GB.</li><li>• 16 GB if you are using data deduplication.</li><li>• At least 32 GB for heavily used servers. Using 32 GB or more of memory enhances performance of the Tivoli Storage Manager server database inventory.</li><li>• If you plan to run multiple instances, each instance requires the memory listed for one server. Multiply the memory for one server by the number of instances planned for the system.</li><li>• Node replication processing requires additional memory. Use a minimum of 32 GB of memory for node replication without data deduplication. Node replication with data deduplication requires a minimum of 64 GB of memory.</li><li>• When you create the active log, you need at least 64 GB of memory to run replication. If replication and deduplication are both being used, create an active log of 128 GB in size.</li></ul>

### Software requirements

Table 4 describes the minimum software requirements that are needed for your Tivoli Storage Manager Linux X86\_64 system.

Table 4. Software requirements

Type of software	Minimum software requirements
Operating system	<p>The Tivoli Storage Manager server on Linux X86_64 requires one of the following operating systems:</p> <ul style="list-style-type: none"><li>• Red Hat Enterprise Linux 6</li><li>• SUSE Linux Enterprise Server 11, Service Pack 2</li></ul>



## Installing the Tivoli Storage Manager server

Table 4. Software requirements (continued)

Type of software	Minimum software requirements
Libraries	<p>GNU C libraries, Version 2.3.3-98.38 or later that is installed on the Tivoli Storage Manager system.</p> <p>For SUSE Linux Enterprise Servers:</p> <ul style="list-style-type: none"> <li>• libaio</li> <li>• libstdc++.so.5 at version 3.3 or later (32 and 64 bit packages are required)</li> <li>• libstdc++.so.6 at version 4.3 or later (32 and 64 bit packages are required)</li> </ul> <p>For Red Hat Enterprise Linux Servers:</p> <ul style="list-style-type: none"> <li>• libaio</li> <li>• libstdc++.so.6 (32 and 64 bit packages are required)</li> </ul> <p>To determine if SELinux is installed and in enforcing mode, perform one of the following tasks:</p> <ul style="list-style-type: none"> <li>• Check the <code>/etc/sysconfig/selinux</code> file.</li> <li>• Run the <code>sestatus</code> operating system command.</li> <li>• Check the <code>/var/log/messages</code> file for SELinux notices.</li> </ul> <p>To disable SELinux, complete one of the following tasks:</p> <ul style="list-style-type: none"> <li>• Set permissive mode by issuing the <code>setenforce 0</code> command as a superuser.</li> <li>• Modify the <code>/etc/sysconfig/selinux</code> file and reboot the machine.</li> </ul>
Communication protocol	<ul style="list-style-type: none"> <li>• TCP/IP Version 4 or Version 6, which is standard with Linux</li> <li>• Shared memory protocol (with Tivoli Storage Manager Version 7.1 Linux X86_64 client)</li> </ul>
Processing	<p>Asynchronous I/O must be enabled. On Linux kernels at 2.6 or later, install the libaio library to enable Asynchronous I/O.</p>
Device drivers	<p>The Tivoli Storage Manager passthru device driver is used for non- IBM devices. It uses the SCSI passthru interface to communicate with tape devices and tape libraries. The Linux SCSI Generic (sg) device driver is required for tape drives and tape libraries. The Tivoli Storage Manager device driver package contains device driver tools and ACSLS daemons.</p> <p>For the IBM 3590, 3592, or the Ultrium tape library or drives, the IBM device drivers are required. Install the most current device drivers. You can locate IBM driver packages at the Fix Central website: <a href="http://www.ibm.com/support/fixcentral/">http://www.ibm.com/support/fixcentral/</a>.</p> <p>Configure the device drivers before you use the Tivoli Storage Manager server with tape devices.</p>
Other software	<p>Korn Shell (ksh)</p>

### Linux on System z server requirements

The Tivoli Storage Manager server for Linux on System z has hardware and software requirements.

#### Hardware requirements

Table 5 describes the minimum hardware requirements that are needed for your Tivoli Storage Manager Linux on System z system. For more details about planning disk space, see “Capacity planning” on page 13.

Table 5. Hardware requirements

Type of hardware	Hardware requirements
Hardware	An IBM zSeries, IBM System z9®, IBM System z10®, or IBM zEnterprise® System (z114 and z196) 64-bit native logical partition (LPAR) or z/VM® guest.
Disk space	<p>The following minimum values for disk space:</p> <ul style="list-style-type: none"><li>• 512 MB for the /var directory</li><li>• 3 GB for the installation directory</li><li>• 2 GB for the /tmp directory</li><li>• 300 MB for the /usr directory</li><li>• 2 GB in the home directory</li></ul> <p><b>Tip:</b> Expect to use more space for problem determination.</p> <ul style="list-style-type: none"><li>• 2 GB for the shared resources area</li></ul> <p>Significant additional disk space is required for database and log files. The size of the database depends on the number of client files to be stored and the method by which the server manages them. The default active log space is 16 GB, the minimum that is needed for most workloads and configurations. Allocate at least three times the active log space for the archive log (48 GB). Ensure that you have sufficient resources if you are using data deduplication or expect a heavy client workload.</p> <p>For optimal performance and to facilitate I/O, specify at least two equally sized containers or Logical Unit Numbers (LUNs) for the database. See <i>Optimizing Performance</i> for more information about the configuration of directories for the database. In addition, each active log and archive log should have its own container or LUN.</p> <p>Ensure that you see the capacity planning section for more details about disk space.</p>

Table 5. Hardware requirements (continued)

Type of hardware	Hardware requirements
Memory	<p>The following minimum values for memory:</p> <ul style="list-style-type: none"> <li>• 12 GB.</li> <li>• 16 GB if you are using data deduplication.</li> <li>• At least 32 GB for heavily used servers. Using 32 GB or more of memory enhances performance of the Tivoli Storage Manager server database inventory.</li> <li>• If you plan to run multiple instances, each instance requires the memory listed for one server. Multiply the memory for one server by the number of instances planned for the system.</li> <li>• Node replication processing requires additional memory. Use a minimum of 32 GB of memory for node replication without data deduplication. Node replication with data deduplication requires a minimum of 64 GB of memory.</li> <li>• When you create the active log, you need at least 64 GB of memory to run replication. If replication and deduplication are both being used, create an active log of 128 GB in size.</li> </ul>

### Software requirements

Table 6 describes the minimum software requirements that are needed for your Tivoli Storage Manager Linux on System z system.

Table 6. Software requirements

Type of software	Minimum software requirements
Operating system	<p>The Tivoli Storage Manager server on Linux on System z (s390x 64-bit architecture) requires one of the following operating systems:</p> <ul style="list-style-type: none"> <li>• Red Hat Enterprise Linux 6</li> <li>• SUSE Linux Enterprise Server 11, Service Pack 2</li> </ul>
Libraries	<p>GNU C library, Version 2.4-31.43.6 is installed on the Tivoli Storage Manager system.</p> <p>For SUSE Linux Enterprise Servers:</p> <ul style="list-style-type: none"> <li>• libaio</li> <li>• libstdc++.so.5 at version 3.3 or later (32 and 64 bit packages are required)</li> <li>• libstdc++.so.6 at version 4.3 or later (32 and 64 bit packages are required)</li> </ul> <p>For Red Hat Enterprise Linux Servers:</p> <ul style="list-style-type: none"> <li>• libaio</li> <li>• libstdc++.so.6 (32 and 64 bit packages are required)</li> </ul>
Communication protocol	<ul style="list-style-type: none"> <li>• TCP/IP Version 4 or Version 6, which is standard with Linux</li> <li>• Shared memory protocol (with Tivoli Storage Manager Version 7.1 Linux on System z client)</li> </ul>
Processing	<p>Asynchronous I/O must be enabled. On Linux kernels at 2.6 or later, install the libaio library to enable Asynchronous I/O.</p>
Other software	<p>Korn Shell (ksh)</p>

### Compatibility of the Tivoli Storage Manager server with other DB2 products on the system

You can install other products that deploy and use DB2 products on the same system as the Tivoli Storage Manager Version 7.1 server on AIX, HP-UX, Linux, and Oracle Solaris platforms, with some limitations.

To install and use other products that use a DB2 product on the same system as the Tivoli Storage Manager server, ensure that the following criteria are met:

*Table 7. Compatibility of the Tivoli Storage Manager server with other DB2 products on the system*

Criterion	Instructions
Version level	The other products that use a DB2 product must use DB2 version 9 or later. DB2 products include product encapsulation and segregation support beginning with Version 9. Starting with this version, you can run multiple copies of DB2 products, at different code levels, on the same system. For details, see the information about multiple DB2 copies: <a href="http://pic.dhe.ibm.com/infocenter/db2luw/v10r5">http://pic.dhe.ibm.com/infocenter/db2luw/v10r5</a> .
User IDs and directories	Ensure that the user IDs, fence user IDs, installation location, other directories, and related information are not shared across DB2 installations. Your specifications must be different from the IDs and locations that you used for the Tivoli Storage Manager server installation and configuration. If you used the <b>dsmicfgx</b> wizard or <b>dsmupgdx</b> wizard to configure Version 7.1, or upgrade the server from Version 5.5, these are values that you entered when running the wizard. If you used the manual configuration for Version 7.1 or upgrade from Version 5.5 procedures, review the procedures that you used if necessary to recall the values that were used for the server.

Table 7. Compatibility of the Tivoli Storage Manager server with other DB2 products on the system (continued)

Criterion	Instructions
Resource allocation	<p>Consider the resources and capability of the system compared to the requirements for both the Tivoli Storage Manager server and the other applications that use the DB2 product. To provide sufficient resources for the other DB2 applications, you might have to change the Tivoli Storage Manager server settings so that the server uses less system memory and resources. Similarly, if the workloads for the other DB2 applications compete with the Tivoli Storage Manager server for processor or memory resources, the performance of the server in handling the expected client workload or other server operations might be adversely affected.</p> <p>To segregate resources and provide more capability for the tuning and allocation of processor, memory, and other system resources for multiple applications, consider using logical partition (LPAR), workload partition (WPAR), or other virtual workstation support. For example, run a DB2 application on its own virtualized system.</p>

## IBM Installation Manager

Tivoli Storage Manager uses IBM Installation Manager, which is an installation program that can use remote or local software repositories to install or update many IBM products.

If the required version of IBM Installation Manager is not already installed, it is automatically installed or upgraded when you install Tivoli Storage Manager. It must remain installed on the system so that Tivoli Storage Manager can be updated or uninstalled later as needed.

The following list contains explanations of some terms that are used in IBM Installation Manager:

### Offering

An installable unit of a software product.

The Tivoli Storage Manager offering contains all of the media that IBM Installation Manager requires to install Tivoli Storage Manager.

### Package

The group of software components that are required to install an offering.

The Tivoli Storage Manager package contains the following components:

- IBM Installation Manager installation program
- Tivoli Storage Manager offering

### Package group

A set of packages that share a common parent directory.

## Installing the Tivoli Storage Manager server

The default package group for the Tivoli Storage Manager package is IBM Tivoli Storage Manager.

### Repository

A remote or local storage area for data and other application resources.

The Tivoli Storage Manager package is stored in a repository on IBM Fix Central.

### Shared resources directory

A directory that contains software files or plug-ins that are shared by packages.

IBM Installation Manager stores installation-related files in the shared resources directory, including files that are used for rolling back to a previous version of Tivoli Storage Manager.

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## Worksheets for planning details for the Tivoli Storage Manager server

You can use the worksheets to help you plan the amount and location of storage needed for the Tivoli Storage Manager server. You can also use them to keep track of names and user IDs.

See *Tivoli Storage Manager Optimizing Performance* for server configuration guidelines and best practices.

Item	Space required	Number of directories	Location of directories
The database			
Active log			
Archive log			
Optional: Log mirror for the active log			
Optional: Secondary archive log (failover location for archive log)			

Item	Names and user IDs	Location
The <i>instance user ID</i> for the server, which is the ID you use to start and run the Tivoli Storage Manager server		
The <i>home directory</i> for the server, which is the directory that contains the instance user ID		
The database instance name		
The <i>instance directory</i> for the server, which is a directory that contains files specifically for this server instance (the server options file and other server-specific files)		
Server name, use a unique name for each server		

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## Capacity planning

Capacity planning for Tivoli Storage Manager includes managing resources such as the database and recovery log. To maximize resources as part of capacity planning, you must estimate space requirements for the database and the recovery log.

### Procedure

For information about the benefits of deduplication and guidance on how to make effective use of the Tivoli Storage Manager deduplication feature, see *Optimizing Performance*.

## Estimating space requirements for the database

To estimate space requirements for the database, you can use the maximum number of files that can be in server storage at one time or you can use storage pool capacity.

### About this task

Consider using at least 25 GB for the initial database space. Provision file system space appropriately. A database size of 25 GB is adequate for a test environment or a library-manager-only environment. For a production server supporting client workloads, the database size is expected to be larger. If you use random-access disk (DISK) storage pools, more database and log storage space is needed than for sequential-access storage pools.

The maximum size of the Tivoli Storage Manager database is 4 TB.

For information about sizing the database in a production environment that is based on the number of files and on storage pool size, see the following topics.

### Estimating database space requirements based on the number of files

If you can estimate the maximum number of files that might be in server storage at a time, you can use that number to estimate space requirements for the database.

### About this task

To estimate space requirements that is based on the maximum number of files in server storage, use the following guidelines:

- 600 - 1000 bytes for each stored version of a file, including image backups.

**Restriction:** The guideline does not include space that is used during data deduplication.

- 100 - 200 bytes for each cached file, copy storage pool file, active-data pool file, and deduplicated file.
- Additional space is required for database optimization to support varying data-access patterns and to support server back-end processing of the data. The amount of extra space is equal to 50% of the estimate for the total number of bytes for file objects.

In the following example for a single client, the calculations are based on the maximum values in the preceding guidelines. The examples do not take into account that you might use file aggregation. In general, when you aggregate small

## Installing the Tivoli Storage Manager server

files, it reduces the amount of required database space. File aggregation does not affect space-managed files.

### Procedure

1. Calculate the number of file versions. Add each of the following values to obtain the number of file versions:
  - a. Calculate the number of backed-up files. For example, as many as 500,000 client files might be backed up at a time. In this example, storage policies are set to keep up to three copies of backed up files:  
 $500,000 \text{ files} * 3 \text{ copies} = 1,500,000 \text{ files}$
  - b. Calculate the number of archive files. For example, as many as 100,000 client files might be archived copies.
  - c. Calculate the number of space-managed files. For example, as many as 200,000 client files might be migrated from client workstations.

Using 1000 bytes per file, the total amount of database space that is required for the files that belong to the client is 1.8 GB:

$$(1,500,000 + 100,000 + 200,000) * 1000 = 1.8 \text{ GB}$$

2. Calculate the number of cached files, copy storage-pool files, active-data pool files, and deduplicated files:
  - a. Calculate the number of cached copies. For example, caching is enabled in a 5 GB disk storage pool. The high migration threshold of the pool is 90% and the low migration threshold of the pool is 70%. Thus, 20% of the disk pool, or 1 GB, is occupied by cached files.  
If the average file size is about 10 KB, approximately 100,000 files are in cache at any one time:  
 $100,000 \text{ files} * 200 \text{ bytes} = 19 \text{ MB}$
  - b. Calculate the number of copy storage-pool files. All primary storage pools are backed up to the copy storage pool:  
 $(1,500,000 + 100,000 + 200,000) * 200 \text{ bytes} = 343 \text{ MB}$
  - c. Calculate the number of active storage-pool files. All the active client-backup data in primary storage pools is copied to the active-data storage pool. Assume that 500,000 versions of the 1,500,000 backup files in the primary storage pool are active:  
 $500,000 * 200 \text{ bytes} = 95 \text{ MB}$
  - d. Calculate the number of deduplicated files. Assume that a deduplicated storage pool contains 50,000 files:  
 $50,000 * 200 \text{ bytes} = 10 \text{ MB}$

Based on the preceding calculations, about 0.5 GB of extra database space is required for the client's cached files, copy storage-pool files, active-data pool files, and deduplicated files.

3. Calculate the amount of extra space that is required for database optimization. To provide optimal data access and management by the server, extra database space is required. The amount of extra database space is equal to 50% of the total space requirements for file objects.  
 $(1.8 + 0.5) * 50\% = 1.2 \text{ GB}$
4. Calculate the total amount of database space that is required for the client. The total is approximately 3.5 GB:  
 $1.8 + 0.5 + 1.2 = 3.5 \text{ GB}$
5. Calculate the total amount of database space that is required for all clients. If the client that was used in the preceding calculations is typical and you have



500 clients, for example, you can use the following calculation to estimate the total amount of database space that is required for all clients:

$$500 * 3.5 = 1.7 \text{ TB}$$

### Results

**Tip:** In the preceding examples, the results are estimates. The actual size of the database might differ from the estimate because of factors such as the number of directories and the length of the path and file names. Periodically monitor your database and adjust its size as necessary.

### What to do next

During normal operations, the Tivoli Storage Manager server might require temporary database space. This space is needed for the following reasons:

- To hold the results of sorting or ordering that are not already being kept and optimized in the database directly. The results are temporarily held in the database for processing.
- To give administrative access to the database through one of the following methods:
  - A DB2 open database connectivity (ODBC) client
  - An Oracle Java™ database connectivity (JDBC) client
  - Structured Query Language (SQL) to the server from an administrative-client command line

Consider using an extra 50 GB of temporary space for every 500 GB of space for file objects and optimization. See the guidelines in the following table. In the example that is used in the preceding step, a total of 1.7 TB of database space is required for file objects and optimization for 500 clients. Based on that calculation, 200 GB is required for temporary space. The total amount of required database space is 1.9 TB.

Database size	Minimum temporary-space requirement
< 500 GB	50 GB
≥ 500 GB and < 1 TB	100 GB
≥ 1 TB and < 1.5 TB	150 GB
≥ 1.5 and < 2 TB	200 GB
≥ 2 and < 3 TB	250 - 300 GB
≥ 3 and < 4 TB	350 - 400 GB

### Estimating database space requirements based on storage pool capacity

To estimate database space requirements based on storage pool capacity, use a ratio of 1 - 5%. For example, if you require 200 TB of storage pool capacity, the size of your database is expected to be 2 - 10 TB. As a general rule, make your database as large as possible to prevent running out of space. If you run out of database space, server operations and client-store operations can fail.

## Installing the Tivoli Storage Manager server

### The database manager and temporary space

The Tivoli Storage Manager server database manager manages and allocates system memory and disk space for the database. The amount of database space you require depends on the amount of system memory available and the server workload.

The database manager sorts data in a specific sequence, as per the SQL statement that you issue to request the data. Depending on the workload on the server, and if there is more data than the database manager can manage, the data (that is ordered in sequence) is allocated to temporary disk space. Data is allocated to temporary disk space when there is a large result set. The database manager dynamically manages the memory used when data is allocated to temporary disk space.

For example, expiration processing can produce a large result set. If there is not enough system memory on the database to store the result set, some of the data is allocated to temporary disk space. During expiration processing, if a node or file space are selected that are too large to process, the database manager does not have enough memory to sort the data.

To run database operations, consider adding more database space for the following scenarios:

- The database has a small amount of space and the server operation that requires temporary space uses the remaining free space.
- The file spaces are large, or the file spaces has a policy assigned to it which creates many file versions.
- The Tivoli Storage Manager server must run with limited memory. The database uses the Tivoli Storage Manager server main memory to run database operations. However, if there is insufficient memory available, the Tivoli Storage Manager server allocates temporary space on disk to the database. For example, if 10G of memory is available and database operations require 12G of memory, the database uses temporary space.
- An out of database space error is displayed when you deploy a Tivoli Storage Manager V6 server. Monitor the server activity log for messages related to database space.

**Important:** Do not change the DB2 software that is installed with the Tivoli Storage Manager installation packages and fix packs. Do not install or upgrade to a different version, release, or fix pack, of DB2 software to avoid damage to the database.

### Recovery log space requirements

In Tivoli Storage Manager, the term *recovery log* comprises the active log, the archive log, the active log mirror, and the archive failover log. The amount of space that you require for the recovery log depends on various factors, including, for example, the amount of client activity with the server.

### Active and archive log space

When you estimate space requirements for active and archive logs, include some extra space for contingencies such as occasional heavy workloads and failovers.

In Tivoli Storage Manager servers V6.1 and later, the active log can be a maximum size of 128 GB. The archive log size is limited to the size of the file system that it is installed on.

Use the following general guidelines when you estimate the size of the active log:

- The suggested starting size for the active log is 16 GB.
- Ensure that the active log is at least large enough for the amount of concurrent activity that the server typically handles. As a precaution, try to anticipate the largest amount of work that the server manages at one time. Provision the active log with extra space that can be used if needed. Consider using 20% of extra space.
- Monitor used and available active log space. Adjust the size of the active log as needed, depending upon factors such as client activity and the level of server operations.
- Ensure that the directory that holds the active log is as large as, or larger than, the size of the active log. A directory that is larger than the active log can accommodate failovers, if they occur.
- Ensure that the file system that contains the active log directory has at least 8 GB of free space for temporary log movement requirements.

The suggested starting size for the archive log is 48 GB.

The archive log directory must be large enough to contain the log files that are generated since the previous full backup. For example, if you perform a full backup of the database every day, the archive log directory must be large enough to hold the log files for all the client activity that occurs during 24 hours. To recover space, the server deletes obsolete archive log files after a full backup of the database. If the archive log directory becomes full and a directory for archive failover logs does not exist, log files remain in the active log directory. This condition can cause the active log directory to fill up and stop the server. When the server restarts, some of the existing active-log space is released.

After the server is installed, you can monitor archive log utilization and the space in the archive log directory. If the space in the archive log directory fills up, it can cause the following problems:

- The server is unable to perform full database backups. Investigate and resolve this problem.
- Other applications write to the archive log directory, exhausting the space that is required by the archive log. Do not share archive log space with other applications including other Tivoli Storage Manager servers. Ensure that each server has a separate storage location that is owned and managed by that specific server.

For guidance about the layout and tuning of the active log and archive log, see *Optimizing Performance*.

## Installing the Tivoli Storage Manager server

### Example: Estimating active and archive log sizes for basic client-store operations:

Basic client-store operations include backup, archive, and space management. Log space must be sufficient to handle all store transactions that are in progress at one time.

To determine the sizes of the active and archive logs for basic client-store operations, use the following calculation:

$$\begin{aligned} &\text{number of clients} \times \text{files stored during each transaction} \\ &\quad \times \text{log space needed for each file} \end{aligned}$$

This calculation is used in the example in the following table.

Table 8. Basic client-store operations

Item	Example values	Description
Maximum number of client nodes that back up, archive, or migrate files concurrently at any time	300	The number of client nodes that back up, archive, or migrate files every night.
Files stored during each transaction	4096	The default value of the server option TXNGROUPMAX is 4096.
Log space that is required for each file	3053 bytes	<p>The value of 3053 bytes for each file in a transaction represents the log bytes that are needed when backing up files from a Windows client where the file names are 12 - 120 bytes.</p> <p>This value is based on the results of tests performed under laboratory conditions. The tests consisted of backup-archive clients performing backup operations to a random-access disk (DISK) storage pool. DISK pools result in more log use than sequential-access storage pools. Consider a value larger than 3053 bytes if the data being stored has file names that are longer than 12 - 120 bytes.</p>
Active log: Suggested size	19.5 GB <sup>1</sup>	<p>Use the following calculation to determine the size of the active log. One GB equals 1,073,741,824 bytes.</p> <p><math>(300 \text{ clients} \times 4096 \text{ files stored during each transaction} \times 3053 \text{ bytes for each file}) \div 1,073,741,824 \text{ bytes} = 3.5 \text{ GB}</math></p> <p>Increase that amount by the suggested starting size of 16 GB:</p> <p><math>3.5 + 16 = 19.5 \text{ GB}</math></p>
Archive log: Suggested size	58.5 GB <sup>1</sup>	<p>Because of the requirement to be able to store archive logs across three server database-backup cycles, multiply the estimate for the active log by 3 to estimate the total archive log requirement.</p> <p><math>3.5 \times 3 = 10.5 \text{ GB}</math></p> <p>Increase that amount by the suggested starting size of 48 GB:</p> <p><math>10.5 + 48 = 58.5 \text{ GB}</math></p>

Table 8. Basic client-store operations (continued)

Item	Example values	Description
<p><sup>1</sup> The example values in this table are used only to illustrate how the sizes for active logs and archive logs are calculated. In a production environment that does not use deduplication, 16 GB is the suggested minimum size for an active log. The suggested minimum size for an archive log in a production environment that does not use deduplication is 48 GB. If you substitute values from your environment and the results are larger than 16 GB and 48 GB, use your results to size the active log and archive log.</p> <p>Monitor your logs and adjust their size if necessary.</p>		

**Example: Estimating active and archive log sizes for clients that use multiple sessions:**

If the client option RESOURCEUTILIZATION is set to a value that is greater than the default, the concurrent workload for the server increases.

To determine the sizes of the active and archive logs when clients use multiple sessions, use the following calculation:

$$\text{number of clients} \times \text{sessions for each client} \times \text{files stored during each transaction} \times \text{log space needed for each file}$$

This calculation is used in the example in the following table.

Table 9. Multiple client sessions

Item	Example values		Description
Maximum number of client nodes that back up, archive, or migrate files concurrently at any time	300	1000	The number of client nodes that back up, archive, or migrate files every night.
Possible sessions for each client	3	3	The setting of the client option RESOURCEUTILIZATION is larger than the default. Each client session runs a maximum of three sessions in parallel.
Files stored during each transaction	4096	4096	The default value of the server option TXNGROUPMAX is 4096.
Log space that is required for each file	3053	3053	<p>The value of 3053 bytes for each file in a transaction represents the log bytes needed when backing up files from a Windows client where the file names are 12 - 120 bytes.</p> <p>This value is based on the results of tests performed under laboratory conditions. Tests consisted of clients performing backup operations to a random-access disk (DISK) storage pool. DISK pools result in more log use than sequential-access storage pools. Consider a value larger than 3053 bytes if the data being stored has file names that are longer than 12 - 120 bytes.</p>

## Installing the Tivoli Storage Manager server

Table 9. Multiple client sessions (continued)

Item	Example values		Description
Active log: Suggested size	26.5 GB <sup>1</sup>	51 GB <sup>1</sup>	<p>The following calculation was used for 300 clients. One GB equals 1,073,741,824 bytes.</p> <p>(300 clients x 3 sessions for each client x 4096 files stored during each transaction x 3053 bytes for each file) ÷ 1,073,741,824 = 10.5 GB</p> <p>Increase that amount by the suggested starting size of 16 GB:</p> <p>10.5 + 16 = 26.5 GB</p> <p>The following calculation was used for 1000 clients. One GB equals 1,073,741,824 bytes.</p> <p>(1000 clients x 3 sessions for each client x 4096 files store during each transaction x 3053 bytes for each file) ÷ 1,073,741,824 = 35 GB</p> <p>Increase that amount by the suggested starting size of 16 GB:</p> <p>35 + 16 = 51 GB</p>
Archive log: Suggested size	79.5 GB <sup>1</sup>	153 GB <sup>1</sup>	<p>Because of the requirement to be able to store archive logs across three server-database backup cycles, the estimate for the active log is multiplied by 3:</p> <p>10.5 x 3 = 31.5 GB</p> <p>35 x 3 = 105 GB</p> <p>Increase those amounts by the suggested starting size of 48 GB:</p> <p>31.5 + 48 = 79.5 GB</p> <p>105 + 48 = 153 GB</p>
<p><sup>1</sup> The example values in this table are used only to illustrate how the sizes for active logs and archive logs are calculated. In a production environment that does not use deduplication, 16 GB is the suggested minimum size for an active log. The suggested minimum size for an archive log in a production environment that does not use deduplication is 48 GB. If you substitute values from your environment and the results are larger than 16 GB and 48 GB, use your results to size the active log and archive log.</p> <p>Monitor your active log and adjust its size if necessary.</p>			

### Example: Estimating active and archive log sizes for simultaneous write operations:

If client backup operations use storage pools that are configured for simultaneous write, the amount of log space that is required for each file increases.

The log space that is required for each file increases by about 200 bytes for each copy storage pool that is used for a simultaneous write operation. In the example in the following table, data is stored to two copy storage pools in addition to a primary storage pool. The estimated log size increases by 400 bytes for each file. If you use the suggested value of 3053 bytes of log space for each file, the total number of required bytes is 3453.

This calculation is used in the example in the following table.

*Table 10. Simultaneous write operations*

Item	Example values	Description
Maximum number of client nodes that back up, archive, or migrate files concurrently at any time	300	The number of client nodes that back up, archive, or migrate files every night.
Files stored during each transaction	4096	The default value of the server option TXNGROUPMAX is 4096.
Log space that is required for each file	3453 bytes	<p>3053 bytes plus 200 bytes for each copy storage pool.</p> <p>The value of 3053 bytes for each file in a transaction represents the log bytes that are needed when backing up files from a Windows client where the file names are 12 - 120 bytes.</p> <p>This value is based on the results of tests performed under laboratory conditions. The tests consisted of backup-archive clients performing backup operations to a random-access disk (DISK) storage pool. DISK pools result in more log use than sequential-access storage pools. Consider a value larger than 3053 bytes if the data being stored has file names that are longer than 12 - 120 bytes.</p>
Active log: Suggested size	20 GB <sup>1</sup>	<p>Use the following calculation to determine the size of the active log. One GB equals 1,073,741,824 bytes.</p> <p>(300 clients x 4096 files stored during each transaction x 3453 bytes for each file) ÷ 1,073,741,824 bytes = 4.0 GB</p> <p>Increase that amount by the suggested starting size of 16 GB:</p> <p>4 + 16 = 20 GB</p>
Archive log: Suggested size	60 GB <sup>1</sup>	<p>Because of the requirement to be able to store archive logs across three server database-backup cycles, multiply the estimate for the active log by 3 to estimate the archive log requirement:</p> <p>4 GB x 3 = 12 GB</p> <p>Increase that amount by the suggested starting size of 48 GB:</p> <p>12 + 48 = 60 GB</p>
<p><sup>1</sup> The example values in this table are used only to illustrate how the sizes for active logs and archive logs are calculated. In a production environment that does not use deduplication, 16 GB is the suggested minimum size for an active log. The suggested minimum size for an archive log in a production environment that does not use deduplication is 48 GB. If you substitute values from your environment and the results are larger than 16 GB and 48 GB, use your results to size the active log and archive log.</p> <p>Monitor your logs and adjust their size if necessary.</p>		

## Installing the Tivoli Storage Manager server

### Example: Estimating active and archive log sizes for basic client store operations and server operations:

Migration of data in server storage, identification processes for data deduplication, reclamation, and expiration might run concurrently with client store operations. Administrative tasks such as administrative commands or SQL queries from administrative clients can also run concurrently with client store operations. Server operations and administrative tasks that run concurrently can increase the active log space that is required.

For example, migration of files from the random-access (DISK) storage pool to a sequential-access disk (FILE) storage pool uses approximately 110 bytes of log space for each file that is migrated. For example, suppose that you have 300 backup-archive clients and each one of them backs up 100,000 files every night. The files are initially stored on DISK and then migrated to a FILE storage pool. To estimate the amount of active log space that is required for the data migration, use the following calculation. The number of clients in the calculation represents the maximum number of client nodes that back up, archive, or migrate files concurrently at any time.

300 clients x 100,000 files for each client x 110 bytes = 3.1 GB

Add this value to the estimate for the size of the active log that calculated for basic client store operations.

### Example: Estimating active and archive log sizes under conditions of extreme variation:

Problems with running out of active log space can occur if you have many transactions that complete quickly and some transactions that take much longer to complete. A typical case occurs when many workstation or file-server backup sessions are active and a few very large database server-backup sessions are active. If this situation applies to your environment, you might need to increase the size of the active log so that the work completes successfully.

### Example: Estimating archive log sizes with full database backups:

The Tivoli Storage Manager server deletes unnecessary files from the archive log only when a full database backup occurs. Consequently, when you estimate the space that is required for the archive log, you must also consider the frequency of full database backups.

For example, if a full database backup occurs once a week, the archive log space must be able to contain the information in the archive log for a full week.

The difference in archive log size for daily and full database backups is shown in the example in the following table.

Table 11. Full database backups

Item	Example values	Description
Maximum number of client nodes that back up, archive, or migrate files concurrently at any time	300	The number of client nodes that back up, archive, or migrate files every night.
Files stored during each transaction	4096	The default value of the server option TXNGROUPMAX is 4096.



Table 11. Full database backups (continued)

Item	Example values	Description
Log space that is required for each file	3453 bytes	<p>3053 bytes for each file plus 200 bytes for each copy storage pool.</p> <p>The value of 3053 bytes for each file in a transaction represents the log bytes needed when backing up files from a Windows client where the file names are 12 - 120 bytes.</p> <p>This value is based on the results of tests performed under laboratory conditions. Tests consisted of clients performing backup operations to a random-access disk (DISK) storage pool. DISK pools result in more log use than sequential-access storage pools. Consider a value larger than 3053 bytes if the data being stored has file names that are longer than 12 - 120 bytes.</p>
Active log: Suggested size	20 GB <sup>1</sup>	<p>Use the following calculation to determine the size of the active log. One GB equals 1,073,741,824 bytes.</p> <p>(300 clients x 4096 files per transaction x 3453 bytes per file) ÷ 1,073,741,824 bytes = 4.0 GB</p> <p>Increase that amount by the suggested starting size of 16 GB:</p> <p>4 + 16 = 20 GB</p>
Archive log: Suggested size with a full database backup every day	60 GB <sup>1</sup>	<p>Because of the requirement to be able to store archive logs across three backup cycles, multiply the estimate for the active log by 3 to estimate the total archive log requirement:</p> <p>4 GB x 3 = 12 GB</p> <p>Increase that amount by the suggested starting size of 48 GB:</p> <p>12 + 48 = 60 GB</p>
Archive log: Suggested size with a full database every week	132 GB <sup>1</sup>	<p>Because of the requirement to be able to store archive logs across three server database-backup cycles, multiply the estimate for the active log by 3 to estimate the total archive log requirement. Multiply the result by the number of days between full database backups:</p> <p>(4 GB x 3 ) x 7 = 84 GB</p> <p>Increase that amount by the suggested starting size of 48 GB:</p> <p>84 + 48 = 132 GB</p>
<p><sup>1</sup> The example values in this table are used only to illustrate how the sizes for active logs and archive logs are calculated. In a production environment that does not use deduplication, 16 GB is the suggested minimum size for an active log. The suggested starting size for an archive log in a production environment that does not use deduplication is 48 GB. If you substitute values from your environment and the results are larger than 16 GB and 48 GB, use your results to size the active log and archive log.</p> <p>Monitor your logs and adjust their size if necessary.</p>		

## Installing the Tivoli Storage Manager server

### **Example: Estimating active and archive log sizes for data deduplication operations:**

If you deduplicate data, you must consider its effects on space requirements for active and archive logs.

The following factors affect requirements for active and archive log space:

#### **The amount of deduplicated data**

The effect of data deduplication on the active log and archive log space depends on the percentage of data that is eligible for deduplication. If the percentage of data that can be deduplicated is relatively high, more log space is required.

#### **The size and number of extents**

Approximately 1,500 bytes of active log space are required for each extent that is identified by a duplicate-identification process. For example, if 250,000 extents are identified by a duplicate-identification process, the estimated size of the active log is 358 MB:

$$250,000 \text{ extents identified during each process} \times 1,500 \text{ bytes for each extent} = 358 \text{ MB}$$

Consider the following scenario. Three hundred backup-archive clients back up 100,000 files each night. This activity creates a workload of 30,000,000 files. The average number of extents for each file is two. Therefore, the total number of extents is 60,000,000, and the space requirement for the archive log is 84 GB:

$$60,000,000 \text{ extents} \times 1,500 \text{ bytes for each extent} = 84 \text{ GB}$$

A duplicate-identification process operates on aggregates of files. An aggregate consists of files that are stored in a given transaction, as specified by the TXNGROUPMAX server option. Suppose that the TXNGROUPMAX server option is set to the default of 4096. If the average number of extents for each file is two, the total number of extents in each aggregate is 8192, and the space required for the active log is 12 MB:

$$8192 \text{ extents in each aggregate} \times 1500 \text{ bytes for each extent} = 12 \text{ MB}$$

#### **The timing and number of the duplicate-identification processes**

The timing and number of duplicate-identification processes also affects the size of the active log. Using the 12 MB active-log size that was calculated in the preceding example, the concurrent load on the active log is 120 MB if 10 duplicate-identification processes are running in parallel:

$$12 \text{ MB for each process} \times 10 \text{ processes} = 120 \text{ MB}$$

#### **File size**

Large files that are processed for duplicate identification can also affect the size of the active log. For example, suppose that a backup-archive client backs up an 80 GB, file-system image. This object can have a high number of duplicate extents if, for example, the files included in the file system image were backed up incrementally. For example, assume that a file system image has 1.2 million duplicate extents. The 1.2 million extents in this large file represent a single transaction for a duplicate-identification process. The total space in the active log that is required for this single object is 1.7 GB:

$$1,200,000 \text{ extents} \times 1,500 \text{ bytes for each extent} = 1.7 \text{ GB}$$

If other, smaller duplicate-identification processes occur at the same time as the duplicate-identification process for a single large object, the active log might not have enough space. For example, suppose that a storage pool is enabled for deduplication. The storage pool has a mixture of data, including many relatively small files that range from 10 KB to several hundred KB. The storage pool also has few large objects that have a high percentage of duplicate extents.

To take into account not only space requirements but also the timing and duration of concurrent transactions, increase the estimated size of the active log by a factor of two. For example, suppose that your calculations for space requirements are 25 GB (23.3 GB + 1.7 GB for deduplication of a large object). If deduplication processes are running concurrently, the suggested size of the active log is 50 GB. The suggested size of the archive log is 150 GB.

The examples in the following tables show calculations for active and archive logs. The example in the first table uses an average size of 700 KB for extents. The example in the second table uses an average size of 256 KB. As the examples show, the average deduplicate-extent size of 256 KB indicates a larger estimated size for the active log. To minimize or prevent operational problems for the server, use 256 KB to estimate the size of the active log in your production environment.

Table 12. Average duplicate-extent size of 700 KB

Item	Example values		Description
Size of largest single object to deduplicate	800 GB	4 TB	The granularity of processing for deduplication is at the file level. Therefore, the largest single file to deduplicate represents the largest transaction and a correspondingly large load on the active and archive logs.
Average size of extents	700 KB	700 KB	The deduplication algorithms use a variable block method. Not all deduplicated extents for a given file are the same size, so this calculation assumes an average size for extents.
Extents for a given file	1,198,372 bits	6,135,667 bits	Using the average extent size (700 KB), these calculations represent the total number of extents for a given object.  The following calculation was used for an 800 GB object: $(800 \text{ GB} \div 700 \text{ KB}) = 1,198,372 \text{ bits}$  The following calculation was used for a 4 TB object: $(4 \text{ TB} \div 700 \text{ KB}) = 6,135,667 \text{ bits}$
Active log: Suggested size that is required for the deduplication of a single large object during a single duplicate-identification process	1.7 GB	8.6 GB	The estimated active log space that are needed for this transaction.

## Installing the Tivoli Storage Manager server

Table 12. Average duplicate-extent size of 700 KB (continued)

Item	Example values		Description
Active log: Suggested total size	66 GB <sup>1</sup>	79.8 GB <sup>1</sup>	<p>After considering other aspects of the workload on the server in addition to deduplication, multiply the existing estimate by a factor of two. In these examples, the active log space required to deduplicate a single large object is considered along with previous estimates for the required active log size.</p> <p>The following calculation was used for multiple transactions and an 800 GB object:</p> $(23.3 \text{ GB} + 1.7 \text{ GB}) \times 2 = 50 \text{ GB}$ <p>Increase that amount by the suggested starting size of 16 GB:</p> $50 + 16 = 66 \text{ GB}$ <p>The following calculation was used for multiple transactions and a 4 TB object:</p> $(23.3 \text{ GB} + 8.6 \text{ GB}) \times 2 = 63.8 \text{ GB}$ <p>Increase that amount by the suggested starting size of 16 GB:</p> $63.8 + 16 = 79.8 \text{ GB}$
Archive log: Suggested size	198 GB <sup>1</sup>	239.4 GB <sup>1</sup>	<p>Multiply the estimated size of the active log by a factor of 3.</p> <p>The following calculation was used for multiple transactions and an 800 GB object:</p> $50 \text{ GB} \times 3 = 150 \text{ GB}$ <p>Increase that amount by the suggested starting size of 48 GB:</p> $150 + 48 = 198 \text{ GB}$ <p>The following calculation was used for multiple transactions and a 4 TB object:</p> $63.8 \text{ GB} \times 3 = 191.4 \text{ GB}$ <p>Increase that amount by the suggested starting size of 48 GB:</p> $191.4 + 48 = 239.4 \text{ GB}$
<p><sup>1</sup> The example values in this table are used only to illustrate how the sizes for active logs and archive logs are calculated. In a production environment that uses deduplication, 32 GB is the suggested minimum size for an active log. The suggested minimum size for an archive log in a production environment that uses deduplication is 96 GB. If you substitute values from your environment and the results are larger than 32 GB and 96 GB, use your results to size the active log and archive log.</p> <p>Monitor your logs and adjust their size if necessary.</p>			

Table 13. Average duplicate-extent size of 256 KB

Item	Example values		Description
Size of largest single object to deduplicate	800 GB	4 TB	The granularity of processing for deduplication is at the file level. Therefore, the largest single file to deduplicate represents the largest transaction and a correspondingly large load on the active and archive logs.

Table 13. Average duplicate-extent size of 256 KB (continued)

Item	Example values		Description
Average size of extents	256 KB	256 KB	The deduplication algorithms use a variable block method. Not all deduplicated extents for a given file are the same size, so this calculation assumes an average extent size.
Extents for a given file	3,276,800 bits	16,777,216 bits	<p>Using the average extent size, these calculations represent the total number of extents for a given object.</p> <p>The following calculation was used for multiple transactions and an 800 GB object:</p> $(800 \text{ GB} \div 256 \text{ KB}) = 3,276,800 \text{ bits}$ <p>The following calculation was used for multiple transactions and a 4 TB object:</p> $(4 \text{ TB} \div 256 \text{ KB}) = 16,777,216 \text{ bits}$
Active log: Suggested size that is required for the deduplication of a single large object during a single duplicate-identification process	4.5 GB	23.4 GB	The estimated size of the active log space that is required for this transaction.
Active log: Suggested total size	71.6 GB <sup>1</sup>	109.4 GB <sup>1</sup>	<p>After considering other aspects of the workload on the server in addition to deduplication, multiply the existing estimate by a factor of 2. In these examples, the active log space required to deduplicate a single large object is considered along with previous estimates for the required active log size.</p> <p>The following calculation was used for multiple transactions and an 800 GB object:</p> $(23.3 \text{ GB} + 4.5 \text{ GB}) \times 2 = 55.6 \text{ GB}$ <p>Increase that amount by the suggested starting size of 16 GB:</p> $55.6 + 16 = 71.6 \text{ GB}$ <p>The following calculation was used for multiple transactions and a 4 TB object:</p> $(23.3 \text{ GB} + 23.4 \text{ GB}) \times 2 = 93.4 \text{ GB}$ <p>Increase that amount by the suggested starting size of 16 GB:</p> $93.4 + 16 = 109.4 \text{ GB}$

## Installing the Tivoli Storage Manager server

Table 13. Average duplicate-extent size of 256 KB (continued)

Item	Example values		Description
Archive log: Suggested size	214.8 GB <sup>1</sup>	328.2 GB <sup>1</sup>	The estimated size of the active log multiplied by a factor of 3.  The following calculation was used for an 800 GB object:  $55.6 \text{ GB} \times 3 = 166.8 \text{ GB}$  Increase that amount by the suggested starting size of 48 GB:  $166.8 + 48 = 214.8 \text{ GB}$  The following calculation was used for a 4 TB object:  $93.4 \text{ GB} \times 3 = 280.2 \text{ GB}$  Increase that amount by the suggested starting size of 48 GB:  $280.2 + 48 = 328.2 \text{ GB}$
<p><sup>1</sup> The example values in this table are used only to illustrate how the sizes for active logs and archive logs are calculated. In a production environment that uses deduplication, 32 GB is the suggested minimum size for an active log. The suggested minimum size for an archive log in a production environment that uses deduplication is 96 GB. If you substitute values from your environment and the results are larger than 32 GB and 96 GB, use your results to size the active log and archive log.</p> <p>Monitor your logs and adjust their size if necessary.</p>			

### Active-log mirror space

The active log can be mirrored so that the mirrored copy can be used if the active log files cannot be read. There can be only one active log mirror.

Creating a log mirror is a suggested option. If you increase the size of the active log, the log mirror size is increased automatically. Mirroring the log can affect performance because of the doubled I/O activity that is required to maintain the mirror. The additional space that the log mirror requires is another factor to consider when deciding whether to create a log mirror.

If the mirror log directory becomes full, the server issues error messages to the activity log and to the `db2diag.log`. Server activity continues.

### Archive-failover log space

The archive failover log is used by the server if the archive log directory runs out of space.

Specifying an archive failover log directory can prevent problems that occur if the archive log runs out of space. If both the archive log directory and the drive or file system where the archive failover log directory is located become full, the data remains in the active log directory. This condition can cause the active log to fill up, which causes the server to halt.

## Monitoring space utilization for the database and recovery logs

To determine the amount of used and available active log space, you issue the **QUERY LOG** command. To monitor space utilization in the database and recovery logs, you can also check the activity log for messages.

### Active log

If the amount of available active log space is too low, the following messages are displayed in the activity log:

**ANR4531I: IC\_AUTOBACKUP\_LOG\_USED\_SINCE\_LAST\_BACKUP\_TRIGGER**  
This message is displayed when the active log space exceeds the maximum specified size. The Tivoli Storage Manager server starts a full database backup.

To change the maximum log size, halt the server. Open the `dsmserv.opt` file, and specify a new value for the `ACTIVELOGSIZE` option. When you are finished, restart the server.

**ANR0297I: IC\_BACKUP\_NEEDED\_LOG\_USED\_SINCE\_LAST\_BACKUP**  
This message is displayed when the active log space exceeds the maximum specified size. You must back up the database manually.

To change the maximum log size, halt the server. Open the `dsmserv.opt` file, and specify a new value for the `ACTIVELOGSIZE` option. When you are finished, restart the server.

**ANR4529I: IC\_AUTOBACKUP\_LOG\_UTILIZATION\_TRIGGER**  
The ratio of used active-log space to available active-log space exceeds the log utilization threshold. If at least one full database backup has occurred, the Tivoli Storage Manager server starts an incremental database backup. Otherwise, the server starts a full database backup.

**ANR0295I: IC\_BACKUP\_NEEDED\_LOG\_UTILIZATION**  
The ratio of used active-log space to available active-log space exceeds the log utilization threshold. You must back up the database manually.

### Archive log

If the amount of available archive log space is too low, the following message is displayed in the activity log:

**ANR0299I: IC\_BACKUP\_NEEDED\_ARCHLOG\_USED**  
The ratio of used archive-log space to available archive-log space exceeds the log utilization threshold. The Tivoli Storage Manager server starts a full automatic database backup.

### Database

If the amount of space available for database activities is too low, the following messages are displayed in the activity log:

**ANR2992W: IC\_LOG\_FILE\_SYSTEM\_UTILIZATION\_WARNING\_2**  
The used database space exceeds the threshold for database space utilization. To increase the space for the database, use the **EXTEND DBSPACE** command, the **EXTEND DBSPACE** command, or the `DSMSERV FORMAT` utility with the **DBDIR** parameter.

## Installing the Tivoli Storage Manager server

### ANR1546W: FILESYSTEM\_DBPATH\_LESS\_1GB

The available space in the directory where the server database files are located is less than 1 GB.

When a Tivoli Storage Manager server is created with the DSMSEV FORMAT utility or with the configuration wizard, a server database and recovery log are also created. In addition, files are created to hold database information used by the database manager. The path specified in this message indicates the location of the database information used by the database manager. If space is unavailable in the path, the server can no longer function.

You must add space to the file system or make space available on the file system or disk.

---

## Server naming best practices

Use these descriptions as a reference when you install or upgrade a Tivoli Storage Manager server.

### Instance user ID

The instance user ID is used as the basis for other names related to the server instance. The instance user ID is also called the instance owner.

For example: `tsminst1`

The instance user ID is the user ID that must have ownership or read/write access authority to all directories that you create for the database and the recovery log. The standard way to run the server is under the instance user ID. That user ID must also have read/write access to the directories that are used for any **FILE** device classes.

### Home directory for the instance user ID

The home directory can be created when creating the instance user ID, by using the option `(-m)` to create a home directory if it does not exist already. Depending on local settings, the home directory might have the form:  
`/home/instance_user_ID`

For example: `/home/tsminst1`

The home directory is primarily used to contain the profile for the user ID and for security settings.

### Database instance name

The database instance name must be the same as the instance user ID under which you run the server instance.

For example: `tsminst1`

### Instance directory

The instance directory is a directory that contains files specifically for a server instance (the server options file and other server-specific files). It can have any name that you want. For easier identification, use a name that ties the directory to the instance name.



## Installing the Tivoli Storage Manager server

You can create the instance directory as a subdirectory of the home directory for the instance user ID. For example: `/home/instance_user_ID/instance_user_ID`

The following example places the instance directory in the home directory for user ID `tsminst1`: `/home/tsminst1/tsminst1`

You can also create the directory in another location, for example: `/tsmsserver/tsminst1`

The instance directory stores the following files for the server instance:

- The server options file, `dsmserv.opt`
- The server key database file, `cert.kdb`, and the `.arm` files (used by clients and other servers to import the Secure Sockets Layer certificates of the server)
- Device configuration file, if the `DEVCONFIG` server option does not specify a fully qualified name
- Volume history file, if the `VOLUMEHISTORY` server option does not specify a fully qualified name
- Volumes for **DEVTYPE=FILE** storage pools, if the directory for the device class is not fully specified, or not fully qualified
- User exits
- Trace output (if not fully qualified)

### Database name

The database name is always `TSMDB1`, for every server instance. This name cannot be changed.

### Server name

The server name is an internal name for Tivoli Storage Manager, and is used for operations that involve communication among multiple Tivoli Storage Manager servers. Examples include server-to-server communication and library sharing.

The server name is also used when you add the server to the Operations Center so that it can be managed using that interface. Use a unique name for each server. For easy identification in the Operations Center (or from a **QUERY SERVER** command), use a name that reflects the location or purpose of the server. Do not change the name of a Tivoli Storage Manager server after it is configured as a hub or spoke server.

If you use the wizard, the default name that is suggested is the host name of the system that you are using. You can use a different name that is meaningful in your environment. If you have more than one server on the system and you use the wizard, you can use the default name for only one of the servers. You must enter a unique name for each server.

For example:

```
PAYROLL
SALES
```

For more information about server names, see the *Administrator's Guide*.

## Installing the Tivoli Storage Manager server

### Directories for database space and recovery log

The directories can be named according to local practices. For easier identification, consider using names that tie the directories to the server instance.

For example, for the archive log:

```
/tsminst1_archlog
```

---

## Installation directories

Installation directories for the Tivoli Storage Manager server include the server, DB2, device, language, and other directories. Each one contains several additional directories.

The default directories and their subdirectories are listed here for the server, DB2, devices, and languages:

- **Server directory** (/opt/tivoli/tsm/server/bin), which contains:
  - Server code and licensing
- **Additional server directories:**
  - The command and message help are in the /opt/tivoli/tsm/server/bin directory.

- **DB2 directories**

The DB2 product that is installed as part of the installation of the Tivoli Storage Manager server has the directory structure as documented in DB2 information sources. Protect these directories and files as you do the server directories.

- /opt/tivoli/tsm/db2

- **Device directories**

- /opt/tivoli/tsm/devices/bin

- **Language directory**

Language-dependent portions of the program are located here:

- /opt/tivoli/tsm/server/bin

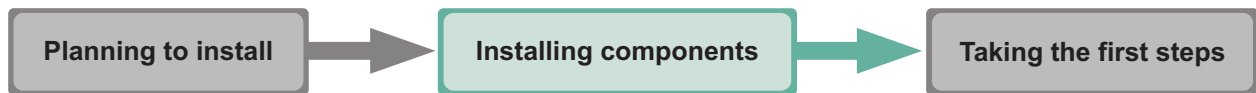
You can use US English, German, French, Italian, Spanish, Brazilian Portuguese, Korean, Japanese, traditional Chinese, simplified Chinese, Chinese GBK, Chinese Big5, and Russian.

---

## Chapter 2. Installing the Tivoli Storage Manager server components

To install the Tivoli Storage Manager 7.1 server, you can use the graphical installation wizard, the command line in console mode, or silent mode.

### About this task



Using the Tivoli Storage Manager installation software, you can install the following components:

- Tivoli Storage Manager Server

**Tip:** The database (DB2) and the Global Security Kit (GSKit) are automatically installed when you select the server component.

- Tivoli Storage Manager Server Languages
- Tivoli Storage Manager License
- Tivoli Storage Manager Devices
- Tivoli Storage Manager Operations Center
- Tivoli Storage Manager Storage Agent

See the *Storage Agent User's Guide* for more details about storage agents.

---

## Obtaining the Tivoli Storage Manager installation package

You can obtain the installation package from the product DVD or from an IBM download site.

### Before you begin

If you plan to download the files, set the system user limit for maximum file size to unlimited to ensure that the files can be downloaded correctly.

1. To query the maximum file size value, issue the following command:  

```
ulimit -Hf
```
2. If the system user limit for maximum file size is not set to unlimited, change it to unlimited by following the instructions in the documentation for your operating system.

### About this task

If you obtain the package from the product DVD, ensure that the installation files are visible on the DVD drive.

If you obtain the package from an IBM download site, you must extract the installation files.

## Installing the Tivoli Storage Manager server

### Procedure

1. Download the appropriate package file from one of the following websites, or you can access the files from the product DVD:
  - For a first time installation or a new release go to Passport Advantage® at: <http://www.ibm.com/software/lotus/passportadvantage/>. Passport Advantage is the only site that you can download a licensed package file from.
  - For the latest information, updates, and maintenance fixes, go to the Tivoli Storage Manager support site: [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager).
2. If you download the package from one of the download sites, complete the following steps:
  - a. Verify that you have enough space to store the installation files when they are extracted from the product package. See the download document for the space requirements:
    - Tivoli Storage Manager: <http://www.ibm.com/support/docview.wss?uid=swg24035122>
    - Tivoli Storage Manager Extended Edition: <http://www.ibm.com/support/docview.wss?uid=swg24035635>
    - System Storage® Archive Manager: <http://www.ibm.com/support/docview.wss?uid=swg24035637>
  - b. Download the package file to the directory of your choice. The path must contain no more than 128 characters. Be sure to extract the installation files to an empty directory. Do not extract to a directory that contains previously extracted files, or any other files.  
Also, ensure that you have executable permission for the package file.
  - c. If necessary, change the file permissions by issuing the following command:  

```
chmod a+x package_name.bin
```
  - d. Issue the following command to extract the installation files:  

```
./package_name.bin
```

  
where *package\_name* is like the following example:  

```
7.1.0.000-TIV-TSMSRV-LinuxX64.bin  
7.1.0.000-TIV-TSMSRV-LinuxS390X.bin
```
3. Select one of the following methods of installing Tivoli Storage Manager:
  - “Installing Tivoli Storage Manager by using the installation wizard” on page 35
  - “Installing Tivoli Storage Manager by using console mode” on page 36
  - “Installing Tivoli Storage Manager in silent mode” on page 37
4. After you install Tivoli Storage Manager, and before you customize it for your use, go to the following website: [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager). Click **Support and downloads** and apply any applicable fixes.

## Installing Tivoli Storage Manager by using the installation wizard

You can install or update Tivoli Storage Manager by using the IBM Installation Manager graphical wizard.

### Before you begin

Ensure that you review the following important information about installing the server:

- Verify that the operating system is set to the language that you require. By default, the language of the operating system is the language of the installation wizard.

**On test servers only:** Use the following command to bypass prerequisite checks such as the operating system and the required memory. Do not issue this command on a production server.

```
./install.sh -g -vmargs "-DBYPASS_TSM_REQ_CHECKS=true"
```

### Procedure

Choose whether to install from a downloaded package file, or from the DVD, and complete the following steps to begin the installation:

Option	Description
Installing from a downloaded package file:	<ol style="list-style-type: none"> <li>1. Change to the directory where you downloaded the package file.</li> <li>2. Start the graphical interface installation wizard by issuing the following command: <code>./install.sh</code></li> </ol>
Installing from DVD media:	<ol style="list-style-type: none"> <li>1. Insert the DVD into the DVD drive. <b>Tip:</b> Ensure that the installation files are visible on the DVD drive.</li> <li>2. Start the graphical interface installation wizard by issuing the following command: <code>./install.sh</code></li> </ol>

### What to do next

- If errors occur during the installation process, these errors are recorded in log files that are stored in the IBM Installation Manager logs directory.  
You can view installation log files by clicking **File > View Log** from the Installation Manager tool. To collect these log files, click **Help > Export Data for Problem Analysis** from the Installation Manager tool.
- After you install Tivoli Storage Manager, and before you customize it for your use, go to the following website: [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager). Click **Support and downloads** and apply any applicable fixes.

## Installing the Tivoli Storage Manager server

- After you install a new Tivoli Storage Manager server, review Taking the first steps after you install Tivoli Storage Manager to learn about configuring your server.

---

## Installing Tivoli Storage Manager by using console mode

You can install or update Tivoli Storage Manager by using the command line in console mode.

### Before you begin

Ensure that you review the following important information about installing:

- Verify that the operating system is set to the language that you require. By default, the language of the operating system is the language of the installation wizard.

**On test servers only:** Use the following command to bypass prerequisite checks such as the operating system and the required memory. Do not issue this command on a production server.

```
./install.sh -c -vmargs "-DBYPASS_TSM_REQ_CHECKS=true"
```

### Procedure

Choose whether to install from a downloaded package file, or from the DVD, and complete the following steps to begin the installation:

Option	Description
Installing from a downloaded package file:	<ol style="list-style-type: none"><li>1. Change to the directory where you downloaded the package file.</li><li>2. Start the installation wizard in console mode, by issuing the following command: <pre>./install.sh -c</pre><p>You can generate a response file as part of a console mode installation. Complete the console mode installation options, and in the Summary panel, specify <b>G</b> to generate the responses.</p></li></ol>
Installing from DVD media:	<ol style="list-style-type: none"><li>1. Insert the DVD into the DVD drive. <b>Tip:</b> Ensure that the installation files are visible on the DVD drive.</li><li>2. Start the installation wizard in console mode, by issuing the following command: <pre>./install.sh -c</pre><p>You can generate a response file as part of a console mode installation. Complete the console mode installation options, and in the Summary panel, specify <b>G</b> to generate the responses.</p></li></ol>

### What to do next

- If errors occur during the installation process, these errors are recorded in log files that are stored in the IBM Installation Manager logs directory.  
You can view installation log files by clicking **File > View Log** from the Installation Manager tool. To collect these log files, click **Help > Export Data for Problem Analysis** from the Installation Manager tool.
- After you install Tivoli Storage Manager, and before you customize it for your use, go to the following website: [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager). Click **Support and downloads** and apply any applicable fixes.

## Installing Tivoli Storage Manager in silent mode

You can install or update the IBM Tivoli Storage Manager server in silent mode without any user interaction.

### Before you begin

A silent installation can use response files for data input. The following sample response files are provided for installing, updating, and uninstalling the server:

- `install_response_sample.xml`
- `update_response_sample.xml`
- `uninstall_response_sample.xml`

If you want to use one of the sample response files, they can be found after you extract the package files, in the `input` subdirectory. You can use these sample files as they are or you can customize them to suit your needs. It is optimal to use the sample response files. These sample files contain instructions and default values to help you avoid any unnecessary warnings.

**On test servers only:** Use the following command to bypass prerequisite checks such as the operating system and the required memory. Do not issue this command on a production server.

```
./install.sh -s -acceptLicense -vmargs "-DBYPASS_TSM_REQ_CHECKS=true"
```

### Procedure

1. Create a response file, or use one of the sample response files such as `install_response_sample.xml` or `update_response_sample.xml`.
2. To start the silent installation, issue one of the following commands from the directory where the installation package file is extracted:

Option	Description
<b>Installing from a downloaded package file or DVD media:</b>	<p>To start the installation by accepting the default values, issue the following command:</p> <pre>./install.sh -s -acceptLicense</pre> <p>To start the installation with a custom response file, issue the following command, where <i>response_file</i> represents the response file path, including the file name:</p> <pre>./install.sh -s -input response_file -acceptLicense</pre>

## Installing the Tivoli Storage Manager server

### What to do next

- If errors occur during the installation process, these errors are recorded in log files that are stored in the IBM Installation Manager logs directory.  
You can view installation log files by clicking **File > View Log** from the Installation Manager tool. To collect these log files, click **Help > Export Data for Problem Analysis** from the Installation Manager tool.
- After you install Tivoli Storage Manager, and before you customize it for your use, go to the following website: [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager). Click **Support and downloads** and apply any applicable fixes.
- After you install a new Tivoli Storage Manager server, review the information in *Taking the first steps after you install Tivoli Storage Manager* to learn about configuring your server.

---

## Installing server language packages

Translations for the IBM Tivoli Storage Manager server allow the server to display messages and help in languages other than U.S. English. The translations also allow for the use of locale conventions for date, time, and number formatting.

### Server language locales

Use either the default language package option or select another language package to display server messages and help.

This language package is automatically installed for the following default language option for Tivoli Storage Manager server messages and help:

- LANGUAGE en\_US

For languages or locales other than the default, install the language package that your installation requires.

You can use the languages that are shown:

Table 14. Server languages for Linux

LANGUAGE	LANGUAGE option value
Chinese, Simplified	zh_CN
	zh_CN.gb18030
	zh_CN.utf8
Chinese, Traditional	Big5 / Zh_TW
	zh_TW
	zh_TW.utf8
English, United States	en_US
	en_US.utf8
French	fr_FR
	fr_FR.utf8
German	de_DE
	de_DE.utf8
Italian	it_IT
	it_IT.utf8



Table 14. Server languages for Linux (continued)

LANGUAGE	LANGUAGE option value
Japanese	ja_JP
	ja_JP.utf8
Korean	ko_KR
	ko_KR.utf8
Portuguese, Brazilian	pt_BR
	pt_BR.utf8
Russian	ru_RU
	ru_RU.utf8
Spanish	es_ES
	es_ES.utf8
<b>Notes:</b> For more information about setting the LANGUAGE option, see the <i>Administrator's Reference</i> .	

**Restriction:** For Operations Center users, some characters might not be displayed properly if the web browser does not use the same language as the server. If this problem occurs, set the browser to use the same language as the server.

## Configuring a language package

After you configure a language package, messages and help are shown on the Tivoli Storage Manager in languages other than US English. Installation packages are provided with Tivoli Storage Manager.

### About this task

To set support for a certain locale, complete one of the following tasks:

- Set the LANGUAGE option in the server options file to the name of the locale that you want to use. For example:

To use the `it_IT` locale, set the LANGUAGE option to `it_IT`. See “Server language locales” on page 38.

- If you are starting the server in the foreground, set the LC\_ALL environment variable to match the value that is set in the server options file. For example, to set the environment variable for Italian, enter the following value:

```
export LC_ALL=it_IT
```

If the locale is successfully initialized, it formats the date, time, and number for the server. If the locale is not successfully initialized, the server uses the US English message files and the date, time, and number format.

### Updating a language package

You can modify or update a language package by using the IBM Installation Manager.

#### About this task

You can install another language package within the same Tivoli Storage Manager instance.

- Use the **Modify** function of IBM Installation Manager to install another language package.
- Use the **Update** function of IBM Installation Manager to update to newer versions of the language packages.

**Tip:** In IBM Installation Manager, the term *update* means to discover and install updates and fixes to installed software packages. In this context, *update* and *upgrade* are synonymous.

---

## Chapter 3. Taking the first steps after you install Tivoli Storage Manager

After you install Tivoli Storage Manager Version 7.1, prepare for the configuration. Using the configuration wizard is the preferred method of configuring the Tivoli Storage Manager instance.

### About this task

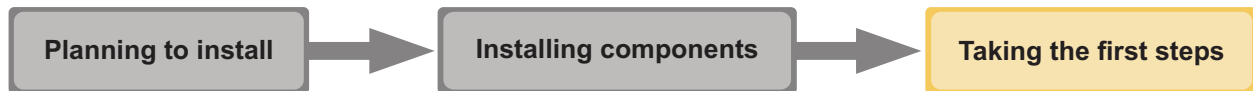


Figure 2. You are in the configuring the Tivoli Storage Manager server section.

Configure the Tivoli Storage Manager server instance by completing the following steps:

1. Update the kernel parameter values.  
See “Tuning kernel parameters” on page 42.
2. Create the directories and user ID for the server instance. See “Creating the user ID and directories for the server instance” on page 44.
3. Configure a Tivoli Storage Manager instance. Select one of the following options:
  - Use the Tivoli Storage Manager configuration wizard, the preferred method. See “Configuring Tivoli Storage Manager using the configuration wizard” on page 46.
  - Manually configure the new Tivoli Storage Manager instance. See “Configuring the server instance manually” on page 47. Complete the following steps during a manual configuration.
    - a. Set up your directories and create the Tivoli Storage Manager instance. See “Creating the server instance” on page 47.
    - b. Create a new server options file by copying the sample file to set up communications between the server and clients. See “Configuring server and client communications” on page 48.
    - c. Issue the **DSMSERV FORMAT** command to format the database. See “Formatting the database and log” on page 52.
    - d. Configure your system for database backup. See “Preparing the database manager for database backup” on page 52.
4. Configure options to control when database reorganization runs. See “Configuring server options for server database maintenance” on page 54.
5. Start the Tivoli Storage Manager server instance if it is not already started.  
See “Starting the server instance” on page 55.
6. Register your license. See “Registering licenses” on page 60.
7. Prepare your system for database backups. See “Specifying a device class in preparation for database backups” on page 61.
8. Monitor the server. See “Monitoring the server” on page 62.

### Tuning kernel parameters

For IBM Tivoli Storage Manager and DB2 to install and operate correctly on Linux, you must update the kernel configuration parameters.

#### About this task

If you do not update these parameters, the installation of DB2 and Tivoli Storage Manager might fail. Even if installation is successful, operational problems might occur if you do not set parameter values.

### Updating kernel parameters

DB2 automatically increases interprocess communication (IPC) kernel parameter values to the preferred settings.

#### About this task

To update the kernel parameters on Linux servers, complete the following steps:

#### Procedure

1. Issue the `ipcs -l` command to list the parameter values.
2. Analyze the results to determine whether any changes are required for your system. If changes are required, you can set the parameter in the `/etc/sysctl.conf` file. The parameter value is applied when the system starts.

#### What to do next

For Red Hat Enterprise Linux 6 (RHEL6), you must set the `kernel.shmmax` parameter in the `/etc/sysctl.conf` file before automatically starting the Tivoli Storage Manager server on system startup.

For details about the DB2 database for Linux, see the DB2 information center: <http://pic.dhe.ibm.com/infocenter/db2luw/v10r5>.

### Suggested minimum values

Ensure that the values for kernel parameters are sufficient to prevent operational problems from occurring when running the Tivoli Storage Manager server.

#### About this task

The following table contains the suggested minimum values for running DB2 on your system. To run Tivoli Storage Manager with DB2, the values might need to be increased above the minimum values specified here. In addition to implementing the suggestions in this table, other changes are required to run both Tivoli Storage Manager and DB2. For details, see <http://www.ibm.com/support/docview.wss?uid=swg27015156>.

Parameter	Description	Preferred value
kernel.shmmni	See note. The maximum number of segments	$256 \times \text{size of RAM in GB}$

## Installing the Tivoli Storage Manager server

Parameter	Description	Preferred value
kernel.shmmax	See note. The maximum size of a shared memory segment (bytes)	<i>size of RAM in bytes</i>
kernel.shmall	See note. The maximum allocation of shared memory pages (pages)	$2 \times \text{size of RAM in bytes}$ (setting is in 4 KB pages)
kernel.sem (SEMMNI)	See note. The maximum number of arrays	$256 \times \text{size of RAM in GB}$
kernel.sem (SEMMSL)	See note. The maximum semaphores per array	250
kernel.sem (SEMMNS)	See note. The maximum semaphores per system	256,000
kernel.sem (SEMOPM)	See note. The maximum operations per semaphore call	32
kernel.msgmni	See note. The maximum number of system-wide message queues	$1024 \times \text{size of RAM in GB}$
kernel.msgmax	See note The maximum size of messages (bytes)	65,536
kernel.msgmnb	See note. The default maximum size of queue (bytes)	65,536
kernel.randomize_va_space	The <b>kernel.randomize_va_space</b> parameter configures the kernels use of memory ASLR. When you set the value to 0, <code>kernel.randomize_va_space=0</code> , it disables ASLR. DB2 data servers rely on fixed addresses for certain shared memory objects, and the ASLR can cause errors for some activities. To learn more details about the Linux ASLR and DB2, see the technote at: <a href="http://www.ibm.com/support/docview.wss?uid=swg21365583">http://www.ibm.com/support/docview.wss?uid=swg21365583</a> .	0
vm.swappiness	The <b>vm.swappiness</b> parameter defines whether the kernel can swap application memory out of physical random access memory (RAM). For more information about kernel parameters, see the <a href="http://pic.dhe.ibm.com/infocenter/db2luw/v10r5">http://pic.dhe.ibm.com/infocenter/db2luw/v10r5</a> .	0
vm.overcommit_memory	The <b>vm.overcommit_memory</b> parameter influences how much virtual memory the kernel can permit to be allocated. For more information about kernel parameters, see the <a href="http://pic.dhe.ibm.com/infocenter/db2luw/v10r5">http://pic.dhe.ibm.com/infocenter/db2luw/v10r5</a> .	0
<b>Note:</b> For Linux, DB2 automatically increases interprocess communication (IPC) kernel parameter values to the preferred settings.		

### Creating the user ID and directories for the server instance

Create the user ID for the Tivoli Storage Manager server instance and create the directories that the Tivoli Storage Manager server instance needs for database and recovery logs.

#### Before you begin

Review the information about planning space for the server before completing this task. See “Worksheets for planning details for the Tivoli Storage Manager server” on page 12.

#### Procedure

1. Create the user ID that will own the server instance. You use this user ID when you create the server instance in a later step.

Create a user ID and group that will be the owner of the Tivoli Storage Manager server instance.

- a. The following commands can be run from an administrative user ID that will set up the user and group. Create the user ID and group in the home directory of the user.

**Restriction:** In the user ID, only lowercase letters (a-z), numerals (0-9), and the underscore character ( \_ ) can be used. The user ID and group name must comply with the following rules:

- The length must be 8 characters or less.
- The user ID and group name cannot start with *ibm*, *sql*, *sys*, or a numeral.
- The user ID and group name cannot be *user*, *admin*, *guest*, *public*, *local*, or any SQL reserved word.

For example, create user ID `tsminst1` in group `tsmsrvrs`. The following examples show how to create this user ID and group using operating system commands.

```
groupadd tsmsrvrs
useradd -d /home/tsminst1 -m -g tsmsrvrs -s /bin/bash tsminst1
passwd tsminst1
```

**Restriction:** DB2 does not support direct operating system user authentication through LDAP.

- b. Log off, then log in to your system. Change to the user account that you just created. Use an interactive login program, such as `telnet`, so that you are prompted for the password and can change it if necessary.
2. Create directories that the server requires. Ensure that you are logged in under the new user ID you just created.

## Installing the Tivoli Storage Manager server

Create empty directories for each of the items shown in the following table. Mount the associated storage to each directory for the active log, archive log and database directories.

Item	Example commands for creating the directories	Your directories
The <i>instance directory</i> for the server, which is a directory that will contain files specifically for this server instance (the server options file and other server-specific files)	<pre>mkdir /tsminst1 chown tsminst1 /tsminst1</pre>	
The database directories	<pre>mkdir /tsmdb001 mkdir /tsmdb002 mkdir /tsmdb003 mkdir /tsmdb004</pre>	
Active log directory	<pre>mkdir /tsmlog</pre>	
Archive log directory	<pre>mkdir /tsmarchlog</pre>	
Optional: Directory for the log mirror for the active log	<pre>mkdir /tsmlogmirror</pre>	
Optional: Secondary archive log directory (failover location for archive log)	<pre>mkdir /tsmarchlogfailover</pre>	

When a server is initially created by using the **DSMSERV FORMAT** utility or the configuration wizard, a server database and recovery log are created. In addition, files are created to hold database information that is used by the database manager.

3. Log off the new user ID.

---

## Configuring Tivoli Storage Manager

After you have installed Tivoli Storage Manager Version 7.1 and prepared for the configuration, configure the Tivoli Storage Manager server instance.

### About this task

Configure a Tivoli Storage Manager server instance by selecting one of the following options:

- Use the Tivoli Storage Manager configuration wizard on your local system. See “Configuring Tivoli Storage Manager using the configuration wizard” on page 46.
- Manually configure the new Tivoli Storage Manager instance. See “Configuring the server instance manually” on page 47. Complete the following steps during a manual configuration.
  1. Set up the directories and create the Tivoli Storage Manager instance. See “Creating the server instance” on page 47.
  2. Create a new server options file by copying the sample file in order to set up communications between the Tivoli Storage Manager server and clients. See “Configuring server and client communications” on page 48.

## Installing the Tivoli Storage Manager server

3. Issue the DSMSEV FORMAT command to format the database. See “Formatting the database and log” on page 52.
4. Configure your system for database backup. See “Preparing the database manager for database backup” on page 52.

## Configuring Tivoli Storage Manager using the configuration wizard

The wizard offers a guided approach to configuring a server. By using the graphical user interface (GUI), you can avoid some configuration steps that are complex when done manually. Start the wizard on the system where you installed the Tivoli Storage Manager server program.

### Before you begin

Before beginning the configuration wizard, you must complete all preceding steps to prepare for the configuration, including installing Tivoli Storage Manager, creating the database and log directories, and creating the directories and user ID for the server instance.

### Procedure

1. Ensure that the following requirements are met:
  - The system where you installed Tivoli Storage Manager must have the X Window System client. You must also be running an X Window System server on your desktop.
  - The system must have one of the following protocols enabled. Ensure that the port that the protocol uses is not blocked by a firewall.
    - Secure Shell (SSH). Ensure that the port is set to the default value, 22. Also, ensure that the SSH daemon service has access rights for connecting to the system by using localhost.
    - Remote shell (RSH).
    - Remote Execution Protocol (REXEC).
  - You must be able to log in to Tivoli Storage Manager with the user ID that you created for the server instance, by using the SSH, RSH, or REXEC protocol. When using the wizard, you must provide this user ID and password to access that system.
2. Start the local version of the wizard:
  - Open the dsmicfgx program in the /opt/tivoli/tsm/server/bin directory.
  - This wizard can only be run as a root user.

Follow the instructions to complete the configuration. The wizard can be stopped and restarted, but the server is not operational until the entire configuration process is complete.



## Configuring the server instance manually

After installing Tivoli Storage Manager Version 7.1, you can configure Tivoli Storage Manager manually instead of using the configuration wizard.

### Creating the server instance

Create a Tivoli Storage Manager instance by issuing the **db2icrt** command.

#### About this task

You can have one or more server instances on one workstation.

**Important:** Before you run the **db2icrt** command, verify the following items:

- The home directory for the user (`/home/tsminst1`) exists. If there is no home directory, you must create it.

The instance directory stores the following core files that are generated by the Tivoli Storage Manager server:

- The server options file, `dsmserv.opt`
- The server key database file, `cert.kdb`, and the `.arm` files (used by clients and other servers to import the Secure Sockets Layer certificates of the server)
- Device configuration file, if the `DEVCONFIG` server option does not specify a fully qualified name
- Volume history file, if the `VOLUMEHISTORY` server option does not specify a fully qualified name
- Volumes for **DEVTYPE=FILE** storage pools, if the directory for the device class is not fully specified, or not fully qualified
- User exits
- Trace output (if not fully qualified)
- A shell configuration file (for example, `.profile`) exists in the home directory. The root user and instance-user ID must have write permission to this file. For more information, see the section on Linux and UNIX environment variable settings in the DB2 Information Center at <http://pic.dhe.ibm.com/infocenter/db2luw/v10r5>.

1. Log in using the root user ID and create a Tivoli Storage Manager instance. The name of the instance must be the same name as the user that owns the instance. Use the **db2icrt** command and enter the command on one line:

```
/opt/tivoli/tsm/db2/instance/db2icrt -a server -s ese -u
instance_name instance_name
```

For example, if your user ID for this instance is `tsminst1`, use the following command to create the instance. Enter the command on one line.

```
/opt/tivoli/tsm/db2/instance/db2icrt -a server -s ese -u
tsminst1 tsminst1
```

**Remember:** From this point on, use this new user ID when you configure your Tivoli Storage Manager server. Log out of the root user ID and log in under the new instance-user ID.

2. Change the default directory for the database to be the same as the instance directory for the server. If you have multiple servers, log in under the instance ID for each server. Issue this command:

```
db2 update dbm cfg using dftdbpath instance_directory
```

For example:

## Installing the Tivoli Storage Manager server

```
db2 update dbm cfg using dftdbpath /tsminst1
```

3. Modify the library path to use the version of the IBM Global Security Kit (GSKit) that is installed with the Tivoli Storage Manager server. In the following examples, *server\_bin\_directory* is a subdirectory of the server installation directory. For example, */opt/tivoli/tsm/server/bin*.
  - You must update the following files to set the library path when DB2 or the Tivoli Storage Manager server are started:

```
instance_directory/sql1lib/usercshrc
instance_directory/sql1lib/userprofile
```
  - The following entry is added to the *instance\_directory/sql1lib/usercshrc* file, on one line:

```
setenv LD_LIBRARY_PATH server_bin_directory/dbbkapi:
/opt/ibm/gsk8_64/lib64:$LD_LIBRARY_PATH
```
  - The following entries are added to the *instance\_directory/sql1lib/userprofile* file. Each entry is on one line.

```
LD_LIBRARY_PATH=server_bin_directory/dbbkapi:
/usr/local/ibm/gsk8_64/lib64:$LD_LIBRARY_PATH
export LD_LIBRARY_PATH
```
  - Verify the library path settings and that the GSKit is version 8.0.14.14 or later. Issue the following commands:

```
echo $LD_LIBRARY_PATH
gsk8capicmd_64 -version
gsk8ver_64
```

If your GSKit version is not 8.0.14.14 or later, you must reinstall the Tivoli Storage Manager server. The reinstallation ensures that the correct GSKit version is available.
4. Create a new server options file. See “Configuring server and client communications.”

### Configuring server and client communications

A default sample server options file, *dsmserv.opt.smp*, is created during Tivoli Storage Manager installation in the */opt/tivoli/tsm/server/bin* directory. You must set up communications between the server and clients by creating a new server options file. To do so, copy the sample file to the directory for the server instance.

#### About this task

Ensure that you have a server instance directory, for example */tsminst1*, and copy the sample file to this directory. Name the new file *dsmserv.opt* and edit the options. Complete this set-up before you initialize the server database (see “Formatting the database and log” on page 52). Each sample or default entry in the sample options file is a comment, a line beginning with an asterisk (\*). Options are not case-sensitive and one or more blank spaces are allowed between keywords and values.

When editing the options file, follow these guidelines:

- Remove the asterisk at the beginning of the line to activate an option.
- Begin entering the options in any column.
- Enter only one option per line, and the option must be on only one line.
- If you make multiple entries for a keyword, the Tivoli Storage Manager server uses the last entry.

## Installing the Tivoli Storage Manager server

If you change the server options file, you must restart the server for the changes to take effect. See the *Administrator's Reference* for a description of all server options.

You can specify one or more of the following communication methods:

- TCP/IP Version 4 or Version 6
- Shared memory
- Simple network management protocol (SNMP) DPI
- Secure Sockets Layer (SSL)

**Note:** You can authenticate passwords with the LDAP directory server, or authenticate passwords with the Tivoli Storage Manager server. Passwords that are authenticated with the LDAP directory server can provide enhanced system security. For details, see the managing passwords and logon procedures section in the *Administrator's Guide*.

### Setting TCP/IP options:

Select from a range of TCP/IP options for the Tivoli Storage Manager server or retain the default.

### About this task

The following is an example of a list of TCP/IP options you can use to set up your system.

```
commmethod      tcpip
tcpport         1500
tcpwindowsize   0
tcpnodelay      yes
```

**Tip:** You can use TCP/IP Version 4, Version 6, or both.

### TCPPORT

The server TCP/IP port address. The default value is 1500.

### TCPWINDOWSIZE

Specifies the size of the TCP/IP buffer that is used when sending or receiving data. The window size that is used in a session is the smaller of the server and client window sizes. Larger window sizes use additional memory but can improve performance.

You can specify an integer from 0 to 2048. To use the default window size for the operating system, specify 0.

### TCPNODELAY

Specifies whether or not the server sends small messages or lets TCP/IP buffer the messages. Sending small messages can improve throughput but increases the number of packets sent over the network. Specify YES to send small messages or NO to let TCP/IP buffer them. The default is YES.

### TCPADMINPORT

Specifies the port number on which the server TCP/IP communication driver is to wait for requests other than client sessions. The default value is 1500.

### SSLTCPPOINT

(SSL-only) Specifies the Secure Sockets Layer (SSL) port number on which

## Installing the Tivoli Storage Manager server

the server TCP/IP communication driver waits for requests for SSL-enabled sessions for the command-line backup-archive client and the command-line administrative client.

### SSLTCPADMINPORT

Specifies the port address on which the server TCP/IP communication driver waits for requests for SSL-enabled sessions for the command-line administrative client.

### Setting shared memory options:

You can use shared memory communications between clients and servers on the same system. To use shared memory, TCP/IP Version 4 must be installed on the system.

### About this task

The following example shows a shared memory setting:

```
commethod sharedmem  
shmport 1510
```

In this example, SHMPORT specifies the TCP/IP port address of a server when using shared memory. Use the SHMPORT option to specify a different TCP/IP port. The default port address is 1510.

COMMETHOD can be used multiple times in the IBM Tivoli Storage Manager server options file, with a different value each time. For example, the following example is possible:

```
commethod tcpip  
commethod sharedmem
```

You might receive the following message from the server when using shared memory:

```
ANR9999D shmcomm.c(1598): ThreadId<39>  
Error from msgget (2), errno = 28
```

The message means that a message queue must be created but the system limit for the maximum number of message queues (MSGMNI) would be exceeded.

To find out the maximum number of message queues (MSGMNI) on your system, issue the following command:

```
cat /proc/sys/kernel/msgmni
```

To increase the MSGMNI value on your system, issue the following command:

```
sysctl -w kernel.msgmni=n
```

where **n** is the maximum number of message queues that you want the system to allow.

### Setting SNMP DPI subagent options:

Tivoli Storage Manager implements a simple network management protocol (SNMP) subagent. You can configure the SNMP subagent to send traps to an SNMP manager, such as NetView®, and to provide support for a Management Information Base (MIB).

#### About this task

For details about configuring SNMP for use with Tivoli Storage Manager, see the *Administrator's Guide*.

The subagent communicates with the snmp daemon, which in turn communicates with a management application. The snmp daemon must support the DPI protocol. Agents are available on AIX. The subagent process is separate from the Tivoli Storage Manager server process, but the subagent gets its information from a server options file. When the SNMP management application is enabled, it can get information and messages from servers.

Use the following SNMP DPI options as an example of a SNMP setting. You must specify the COMMETHOD option. For details about the other options, see the *Administrator's Reference*.

commethod	snmp
snmpheartbeatinterval	5
snmpmessagecategory	severity

### Setting Secure Sockets Layer options:

You can add more protection for your data and passwords by using Secure Sockets Layer (SSL).

#### Before you begin

SSL is the standard technology for creating encrypted sessions between servers and clients. SSL provides a secure channel for servers and clients to communicate over open communication paths. With SSL, the identity of the server is verified through the use of digital certificates.

To ensure better system performance, use SSL only for sessions when it is needed. Consider adding additional processor resources on the Tivoli Storage Manager server to manage the increased requirements.

Refer to setting up Transport Layer Security (TLS) in the *Administrator's Guide*.

## Installing the Tivoli Storage Manager server

### Formatting the database and log

Use the **DSMSERV FORMAT** utility to initialize a server instance. No other server activity is allowed while initializing the database and recovery log.

After you set up server communications, you are ready to initialize the database. Ensure that you log in by using the instance user ID. Do not place the directories on file systems that might run out of space. If certain directories (for example, the archive log) become unavailable or full, the server stops. See *Capacity planning* for more details.

For optimal performance and to facilitate I/O, specify at least two equally sized containers or Logical Unit Numbers (LUNs) for the database. See *Optimizing Performance* for more information about the configuration of directories for the database. In addition, each active log and archive log should have its own container or LUN.

### Initializing a server instance

Use the **DSMSERV FORMAT** utility to initialize a server instance. For example, issue the following command:

```
dsmserv format dbdir=/tsmdb001 activelogsiz=8192  
activelogdirectory=/active log archlogdirectory=/archlog  
archfailoverlogdirectory=/archfaillog mirrorlogdirectory=/mirrorlog
```

**Tip:** If DB2 does not start after you issue the **DSMSERV FORMAT** command, you might need to disable the file system mount option **NOSUID**. If this option is set on the file system that contains the DB2 instance owner directory, or on any file system that contains the DB2 database, active logs, archive logs, failover logs, or mirrored logs, the option must be disabled to start the system.

After you disable the **NOSUID** option, remount the file system and then start DB2 by issuing the following command:

```
db2start
```

For more information, see the *Administrator's Reference*.

### Preparing the database manager for database backup

To back up the data in the database to Tivoli Storage Manager, you must enable the database manager and configure the Tivoli Storage Manager application programming interface (API).

#### About this task

Starting with Tivoli Storage Manager V7.1, it is no longer necessary to set the API password during a manual configuration of the server. If you set the API password during the manual configuration process, attempts to back up the database might fail.

If you use the Tivoli Storage Manager configuration wizard to create a Tivoli Storage Manager server instance, you do not have to complete these steps. If you are configuring an instance manually, complete the following steps before you issue either the **BACKUP DB** or the **RESTORE DB** commands.

**Attention:** If the database is unusable, the entire Tivoli Storage Manager server is unavailable. If a database is lost and cannot be recovered, it might be difficult or impossible to recover data that is managed by that server. Therefore, it is critically important to back up the database.

In the following commands, replace the example values with your actual values. The examples use `tsminst1` for the server instance user ID, `/tsminst1` for the Tivoli Storage Manager server instance directory, and `/home/tsminst1` as the server instance users home directory.

1. Set the Tivoli Storage Manager API environment-variable configuration for the database instance:
  - a. Log in using the `tsminst1` user ID.
  - b. When user `tsminst1` is logged in, ensure that the DB2 environment is properly initialized. The DB2 environment is initialized by running the `/home/tsminst1/sql1lib/db2profile` script, which normally runs automatically from the profile of the user ID. Ensure the `.profile` file exists in the instance users home directory, for example, `/home/tsminst1/.profile`. If `.profile` does not run the `db2profile` script, add the following lines:

```
if [ -f /home/tsminst1/sql1lib/db2profile ]; then
    . /home/tsminst1/sql1lib/db2profile
fi
```

- c. For the `instance_directory/sql1lib/userprofile` file, add the following lines:

```
DSMI_CONFIG=server_instance_directory/tsmdbmgr.opt
DSMI_DIR=server_bin_directory/dbbkapi
DSMI_LOG=server_instance_directory
export DSMI_CONFIG DSMI_DIR DSMI_LOG
```

For the `instance_directory/sql1lib/usercshrc` file, add the following lines:

```
setenv DSMI_CONFIG=server_instance_directory/tsmdbmgr.opt
setenv DSMI_DIR=server_bin_directory/dbbkapi
setenv DSMI_LOG=server_instance_directory
```

2. Log out and log in again as `tsminst1`, or issue this command:
 

```
. ~/.profile
```

**Tip:** Ensure that you enter a space after the initial dot (`.`) character.

3. Create a file that is called `tsmdbmgr.opt` in the `server_instance` directory, which is in the `/tsminst1` directory in this example, and add the following line:

```
SERVERNAME TSMDBMGR_TSMINST1
```

**Remember:** The `SERVERNAME` that you use must be consistent in the `tsmdbmgr.opt` and `dsm.sys` files.

4. As root user, add the following lines to the Tivoli Storage Manager API `dsm.sys` configuration file. The `dsm.sys` configuration file is in the following default location:

```
server_bin_directory/dbbkapi/dsm.sys
servername TSMDBMGR_TSMINST1
commethod tcpip
tcpserveraddr localhost
tcpport 1500
errorlogname /tsminst1
nodename $$_TSMDBMGR_$$
where
```

- `servername` matches the `servername` in `tsmdbmgr.opt`.

## Installing the Tivoli Storage Manager server

- *commethod* is the client API used to contact the server for database backup. This value can be *tcPIP* or *sharedmem*. For *sharedmem*, see step 5..
- *tcpserveraddr* is the server address that the client API uses to contact the server for database backup. This value must be *localhost* for database backup to work.
- *tcpport* is the port number that the client API uses to contact the server for database backup. Ensure that you enter the same *tcpport* option that is specified in the *dsmserv.opt* server options file.
- *errorlogname* is the error log where the client API logs errors that are encountered during a database backup. This log is typically in the server instance directory. The log can, however, be placed anywhere the instance user ID has write-permission.
- *nodename* is the node name that the client API uses to connect to the server during a database backup. This value must be `$$_TSMDBMGR_$$` for a database backup to work.

**Note:** Do not add the `PASSWORDACCESS generate` option to the `dsm.sys` configuration file. This option can cause the database backup to fail.

5. Optional: Configure the server to back up the database by using shared memory. In this way, you might be able to reduce the processor load and improve throughput. Complete the following steps:
  - a. Review the `dsmserv.opt` file. If the following lines are not in the file, add them:

```
commethod sharedmem  
shmport port_number
```

where *port\_number* specifies the port to be used for shared memory.

- b. In the `dsm.sys` configuration file, locate the following lines:

```
commethod tcPIP  
tcpserveraddr localhost  
tcpport port_number
```

Replace the specified lines with the following lines:

```
commethod sharedmem  
shmport port_number
```

where *port\_number* specifies the port to be used for shared memory.

---

## Configuring server options for server database maintenance

To help avoid problems with database growth and server performance, the server automatically monitors its database tables and reorganizes them when needed. Before starting the server for production use, set server options to control when reorganization runs. If you plan to use data deduplication, ensure that the option to run index reorganization is enabled.

### About this task

Table and index reorganization requires significant processor resources, active log space, and archive log space. Because database backup takes precedence over reorganization, select the time and duration for reorganization to ensure that the processes do not overlap and reorganization can complete. For more information about scheduling reorganization, see the *Administrator's Guide*.



If you update these server options while the server is running, you must stop and restart the server before the updated values take effect.

### Procedure

1. Modify the server options.

Edit the server options file, `dsmserv.opt`, in the server instance directory. Follow these guidelines when you edit the server options file:

- To activate an option, remove the asterisk at the beginning of the line.
- Create an option on any line.
- Enter only one option per line. The entire option with its value must be on one line.
- If you have multiple entries for an option in the file, the server uses the last entry.
- To view available server options, see the sample file, `dsmserv.opt.smp`, in the `/opt/tivoli/tsm/server/bin` directory.

2. If you plan to use data deduplication, enable the **ALLOWREORGINDEX** server option. Add the following option and value to the server options file:

```
allowreorgindex yes
```

3. Set the **REORGBEGINTIME** and **REORGDURATION** server options to control when reorganization starts and how long it runs. Select a time and duration so that reorganization runs when you expect that the server is least busy. These server options control both table and index reorganization processes.

- a. Set the time for reorganization to start by using the **REORGBEGINTIME** server option. Specify the time by using the 24-hour system. For example, to set the start time for reorganization as 8:30 p.m., specify the following option and value in the server options file:

```
reorgbegintime 20:30
```

- b. Set the interval during which the server can start reorganization. For example, to specify that the server can start reorganization for four hours after the time set by the **REORGBEGINTIME** server option, specify the following option and value in the server options file:

```
reorgduration 4
```

4. If the server was running while you updated the server options file, stop and restart the server.

---

## Starting the server instance

You can start the Tivoli Storage Manager server by using the instance user ID or the root user ID. You can also use the instance user ID or the root user ID to start the server automatically.

### Before you begin

Ensure that you set access permissions and user limits correctly. For instructions, see “Verifying access rights and user limits” on page 56.

### About this task

The preferred way to start the server is by using the instance user ID. By using the instance user ID, you simplify the setup process and avoid potential issues. However, in some cases, it might be necessary to start the server with the root user

## Installing the Tivoli Storage Manager server

ID. For example, you might want to use the root user ID to ensure that the server can access specific devices.

### Procedure

To start the server, take one of the following actions:

- Start the server by using the instance user ID. For instructions, see “Starting the server from the instance user ID” on page 58.
- Start the server by using the root user ID. For instructions, see “Starting the server from the root user ID” on page 58.
- Start the server automatically.

For instructions, see “Automatically starting servers on Linux systems” on page 58.

For information about other options for starting the server, see the *Administrator's Guide*.

## Verifying access rights and user limits

Before you start the server, verify access rights and user limits.

### About this task

If you do not verify user limits, also known as *ulimits*, you might experience server instability or a failure of the server to respond. You must also verify the system-wide limit for the maximum number of open files. The system-wide limit must be greater than or equal to the user limit.

### Procedure

1. Verify that the server instance user ID has permissions to start the server.
2. For the server instance that you plan to start, ensure that you have authority to read and write files in the server instance directory. Verify that the `dsmserv.opt` file exists in the server instance directory, and that the file includes parameters for the server instance.
3. If the server is attached to a tape drive, medium changer, or removable media device, and you plan to start the server by using the instance user ID, grant read/write access to the instance user ID for these devices. To set permissions, take one of the following actions:
  - If the system is dedicated to Tivoli Storage Manager and only the Tivoli Storage Manager administrator has access, make the device special file world-writable:  

```
chmod +w /dev/rmtX
```
  - If the system has multiple users, you can restrict access by making the Tivoli Storage Manager instance user ID the owner of the special device files:  

```
chmod u+w /dev/rmtX
```
  - If multiple user instances are running on the same system, change the group name, for example TAPEUSERS, and add each Tivoli Storage Manager instance user ID to that group. Then, change the ownership of the device special files to belong to the group TAPEUSERS, and make them group-writable:  

```
chmod g+w /dev/rmtX
```
4. If you are using the Tivoli Storage Manager device driver and the `autoconf` utility, use the `-a` option to grant read/write access to the instance user ID.

5. To prevent server failures during interaction with DB2, tune the kernel parameters.

For instructions about tuning kernel parameters, see “Tuning kernel parameters” on page 42.

6. Verify the following user limits based on the guidelines in the table.

*Table 15. User limit (ulimit) values*

User limit type	Standard value	Command to query value
Maximum size of core files created	Unlimited	<code>ulimit -Hc</code>
Maximum size of a data segment for a process	Unlimited	<code>ulimit -Hd</code>
Maximum file size	Unlimited	<code>ulimit -Hf</code>
Maximum number of open files	65536	<code>ulimit -Hn</code>
Maximum amount of processor time in seconds	Unlimited	<code>ulimit -Ht</code>

To modify user limits, follow the instructions in the documentation for your operating system.

**Tip:** If you plan to start the server automatically by using a script, you can set the user limits in the script.

7. Ensure that the user limit of maximum user processes (`nproc`) is set to the minimum suggested value of 16384.
  - a. To verify the current user limit, issue the following command by using the instance user ID:

```
ulimit -Hu
```

For example:

```
[user@Machine ~]$ ulimit -Hu
16384
```

- b. If the limit of maximum user processes is not set to 16384, set the value to 16384.

Add a line to the `/etc/security/limits.conf` file.

If the server is installed on the Red Hat Enterprise Linux 6 operating system, set the user limit by editing the `/etc/security/limits.d/90-nproc.conf` file in the `/etc/security/limits.d` directory. This file overrides the settings in the `/etc/security/limits.conf` file.

**Tip:** The default value for the user limit of maximum user processes has changed on some distributions and versions of the Linux operating system. The default value is 1024. If you do not change the value to the minimum suggested value of 16384, the server might fail or hang.

### Starting the server from the instance user ID

To start the server from the instance user ID, log in with the instance user ID and issue the appropriate command from the server instance directory.

#### Before you begin

Ensure that access rights and user limits are set correctly. For instructions, see “Verifying access rights and user limits” on page 56.

#### Procedure

1. Log in to the system where Tivoli Storage Manager is installed by using the instance user ID for the Tivoli Storage Manager server.
2. If you do not have a user profile that runs the `db2profile` script, issue the following command:

```
. /home/tsminst1/sql1lib/db2profile
```

**Tip:** For instructions about updating the user ID login script to run the `db2profile` script automatically, see the DB2 documentation.

3. Start the server by issuing the following command from the server instance directory:

```
/usr/bin/dsmserv
```

**Tip:** The command runs in the foreground so that you can set an administrator ID and connect to the server instance.

For example, if the name of the Tivoli Storage Manager server instance is `tsminst1` and the server instance directory is `/tsminst1`, you can start the instance by issuing the following commands:

```
cd /tsminst1
. ~/sql1lib/db2profile
/usr/bin/dsmserv
```

### Starting the server from the root user ID

The standard way to start the server is by using the instance user ID. However, in some cases, it might be necessary to use another user ID to start the server. For example, you might want to use the root user ID to ensure that the server can access specific devices.

#### Before you begin

For information about authorizing root users and starting the server by using the root user ID, see the *Administrator's Guide*.

### Automatically starting servers on Linux systems

To automatically start a Tivoli Storage Manager server on a Linux operating system, use the `dsmserv.rc` script.

#### Before you begin

Ensure that kernel parameters are set correctly. For instructions, see “Tuning kernel parameters” on page 42.

Ensure that the Tivoli Storage Manager server instance runs under the instance owner user ID.

Ensure that access rights and user limits are set correctly. For instructions, see “Verifying access rights and user limits” on page 56.

### About this task

The `dsmserv.rc` script is in the server installation directory, for example, `/opt/tivoli/tsm/server/bin`.

The `dsmserv.rc` script can be used either to start the server manually or to start the server automatically by adding entries to the `/etc/rc.d/init.d` directory. The script works with Linux utilities such as **CHKCONFIG** and **SERVICE**.

### Procedure

For each server instance that you want to automatically start, complete the following steps:

1. Place a copy of the `dsmserv.rc` script in the `/init.d` directory, for example, `/etc/rc.d/init.d`.

Ensure that you make any changes in the copy of the script. Do not change the original script.

2. Rename the script copy so that it matches the name of the server instance owner, for example, `tsminst1`.

The script was created under the assumption that the server instance directory is `home_directory/tsminst1`, for example: `/home/tsminst1/tsminst1`.

3. If the server instance directory is not `home_directory/tsminst1`, locate the following line in the script copy:

```
instance_dir="${instance_home}/tsminst1"
```

Change the line so that it points to your server instance directory, for example:

```
instance_dir="/tsminst1"
```

4. Use tools such as the **CHKCONFIG** utility to configure the run level in which the server automatically starts. Specify a value that corresponds to a multiuser mode, with networking turned on. Typically, the run level to use is 3 or 5, depending on the operating system and its configuration. For more information about multiuser mode and run levels, see the documentation for your operating system.
5. Optional: You can start or stop the server by issuing one of the following commands:

- To start the server:

```
service tsminst1 start
```
- To stop the server:

```
service tsminst1 stop
```

### Example

In this example, the instance owner is `tsminst1` and the server instance directory is `/home/tsminst1/tsminst1`. The `dsmserv.rc` script copy is named `tsminst1`, and the **CHKCONFIG** utility is used to configure the script to start at run levels 3, 4, and 5.

```
cp /opt/tivoli/tsm/server/bin/dsmserv.rc /etc/rc.d/init.d/tsminst1
chkconfig --list tsminst1
service tsminst1 supports chkconfig, but is not referenced in
any runlevel (run 'chkconfig --add tsminst1')
chkconfig --add tsminst1
chkconfig --list tsminst1
```

## Installing the Tivoli Storage Manager server

```
tsminst1 0:off 1:off 2:off 3:off 4:off 5:off 6:off
chkconfig --level 345 tsminst1 on
chkconfig --list tsminst1
tsminst1 0:off 1:off 2:off 3:on 4:on 5:on 6:off
```

---

## Stopping the server

You can stop the server when needed to return control to the operating system. To avoid losing administrative and client node connections, stop the server only after current sessions are completed or canceled.

### About this task

To stop the server, issue the following command from the Tivoli Storage Manager command line:

```
halt
```

The server console stops.

If you cannot connect to the server with an administrative client and you want to stop the server, you must cancel the process by using the **kill** command with the process ID number (pid) that is displayed at initialization.

**Important:** Before you issue the **kill** command, ensure that you know the correct process ID for the Tivoli Storage Manager server.

The `dsmserv.v6lock` file, in the directory from which the server is running, can be used to identify the process ID of the process to kill. To display the file enter:

```
cat /instance_dir/dsmserv.v6lock
```

Issue the following command to stop the server:

```
kill -23 dsmserv_pid
```

where *dsmserv\_pid* is the process ID number.

---

## Registering licenses

Immediately register any Tivoli Storage Manager licensed functions that you purchase so you do not lose any data after you start server operations, such as backing up your data.

### About this task

Use the **REGISTER LICENSE** command for this task.

### Example: Register a license

Register the base Tivoli Storage Manager license.

```
register license file=tsmbasic.lic
```

---

## Specifying a device class in preparation for database backups

To prepare the system for automatic and manual database backups, you must specify the device class to be used.

### Before you begin

Before you begin the setup, ensure that you have defined a tape or file device class. See the defining device classes section of the *Administrator's Guide*.

### About this task

To set up your system for database backups, issue the **SET DBRECOVERY** command to specify a device class to be used for the backups. You can also change the device class to be used for database backups with the **SET DBRECOVERY** command.

Perform the following setup procedure:

### Procedure

1. If you did not use the configuration wizard (dsmi cfgx) to configure the server, ensure that you have completed the steps to manually configure the system for database backups.
2. Select the device class to be used for backups of the database. Issue the following command from a IBM Tivoli Storage Manager administrative command line.

```
set dbrecovery device_class_name
```

The device class that you specify is used by the database manager for database backups. If you do not specify a device class with the **SET DBRECOVERY** command, the backup fails.

### Example

For example, to specify that the **DBBACK** device class is to be used, issue this command:

```
set dbrecovery ddback
```

### What to do next

When you are ready to back up your database, see the **BACKUP DB** command in the *Administrator's Reference*.

---

## Running multiple server instances on a single system

You can create more than one server instance on your system. Each server instance has its own instance directory, and database and log directories.

Multiply the memory and other system requirements for one server by the number of instances planned for the system.

The set of files for one instance of the server is stored separately from the files used by another server instance on the same system. Use the steps in "Creating the server instance" on page 47 for each new instance, including creation of the new instance user.

## Installing the Tivoli Storage Manager server

To manage the system memory that is used by each server, use the `DBMEMPERCENT` server option to limit the percentage of system memory. If all servers are equally important, use the same value for each server. If one server is a production server and other servers are test servers, set the value for the production server to a higher value than the test servers.

When you upgrade from Tivoli Storage Manager V6.1, you must upgrade to V6.3 first, and then to V7.1. You can upgrade directly from either V6.2 or V6.3 to V7.1. See the upgrade section (Chapter 5, “Upgrading to Tivoli Storage Manager Version 7.1,” on page 69) for more details. When you upgrade and have multiple servers on your system, you must run the installation wizard only once. The installation wizard collects the database and variables information for all of your original server instances.

If you upgrade from Tivoli Storage Manager V6.2 or V6.3 to V7.1 and have multiple servers on your system, all instances that exist in DB2 V9.7 are dropped and recreated in DB2 V10.5. The wizard issues the `db2 upgrade db dbname` command for each database. The database environment variables for each instance on your system are also reconfigured during the upgrade process.

For information about the Server Initialization wizard, see the *Tivoli Storage Manager Administrator's Guide*.

---

## Monitoring the server

When you start using server in production operation, monitor the space used by the server to ensure that the amount of space is adequate. Make adjustments as needed.

### Procedure

1. Monitor the active log, to ensure that the size is correct for the workload that is handled by the server instance.

When the server workload is up to its typical expected level, and the space that is used by the active log is 80 - 90% of the space that is available to the active log directory, you might need to increase the amount of space. Whether you need to increase the space depends on the types of transactions in the server's workload, because transaction characteristics affect how the active log space is used.

The following transaction characteristics can affect the space usage in the active log:

- The number and size of files in backup operations
  - Clients such as file servers that back up large numbers of small files can cause large numbers of transactions that complete during a short period of time. The transactions might use a large amount of space in the active log, but for a short period of time.
  - Clients such as a mail server or a database server that back up large chunks of data in few transactions can cause small numbers of transactions that take a long time to complete. The transactions might use a small amount of space in the active log, but for a long period of time.
- Network connection types
  - Backup operations that occur over fast network connections cause transactions that complete more quickly. The transactions use space in the active log for a shorter period of time.



- Backup operations that occur over relatively slower connections cause transactions that take a longer time to complete. The transactions use space in the active log for a longer period of time.

If the server is handling transactions with a wide variety of characteristics, the space that is used for the active log might go up and down by a large amount over time. For such a server, you might need to ensure that the active log typically has a smaller percentage of its space used. The extra space allows the active log to grow for transactions that take a very long time to complete, for example.

2. Monitor the archive log to ensure that space is always available.

**Remember:** If the archive log becomes full, and the failover archive log becomes full, the active log can become full and the server will stop. The goal is to make enough space available to the archive log so that it never uses all its available space.

You are likely to notice the following pattern:

- a. Initially, the archive log grows rapidly as typical client-backup operations occur.
- b. Database backups occur regularly, either as scheduled or done manually.
- c. After at least two full database backups occur, log pruning occurs automatically. The space used by the archive log decreases when the pruning occurs.
- d. Normal client operations continue, and the archive log grows again.
- e. Database backups occur regularly, and log pruning occurs as often as full database backups occur.

With this pattern, the archive log grows initially, then decreases, then might grow again. Over a period of time, as normal operations continue, the amount of space used by the archive log should reach a relatively constant level.

If the archive log continues to grow, consider taking one or both of these actions:

- Add space to the archive log. This might mean moving the archive log to a different file system.

For information about moving the archive log, see the *Tivoli Storage Manager Administrator's Guide*.

- Increase the frequency of full database backups, so that log pruning occurs more frequently.

3. If you defined a directory for the failover archive log, determine whether any logs get stored in that directory during normal operations. If the failover log space is being used, consider increasing the size of the archive log. The goal is that the failover archive log is used only under unusual conditions, not in normal operation.

### What to do next

For details about monitoring, see the *Administrator's Guide*.



---

## Chapter 4. Installing a Tivoli Storage Manager server fix pack

Tivoli Storage Manager maintenance updates, which are also referred to as fix packs, bring your server up to the current maintenance level.

### Before you begin

To install a fix pack or interim fix to the server, install the server at the level on which you want to run it. You do not have to start the server installation at the base release level. For example, if you currently have Version 6.3.4.2 installed, you can go directly to the latest fix pack for V7.1. You do not have to start with the V7.1.0 installation if a maintenance update is available.

You must have the Tivoli Storage Manager license package installed. The license package is provided with the purchase of a base release. Alternatively, you can obtain the license package when download a fix pack from the Passport Advantage website. After the fix pack or interim fix is installed, install the license for the server. To display messages and help in a language other than US English, install the language package of your choice.

For information about the estimated time required to install a fix pack, see Techdoc 7023591.

If you upgrade the server to V7.1 or later, and then revert the server to a level that is earlier than V7.1, you must restore the database to a point in time before the upgrade. During the upgrade process, complete the required steps to ensure that the database can be restored: back up the database, the volume history file, the device configuration file, and the server options file. For more information, see Chapter 6, “Reverting from Version 7.1 to the previous V6 server,” on page 79.

Ensure that you retain the installation media from the base release of the installed server. If you installed Tivoli Storage Manager from a DVD, ensure that the DVD is available. If you installed Tivoli Storage Manager from a downloaded package, ensure that the downloaded files are available. If the upgrade fails, and the server license module is uninstalled, the installation media from the server base release are required to reinstall the license.

Visit this website: [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager) for the following information:

- A list of the latest maintenance and download fixes. Click **Support and downloads** and apply any applicable fixes.
- Details about obtaining a base license package. Search for **Warranties and licenses**.
- Supported platforms and system requirements. Click **Server requirements**.

## Installing a Tivoli Storage Manager fix pack

### About this task

To install a fix pack or interim fix, complete the following steps.

**Attention:** Do not alter the DB2 software that is installed with Tivoli Storage Manager installation packages and fix packs. Do not install or upgrade to a different version, release, or fix pack of DB2 software because doing so can damage the database.

### Procedure

1. Log in as the root user.
2. Obtain the package file for the fix pack or interim fix that you want to install from the [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager) site.
3. Change to the directory where you placed the executable file and complete the following steps.

**Tip:** The files are extracted to the current directory. Ensure that the executable file is in the directory where you want the extracted files to be located.

- a. Change file permissions by entering the following command:

```
chmod a+x 6.x.x.x-TIV-TSMALL-platform.bin
```

where *platform* denotes the architecture that Tivoli Storage Manager is to be installed on.

- b. Issue the following command to extract the installation files:

```
./6.x.x.x-TIV-TSMALL-platform.bin
```

4. Back up the database. The preferred method is to use a snapshot backup. A snapshot backup is a full database backup that does not interrupt any scheduled database backups. For example, issue the following Tivoli Storage Manager administrative command:

```
backup db type=dbsnapshot devclass=tapeclass
```

See the *Administrator's Guide* for more details.

5. Back up the device configuration information. Issue the following Tivoli Storage Manager administrative command:

```
backup devconfig filenames=file_name
```

where *file\_name* specifies the name of the file in which to store device configuration information.

6. Save the volume history file to another directory or rename the file. Issue the following Tivoli Storage Manager administrative command:

```
backup volhistory filenames=file_name
```

where *file\_name* specifies the name of the file in which to store the volume history information.

7. Save a copy of the server options file, typically named `dsmserv.opt`. The file is in the server instance directory.
8. Halt the server before installing a fix pack or interim fix. Use the **HALT** command.
9. Ensure that extra space is available in the installation directory. The installation of this fix pack might require additional temporary disk space in the installation directory of the server. The amount of additional disk space

can be as much as that required for installing a new database as part of a Tivoli Storage Manager installation. The Tivoli Storage Manager installation wizard displays the amount of space that is required for installing the fix pack and the available amount. If the required amount of space is greater than the available amount, the installation stops. If the installation stops, add the required disk space to the file system and restart the installation.

10. Select one of the following ways of installing Tivoli Storage Manager.

**Important:** After a fix pack is installed, it is not necessary to go through the configuration again. You can stop after completing the installation, fix any errors, then restart your servers.

Install the Tivoli Storage Manager software by using one of the following methods:

### Installation wizard

Follow the instructions for your operating system:

“Installing Tivoli Storage Manager by using the installation wizard” on page 35

**Tip:** After you start the wizard, in the IBM Installation Manager window, click the **Update** icon; do not click the **Install** or **Modify** icon.

### Command line in console mode

Follow the instructions for your operating system:

“Installing Tivoli Storage Manager by using console mode” on page 36

### Silent mode

Follow the instructions for your operating system:

“Installing Tivoli Storage Manager in silent mode” on page 37

**Tip:** If you have multiple server instances on your system, run the installation wizard only once. The installation wizard upgrades all server instances.

## Results

If errors occur during the installation process, these errors are recorded in log files that are stored in the IBM Installation Manager logs directory.

You can view installation log files by clicking **File > View Log** from the Installation Manager tool. To collect these log files, click **Help > Export Data for Problem Analysis** from the Installation Manager tool.



---

## Chapter 5. Upgrading to Tivoli Storage Manager Version 7.1

You can upgrade a Tivoli Storage Manager V5 or V6 server to V7.1. If a V5 server is installed on an AIX, HP-UX, Solaris, or z/OS operating system, you can complete a cross-platform migration to V7.1 on a different operating system.

### About this task

To upgrade the server on the same operating system, see the upgrade instructions:

Table 16. Upgrade information

To upgrade from this version	To this version	See this information
V7.1	V7.1 fix pack or interim fix	Chapter 4, "Installing a Tivoli Storage Manager server fix pack," on page 65
V6.2 or V6.3	V7.1	"Upgrading from Tivoli Storage Manager V6.2 or V6.3 to V7.1" on page 70
V6.1	V7.1	"Upgrading from Tivoli Storage Manager V6.1 to V7.1" on page 77
V5.5	V7.1	<i>Upgrade and Migration Guide for V5 Servers</i>

For information about upgrades in a clustered environment, see "Upgrading Tivoli Storage Manager in a clustered environment" on page 78.

If a Tivoli Storage Manager V5 server is installed, and you prefer to upgrade the server to V7 on a different operating system, see the instructions for server migration:

Table 17. Migration information

To migrate the server from this operating system	To this operating system	See this information
AIX	Linux x86_64	Section about migrating Tivoli Storage Manager V5 servers on AIX, HP-UX, or Solaris systems to V7.1 on Linux in the <i>Upgrade and Migration Guide for V5 Servers</i>
HP-UX	Linux x86_64	Section about migrating Tivoli Storage Manager V5 servers on AIX, HP-UX, or Solaris systems to V7.1 on Linux in the <i>Upgrade and Migration Guide for V5 Servers</i>

## Upgrading the Tivoli Storage Manager server

Table 17. Migration information (continued)

To migrate the server from this operating system	To this operating system	See this information
Solaris	Linux x86_64	Section about migrating Tivoli Storage Manager V5 servers on AIX, HP-UX, or Solaris systems to V7.1 on Linux in the <i>Upgrade and Migration Guide for V5 Servers</i>
z/OS	AIX	Section about migrating Tivoli Storage Manager V5 servers on z/OS systems to V7 on AIX or Linux on System z in the <i>Upgrade and Migration Guide for V5 Servers</i>
z/OS	Linux on System z	Section about migrating Tivoli Storage Manager V5 servers on z/OS systems to V7 on AIX or Linux on System z in the <i>Upgrade and Migration Guide for V5 Servers</i>

To revert to an earlier version of Tivoli Storage Manager after an upgrade or migration, you must have a full database backup and the installation software for the original server. You must also have key configuration files:

- Volume history file
- Device configuration file
- Server options file
- dmserv.dsk file (for a server upgrade or migration from V5 to V7.1)

---

## Upgrading from Tivoli Storage Manager V6.2 or V6.3 to V7.1

You can upgrade the server directly from Tivoli Storage Manager V6.2 or V6.3 to V7.1. You do not need to uninstall V6.2 or V6.3.

### Before you begin

Ensure that you retain the installation media from the V6.2 or V6.3 server base release that you are upgrading. If you installed Tivoli Storage Manager from a DVD, ensure that the DVD is available. If you installed Tivoli Storage Manager from a downloaded package, ensure that the downloaded files are available. If the upgrade fails, and the server license module is uninstalled, the installation media from the server base release are required to reinstall the license.

### Procedure

To upgrade the server to V7.1, complete the following tasks:

1. "Planning the upgrade" on page 71
2. "Preparing the system" on page 72
3. "Installing the V7.1 server and verifying the upgrade" on page 74



## Planning the upgrade

Before you upgrade the server from V6.2 or V6.3 to V7.1, you must review the relevant planning information, such as system requirements and release notes. Then, select an appropriate day and time to upgrade the system so that you can minimize the impact on production operations.

### About this task

In lab tests, the process of upgrading the server from V6.2 or V6.3 to V7.1 took 14 - 45 minutes. The results that you achieve might differ, depending on your hardware and software environment, and the size of the server database.

The following table shows the results that were obtained in lab tests.

Table 18. V6 to V7 upgrade times in lab tests

Version of source system	Version of target system	Operating system	Size of server database	Random access memory	Upgrade time
V6.3.4	V7.1	AIX	17 GB	64 GB	40 minutes
V6.3.4	V7.1	AIX	487 GB	32 GB	45 minutes
V6.3.4	V7.1	AIX	3.8 TB	64 GB	35 minutes
V6.2.5	V7.1	Linux	6.16 GB	16 GB	15 minutes
V6.3.4	V7.1	Linux	30 GB	16 GB	14 minutes
V6.2.5	V7.1	Linux	70 GB	16 GB	24 minutes
V6.3.4	V7.1	Linux	1.4 TB	64 GB	30 minutes
V6.2.5	V7.1	Solaris	9.43 GB	32 GB	35 minutes
V6.3.4	V7.1	Windows	2.35 TB	64 GB	45 minutes

### Procedure

- Review the hardware and software requirements:
  - “System requirements” on page 4
  - For the latest updates related to system requirements, see the Tivoli Storage Manager support website at <http://www.ibm.com/support/docview.wss?uid=swg21243309>.
- For special instructions or specific information for your operating system, review the release notes: [http://publib.boulder.ibm.com/infocenter/tsminfo/v7r1/topic/com.ibm.itsm.nav.doc/r\\_relnotes.html](http://publib.boulder.ibm.com/infocenter/tsminfo/v7r1/topic/com.ibm.itsm.nav.doc/r_relnotes.html).
- If the server that you are upgrading is at a release level that is earlier than V6.2.3.000, review Technote 1452146 (<http://www.ibm.com/support/docview.wss?uid=swg21452146>). The technote describes improvements in the database reorganization process, and configuration changes that you might be required to make.
- Select an appropriate day and time to upgrade your system to minimize the impact on production operations. The amount of time that is required to update the system depends on the database size and many other factors. When you start the upgrade process, clients cannot connect to the server until the new software is installed and any required licenses are registered again.

### Preparing the system

To prepare the system for the upgrade from V6.2 or V6.3 to V7.1, you must gather information about each DB2 instance. Then, back up the server database, save key configuration files, cancel sessions, and stop the server.

#### Procedure

1. Log on to the computer where Tivoli Storage Manager is installed.  
Ensure that you are logged on with the instance user ID.
2. Obtain a list of DB2 instances. Issue the following system command:  
`/opt/tivoli/tsm/db2/instance/db2ilist`

The output might be similar to the following example:

```
tsminst1
```

Ensure that each instance corresponds to a server that is running on the system.

3. For each DB2 instance, note the default database path, actual database path, database name, database alias, and any DB2 variables that are configured for the instance. Keep the record for future reference. This information is required to restore the V6 database.
  - a. Obtain the default database path of the DB2 instance by issuing the following system command:  
`. ~/sql1lib/db2profile; LC_ALL=C db2 get dbm cfg | grep DFTDBPATH`

The output might be similar to the following example:

```
Default database path          (DFTDBPATH) = /tsminst1/tsminst1
```

**Tip:** If you are upgrading the server from V6.3, the default database path is `/tsminst1/tsminst1`. If you are upgrading the server from V6.2, the default database path is `/home/tsminst1/tsminst1`.

- b. Obtain information about the DB2 instance databases by issuing the following system command:  
`. ~/sql1lib/db2profile; LC_ALL=C db2 list database directory`

The output might be similar to the following example:

```
System Database Directory
```

```
Number of entries in the directory = 2
```

```
Database 1 entry:
```

```
Database alias          = TSMAL001
Database name           = TSMDB1
Node name               = TSMNODE1
Database release level  = d.00
Comment                 = TSM SERVER DATABASE VIA TCPIP
Directory entry type    = Remote
Catalog database partition number = -1
Alternate server hostname =
Alternate server port number =
```

```
Database 2 entry:
```

```
Database alias          = TSMDB1
Database name           = TSMDB1
Local database directory = /tsminst1/tsminst1
```

## Upgrading the Tivoli Storage Manager server

```
Database release level      = d.00
Comment                     = TSM SERVER DATABASE
Directory entry type       = Indirect
Catalog database partition number = 0
Alternate server hostname   =
Alternate server port number =
```

- c. Obtain the DB2 instance variables by issuing the following system command:

```
. ~/sql1lib/db2profile; LC_ALL=C db2set -all
```

The output might be similar to the following example:

```
[i] DB2_PMODEL_SETTINGS=MAX_BACKGROUND_SYSAPPS:500
[i] DB2_SKIPINSERTED=ON
[i] DB2_KEEPTABLELOCK=OFF
[i] DB2_EVALUNCOMMITTED=ON
[i] DB2_SKIPDELETED=ON
[i] DB2COMM=TCPIP
[i] DB2CODEPAGE=819
[i] DB2_PARALLEL_IO=*
[g] DB2FCMCOMM=TCPIP6
[g] DB2SYSTEM=freeride.storage.tucson.ibm.com
[g] DB2INSTDEF=tsminst1inst
```

- d. Obtain more DB2 instance information by saving the following files:

```
~/sql1lib/userprofile
```

```
~/sql1lib/usercshrc
```

For example, issue the following system commands:

```
cp ~/sql1lib/userprofile copy_location
```

```
cp ~/sql1lib/usercshrc copy_location
```

where *copy\_location* is the location where the copied file is saved.

The file content might be similar to the following example:

```
setenv DSMI_CONFIG /tsminst1/tsminst1/tsmdbmgr.opt
setenv DSMI_DIR /opt/tivoli/tsm/client/bin64
setenv DSMI_LOG /tsminst1/tsminst1
setenv LD_LIBRARY_PATH /usr/local/ibm/gsk8_64/lib64:$LD_LIBRARY_PATH
```

4. Connect to the Tivoli Storage Manager server by using an administrative user ID.
5. Back up the Tivoli Storage Manager database. For example, you can create a snapshot backup by issuing the following Tivoli Storage Manager administrative command:

```
backup db type=dbsnapshot devclass=tapeclass
```

A snapshot backup is a full database backup that does not interrupt any scheduled database backups. For more information about this command and other Tivoli Storage Manager administrative commands, see the *Administrator's Reference*.

6. Back up the device configuration information to another directory by issuing the following Tivoli Storage Manager administrative command:

```
backup devconfig filenames=file_name
```

where *file\_name* specifies the name of the file in which to store device configuration information.

**Tip:** If you decide to restore the V6 database, this file is required.

## Upgrading the Tivoli Storage Manager server

7. Back up the volume history file to another directory. Issue the following Tivoli Storage Manager administrative command:

```
backup volhistory filenames=file_name
```

where *file\_name* specifies the name of the file in which to store the volume history information.

**Tip:** If you decide to restore the V6 database, this file is required.

8. Save a copy of the server options file, which is typically named `dsmserv.opt`. The file is in the server instance directory.
9. Prevent activity on the server by disabling new sessions. Issue the following Tivoli Storage Manager administrative commands:

```
disable sessions client  
disable sessions server
```
10. Verify whether any sessions exist, and notify the users that the server will be stopped. To check for existing sessions, issue the following Tivoli Storage Manager administrative command:

```
query session
```
11. Cancel sessions by issuing the following Tivoli Storage Manager administrative command:

```
cancel session all
```

This command cancels all sessions except for your current session.

12. Stop the server by issuing the following Tivoli Storage Manager administrative command:

```
halt
```
13. Verify that the server is shut down and no processes are running. Issue the following command:

```
ps -ef | grep dsmserv
```
14. In the server instance directory of your installation, locate the `NODELOCK` file and move it to another directory, where you are saving configuration files. The `NODELOCK` file contains the previous licensing information for your installation. This licensing information is replaced when the upgrade is complete.

## Installing the V7.1 server and verifying the upgrade

To complete the process of upgrading the server from V6.2 or V6.3 to V7.1, you must install the V7.1 server. Then, verify that the upgrade was successful by starting the server instance.

### Before you begin

You must be logged on to the system by using the root user ID.

You can obtain the installation package from the product DVD or from an IBM download site.

If you plan to download the files, set the system user limit for maximum file size to unlimited to ensure that the files can be downloaded correctly.

1. To query the maximum file size value, issue the following command:

```
ulimit -Hf
```

2. If the system user limit for maximum file size is not set to unlimited, change it to unlimited by following the instructions in the documentation for your operating system.

### About this task

By using the Tivoli Storage Manager installation software, you can install the following components:

- Tivoli Storage Manager server
- Tivoli Storage Manager server languages
- Tivoli Storage Manager license
- Tivoli Storage Manager devices
- Tivoli Storage Manager Operations Center
- Tivoli Storage Manager storage agent

**Tip:** The database (DB2) and the Global Security Kit are automatically installed when you select the server component.

For more information about storage agents, see the *Storage Agent User's Guide*.

### Procedure

1. If you are obtaining the package from an IBM download site, download the appropriate package file from one of the following websites:
  - For a new release, go to Passport Advantage at <http://www.ibm.com/software/lotus/passportadvantage/>. Passport Advantage is the only website from which you can download a licensed package file.
  - For a maintenance fix, go to the Tivoli Storage Manager support site at [http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager).
2. If you are downloading the package from one of the download sites, complete the following steps:
  - a. Verify that you have enough space to store the installation files when they are extracted from the product package. For space requirements, see the download document for your product:
    - Tivoli Storage Manager: <http://www.ibm.com/support/docview.wss?uid=swg24035122>
    - Tivoli Storage Manager Extended Edition: <http://www.ibm.com/support/docview.wss?uid=swg24035635>
    - System Storage Archive Manager: <http://www.ibm.com/support/docview.wss?uid=swg24035637>
  - b. Download the package file to the directory of your choice. The path must contain no more than 128 characters. Be sure to extract the installation files to an empty directory. Do not extract to a directory that contains previously extracted files, or any other files.  
Also, ensure that you have executable permission for the package file.
  - c. If necessary, change the file permissions by issuing the following command:

```
chmod a+x package_name.bin
```

where *package\_name* is like the following example:

## Upgrading the Tivoli Storage Manager server

```
7.1.0.000-TIV-TSMSRV-Linuxx86_64.bin  
7.1.0.000-TIV-TSMSRV-Linuxs390x.bin
```

In the examples, 7.1.0.000 represents the product release level.

- d. Extract the installation files by issuing the following command:

```
./package_name.bin
```

The package is large. Therefore, the extraction takes some time.

3. Install the Tivoli Storage Manager software by using one of the following methods. During the installation process, you must install the Tivoli Storage Manager license.

### Installation wizard

To install the server by using the graphical wizard of IBM Installation Manager, follow the instructions in “Installing Tivoli Storage Manager by using the installation wizard” on page 35. Ensure that your system meets the prerequisites for using the installation wizard. Then, complete the installation procedure. In the IBM Installation Manager window, click the **Install** icon; do not click the **Update** or **Modify** icon.

**Tip:** If you have multiple server instances on your system, run the installation wizard only once. The installation wizard upgrades all server instances.

### Command line in console mode

To install the server by using the command line in console mode, follow the instructions in “Installing Tivoli Storage Manager by using console mode” on page 36.

Review the information about installing the server in console mode and then complete the installation procedure.

### Silent mode

To install the server in silent mode, follow the instructions in “Installing Tivoli Storage Manager in silent mode” on page 37. Review the information about installing the server in silent mode. Then, complete Steps 1 and 2 of the installation procedure.

4. Correct any errors that are detected during the installation process. To view installation log files, from the Installation Manager tool, click **File > View Log**. To collect log files, from the Installation Manager tool, click **Help > Export Data for Problem Analysis**.
5. Obtain any applicable fixes by going to the following website:  
[http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli\\_Storage\\_Manager](http://www.ibm.com/support/entry/portal/Overview/Software/Tivoli/Tivoli_Storage_Manager). Click **Fixes (downloads)** and apply any applicable fixes.
6. Verify that the upgrade was successful:
  - a. Start the server instance. For instructions, see “Starting the server instance” on page 55.
  - b. Monitor the messages that the server issues as it starts. Watch for error and warning messages, and resolve any issues.
  - c. Verify that you can connect to the server by using the administrative client. To start an administrative client session, issue the following Tivoli Storage Manager administrative command:  
dsmadm

- d. To obtain information about the upgraded system, run **QUERY** commands. For example, to obtain consolidated information about the system, issue the following Tivoli Storage Manager administrative command:

```
query system
```

To obtain information about the database, issue the following Tivoli Storage Manager administrative command:

```
query db format=detailed
```

7. Register the licenses for the Tivoli Storage Manager server components that are installed on your system by issuing the **REGISTER LICENSE** command:

```
register license file=installation_directory/server/bin/component_name.lic
```

where *installation\_directory* specifies the directory in which you installed the component, and *component\_name* specifies the abbreviation for the component.

For example, if you installed the server in the default directory, `/opt/tivoli/tsm`, register the license by issuing the following command:

```
register license file=/opt/tivoli/tsm/server/bin/tsmbasic.lic
```

For example, if you installed Tivoli Storage Manager Extended Edition in the `/opt/tivoli/tsm` directory, issue the following command:

```
register license file=/opt/tivoli/tsm/server/bin/tsmee.lic
```

For example, if you installed System Storage Archive Manager in the `/opt/tivoli/tsm` directory, issue the following command:

```
register license file=/opt/tivoli/tsm/server/bin/dataret.lic
```

**Restriction:** You cannot register licenses for Tivoli Storage Manager for Mail, Tivoli Storage Manager for Databases, Tivoli Storage Manager for ERP, and Tivoli Storage Manager for Space Management.

8. Optional: To install an additional language package, use the modify function of the IBM Installation Manager.
9. Optional: To upgrade to a newer version of a language package, use the update function of the IBM Installation Manager.

### What to do next

You can authenticate passwords with the LDAP directory server, or authenticate passwords with the Tivoli Storage Manager server. Passwords that are authenticated with the LDAP directory server can provide enhanced system security. For instructions, see the section about managing passwords and logon procedures in the *Administrator's Guide*.

---

## Upgrading from Tivoli Storage Manager V6.1 to V7.1

You can upgrade the Tivoli Storage Manager server from V6.1 to V6.3, and then upgrade the server to V7.1. It is not possible to upgrade the server directly from V6.1 to V7.1.

### Before you begin

Ensure that you retain the installation media from the base release of the V6.1 and V6.3 servers. If you obtained the Tivoli Storage Manager software from a DVD, ensure that the DVD is available. If you obtained the Tivoli Storage Manager

## Upgrading the Tivoli Storage Manager server

software from a downloaded package, ensure that the downloaded files are available. If the upgrade fails, and the server license module is uninstalled, the installation media from the server base release are required to reinstall the license.

### Procedure

1. Upgrade the server from V6.1 to V6.3. For instructions, go to the Tivoli Storage Manager V6.3 Information Center at <http://pic.dhe.ibm.com/infocenter/tsminfo/v6r3>. Follow the instructions for upgrading the server from V6.1 to V6.3 or later.
2. Upgrade the server from V6.3 to V7.1, as described in “Upgrading from Tivoli Storage Manager V6.2 or V6.3 to V7.1” on page 70.

---

## Upgrading Tivoli Storage Manager in a clustered environment

To upgrade a Tivoli Storage Manager server to V7.1 in a clustered environment, you must complete preparation and installation tasks. The procedures vary, depending on the operating system and release.

### Procedure

Follow the procedure for your operating system, source release, and target release:

*Table 19. Procedures for upgrading the server in a clustered environment on a Linux operating system*

Source release	Target release	Procedure
V6	V7.1	“Upgrading Tivoli Storage Manager to V7.1 in a clustered environment”

## Upgrading Tivoli Storage Manager to V7.1 in a clustered environment

You can upgrade the Tivoli Storage Manager V6 server that is installed on a Linux operating system in a clustered environment to Tivoli Storage Manager V7.1.

### About this task

To upgrade the Tivoli Storage Manager server in a clustered environment on a Linux system, review the upgrade steps in <http://www.ibm.com/support/docview.wss?uid=swg27039780>.



---

## Chapter 6. Reverting from Version 7.1 to the previous V6 server

If you must revert to the previous version of the server after an upgrade, you must have a full database backup from your original version. You must also have the server installation media for your original version and key configuration files. Carefully follow the preparation steps before you upgrade the server. By doing so, it might be possible to revert to the previous version of the Tivoli Storage Manager server with minimal loss of data.

### Before you begin

You must have the following items from the earlier version of the server:

- Server database backup
- Volume history file
- Device configuration file
- Server options file

### About this task

Use the same instructions whether you are reverting within releases or to an earlier release, for example, from 6.2.2 to 6.2.0 or from 6.2.2 to 6.1.2. The older version must match the version that you used before the upgrade to 7.1.

**Attention:** Specify the **REUSEDELAY** parameter to help prevent backup-archive client data loss when you revert the server to a previous version.

---

## Steps for reverting to the previous server version

### About this task

Complete the following steps on the system that has the V7.1 server.

### Procedure

1. Halt the server to shut down all server operations by using the **HALT** command.
2. Remove the database from the database manager, then delete the database and recovery log directories.
  - a. Manually remove the database. One way to remove it is by issuing this command:

```
dsmserv removedb tsmbd1
```
  - b. If you must reuse the space that is occupied by the database and recovery log directories, you can now delete these directories.
3. Use the uninstallation program to uninstall the V7.1 server. Uninstallation removes the server and the database manager, with their directories. For details, see Chapter 8, "Uninstalling Tivoli Storage Manager," on page 87.
4. Reinstall the version of the server program that you were using before the upgrade to V7.1. This version must match the version that your server was running when you created the database backup that you restore in a later step. For example, the server was at version 6.2.2.0 before the upgrade, and

## Reverting to a previous Version 6 server version

you intend to use the database backup that was in use on this server. You must install the 6.2.2.0 fix pack to be able to restore the database backup.

5. Copy the following files to the instance directory.
  - Device configuration file
  - Volume history file
  - The server options file (typically `dsmserv.opt`)
6. Configure the new server database by using the configuration wizard. To start the wizard, issue the following command:  

```
. /dsmicfgx
```
7. Ensure that no servers are running in the background.
8. Restore the database to a point in time before the upgrade. For more details, see the restoring the server database to a point in time section in the *Administrator's Guide*.
9. If you enabled data deduplication for any FILE-type storage pools that existed before the upgrade, or if you moved data that existed before the upgrade into new storage pools while using the V7.1 server, you must complete additional recovery steps. For more details, see "Additional recovery steps if you created new storage pools or enabled data deduplication."
10. If the **REUSEDELAY** parameter setting on storage pools is less than the age of the database that you restored, restore volumes on any sequential-access storage pools that were reclaimed after that database backup. Use the **RESTORE VOLUME** command.  
  
If you do not have a backup of a storage pool, audit the reclaimed volumes by using the **AUDIT VOLUME** command, with the **FIX=YES** parameter to resolve inconsistencies. For example:  

```
audit volume volume_name fix=yes
```
11. If client backup or archive operations were completed using the V7.1 server, audit the storage pool volumes on which the data was stored.

---

## Additional recovery steps if you created new storage pools or enabled data deduplication

If you created new storage pools, turned on data deduplication for any FILE-type storage pools, or did both while your server was running as a V7.1 server, you must complete more steps to return to the previous server version.

### Before you begin

To complete this task, you must have a complete backup of the storage pool that was created before the upgrade to V7.1.

### About this task

Use this information if you did either or both of the following actions while your server was running as a V7.1 server:

- You enabled the data deduplication function for any storage pools that existed before the upgrade to V7.1 program. Data deduplication applies only to storage pools that use a FILE device type.
- You created new, primary storage pools after the upgrade, *and* moved data that was stored in other storage pools into the new storage pools.

Complete these steps after the server is again restored to V6.

### Procedure

- For each storage pool for which you enabled the data deduplication function, restore the entire storage pool by using the **RESTORE STGPOOL** command.
- For storage pools that you created after the upgrade, determine what action to take. Data that was moved from existing, V6 storage pools into the new storage pools might be lost because the new storage pools no longer exist in your restored V6 server. Possible recovery depends on the type of storage pool:
  - If data was moved from V6 DISK-type storage pools into a new storage pool, space that was occupied by the data that was moved was probably reused. Therefore, you must restore the original, V6 storage pools, by using the storage pool backups that were created before the upgrade to V7.1.  
If *no* data was moved from V6 DISK-type storage pools into a new storage pool, then audit the storage pool volumes in these DISK-type storage pools.
  - If data was moved from V6 sequential-access storage pools into a new storage pool, that data might still exist and be usable in storage pool volumes on the restored V6 server. The data might be usable if the **REUSEDELAY** parameter for the storage pool was set to a value that prevented reclamation while the server was running as a V7.1 server. If any volumes were reclaimed while the server was running as a V7.1 server, restore those volumes from storage pool backups that were created before the upgrade to V7.1.

## Reverting to a previous Version 6 server version

## Chapter 7. Reference: DB2 commands for Tivoli Storage Manager server databases

Use this list as reference when you are directed to issue DB2 commands by IBM support.

### Purpose

After using the wizards to install and configure Tivoli Storage Manager, you seldom need to issue DB2 commands. A limited set of DB2 commands that you might use or be asked to issue are listed in Table 20. This list is supplemental material only and is not a comprehensive list. There is no implication that a Tivoli Storage Manager administrator will use it on a daily or ongoing basis. Samples of some commands are provided. Details of output are not listed.

For a full explanation of the commands described here and of their syntax, see <http://pic.dhe.ibm.com/infocenter/db2luw/v10r5>.

Table 20. DB2 commands

Command	Description	Example
<b>db2icrt</b>	Creates DB2 instances in the home directory of the instance owner. <b>Tip:</b> The Tivoli Storage Manager configuration wizard creates the instance used by the server and database. After a server is installed and configured through the configuration wizard, the <b>db2icrt</b> command is generally not used.  This utility is in the DB2DIR/instance directory, where DB2DIR represents the installation location where the current version of the DB2 database system is installed.	Manually create a Tivoli Storage Manager instance. Enter the command on one line:  <code>/opt/tivoli/tsm/db2/instance/ db2icrt -a server -s ese -u instance_name instance_name</code>
<b>db2set</b>	Displays DB2 variables.	List DB2 variables: db2set
<b>CATALOG DATABASE</b>	Stores database location information in the system database directory. The database can be located either on the local workstation or on a remote database partition server. The server configuration wizard takes care of any catalog needed for using the server database. Run this command manually, after a server is configured and running, only if something in the environment changes or is damaged.	Catalog the database: db2 catalog database tsmdb1
<b>CONNECT TO DATABASE</b>	Connects to a specified database for command-line interface (CLI) use.	Connect to the Tivoli Storage Manager database from a DB2 CLI: db2 connect to tsmdb1

## Reference: DB2 commands for Tivoli Storage Manager server databases

Table 20. DB2 commands (continued)

Command	Description	Example
<b>GET DATABASE CONFIGURATION</b>	Returns the values of individual entries in a specific database configuration file. <b>Important:</b> This command and parameters are set and managed directly by DB2. They are listed here for informational purposes and a means to view the existing settings. Changing these settings might be advised by IBM support or through service bulletins such as APARs or Technical Guidance documents (technotes). Do not change these settings manually. Change them only at the direction of IBM and only through the use of Tivoli Storage Manager server commands or procedures.	Show the configuration information for a database alias: db2 get db cfg for tsmdb1  Retrieve information in order to verify settings such as database configuration, log mode, and maintenance. db2 get db config for tsmdb1 show detail
<b>GET DATABASE MANAGER CONFIGURATION</b>	Returns the values of individual entries in a specific database configuration file. <b>Important:</b> This command and parameters are set and managed directly by DB2. They are listed here for informational purposes and a means to view the existing settings. Changing these settings might be advised by IBM support or through service bulletins such as APARs or Technical Guidance documents (technotes). Do not change these settings manually. Change them only at the direction of IBM and only through the use of Tivoli Storage Manager server commands or procedures.	Retrieve configuration information for the database manager: db2 get dbm cfg
<b>GET HEALTH SNAPSHOT</b>	Retrieves the health status information for the database manager and its databases. The information returned represents a snapshot of the health state at the time the command was issued. Tivoli Storage Manager monitors the state of the database using the health snapshot and other mechanisms that are provided by DB2. There might be cases where the health snapshot or other DB2 documentation indicates that an item or database resource might be in an alert state. Such a case indicates that action must be considered to remedy the situation. Tivoli Storage Manager monitors the condition and responds appropriately. Not all declared alerts by the DB2 database are acted on.	Receive a report on DB2 health monitor indicators: db2 get health snapshot for database on tsmdb1
<b>GRANT (Database Authorities)</b>	Grants authorities that apply to the entire database rather than privileges that apply to specific objects within the database.	Grant access to the user ID itmuser: db2 GRANT CONNECT ON DATABASE TO USER itmuser db2 GRANT CREATETAB ON DATABASE TO USER itmuser

## Reference: DB2 commands for Tivoli Storage Manager server databases

Table 20. DB2 commands (continued)

Command	Description	Example
<b>RUNSTATS</b>	<p>Updates statistics about the characteristics of a table and associated indexes or statistical views. These characteristics include number of records, number of pages, and average record length.</p> <p>To see a table, issue this utility after updating or reorganizing the table.</p> <p>A view must be enabled for optimization before its statistics can be used to optimize a query. A view that is enabled for optimization is known as a statistical view. Use the DB2 <b>ALTER VIEW</b> statement to enable a view for optimization. Issue the <b>RUNSTATS</b> utility when changes to underlying tables substantially affect the rows returned by the view.</p> <p><b>Tip:</b> The server configures DB2 to run the <b>RUNSTATS</b> command as needed.</p>	<p>Update statistics on a single table.</p> <pre>db2 runstats on table SCHEMA_NAME.TABLE_NAME with distribution and sampled detailed indexes all</pre>
<b>SET SCHEMA</b>	<p>Changes the value of the <b>CURRENT SCHEMA</b> special register, in preparation for issuing SQL commands directly through the DB2 CLI.</p> <p><b>Tip:</b> A special register is a storage area that is defined for an application process by the database manager. It is used to store information that can be referenced in SQL statements.</p>	<p>Set the schema for Tivoli Storage Manager:</p> <pre>db2 set schema tsmdb1</pre>
<b>START DATABASE MANAGER</b>	<p>Starts the current database manager instance background processes. The Tivoli Storage Manager server starts and stops the instance and database whenever the server starts and halts.</p> <p><b>Important:</b> Allow the Tivoli Storage Manager server to manage the starting and stopping of the instance and database unless otherwise directed by IBM support.</p>	<p>Start the database manager:</p> <pre>db2start</pre>
<b>STOP DATABASE MANAGER</b>	<p>Stops the current database manager instance. Unless explicitly stopped, the database manager continues to be active. This command does not stop the database manager instance if any applications are connected to databases. If there are no database connections, but there are instance attachments, the command forces the instance attachments to stop first. Then, it stops the database manager. This command also deactivates any outstanding database activations before stopping the database manager.</p> <p>This command is not valid on a client.</p> <p>The Tivoli Storage Manager server starts and stops the instance and database whenever the server starts and halts.</p> <p><b>Important:</b> Allow the Tivoli Storage Manager server to manage the starting and stopping of the instance and database unless otherwise directed by IBM support.</p>	<p>Stop the database manager:</p> <pre>db2 stop dbm</pre>





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## Chapter 8. Uninstalling Tivoli Storage Manager

You can use the following procedures to uninstall Tivoli Storage Manager. Before you remove Tivoli Storage Manager, ensure that you do not lose your backup and archive data.

### Before you begin

Complete the following steps before you uninstall Tivoli Storage Manager:

- Complete a full database backup.
- Save a copy of the volume history and device configuration files.
- Store the output volumes in a safe location.

### About this task

You can uninstall Tivoli Storage Manager by using any of the following methods: a graphical wizard, the command line in console mode, or silent mode.

“Uninstalling Tivoli Storage Manager by using a graphical wizard”

“Uninstalling Tivoli Storage Manager in console mode” on page 88

“Uninstalling Tivoli Storage Manager in silent mode” on page 88

### What to do next

See Chapter 2, “Installing the Tivoli Storage Manager server components,” on page 33 for installation steps to reinstall the Tivoli Storage Manager components.

---

## Uninstalling Tivoli Storage Manager by using a graphical wizard

You can uninstall Tivoli Storage Manager by using the IBM Installation Manager installation wizard.

### Procedure

1. Start the Installation Manager.  
In the directory where the Installation Manager is installed, go to the `eclipse` subdirectory (for example, `/opt/IBM/InstallationManager/eclipse`), and issue the following command:  

```
./IBMIM
```
2. Click **Uninstall**.
3. Select **IBM Tivoli Storage Manager server**, and click **Next**.
4. Click **Uninstall**.
5. Click **Finish**.

### Uninstalling Tivoli Storage Manager in console mode

To uninstall Tivoli Storage Manager by using the command line, you must run the uninstallation program of IBM Installation Manager from the command line with the parameter for console mode.

#### Procedure

1. In the directory where IBM Installation Manager is installed, go to the following subdirectory:  
`eclipse/tools`  
For example:  
`/opt/IBM/InstallationManager/eclipse/tools`
2. From the `tools` directory, issue the following command:  
`./imcl -c`
3. To uninstall, enter 5.
4. Choose to uninstall from the IBM Tivoli Storage Manager package group.
5. Enter N for Next.
6. Choose to uninstall the IBM Tivoli Storage Manager server package.
7. Enter N for Next.
8. Enter U for Uninstall.
9. Enter F for Finish.

---

### Uninstalling Tivoli Storage Manager in silent mode

To uninstall Tivoli Storage Manager in silent mode, you must run the uninstallation program of IBM Installation Manager from the command line with the parameters for silent mode.

#### Before you begin

The input directory, which is in the directory where the installation package is extracted, contains the following sample response files for installing, updating, and uninstalling the server:

- `install_response_sample.xml`
- `update_response_sample.xml`
- `uninstall_response_sample.xml`

You can use these sample files as they are with the default values, or you can customize them to suit your needs.

#### Procedure

1. In the directory where IBM Installation Manager is installed, go to the following subdirectory:  
`eclipse/tools`  
For example:  
`/opt/IBM/InstallationManager/eclipse/tools`
2. From the `tools` directory, issue the following command, where *response\_file* represents the response file path, including the file name:

```
./imcl -input response_file -silent
```

The following command is an example:

```
./imcl -input /tmp/input/uninstall_response.xml -silent
```

---

### Uninstalling and reinstalling Tivoli Storage Manager

If you plan to manually reinstall Tivoli Storage Manager instead of using the wizard, there are a number of steps to take to preserve your server instance names and database directories. During an uninstallation, any server instances previously set up are removed, but the database catalogs for those instances still exist.

#### About this task

If you are using the wizard to upgrade from Tivoli Storage Manager Version 6.2 or Version 6.3, it is not necessary to complete these steps, the wizard completes them automatically. To manually uninstall and reinstall Tivoli Storage Manager, complete the following steps:

1. Make a list of your current server instances before proceeding to the uninstallation. Run the following command:

```
/opt/tivoli/tsm/db2/instance/db2ilist
```

2. Run the following commands for every server instance:

```
db2 attach to instance_name  
db2 get dbm cfg show detail  
db2 detach
```

Keep a record of the database path for each instance.

3. Uninstall Tivoli Storage Manager. See Chapter 8, “Uninstalling Tivoli Storage Manager,” on page 87.
4. When you uninstall any version of Tivoli Storage Manager 6.1 or later, including a fix pack, an instance file is created. The instance file is created to help reinstall Tivoli Storage Manager. Check this file and use the information when you are prompted for the instance credentials when reinstalling. In silent installation mode, you provide these credentials using the `INSTANCE_CRED` variable.

You can find the instance file in the following location:

```
/etc/tivoli/tsm/instanceList.obj
```

5. Reinstall Tivoli Storage Manager. See Chapter 2, “Installing the Tivoli Storage Manager server components,” on page 33.
6. Recreate your server instances. See “Creating the server instance” on page 47.

**Tip:** The installation wizard configures the server instances but you must verify that they exist. If they do not exist, you must manually configure them.

7. Catalog the database. Log in to each server instance as the instance user, one at a time, and issue the following commands:

```
db2 catalog database tsmdb1  
db2 attach to instance_name  
db2 update dbm cfg using dftdbpath instance_directory  
db2 detach
```

8. Verify that the server instance was created successfully. Issue this command:

```
/opt/tivoli/tsm/db2/instance/db2ilist
```

## Uninstalling Tivoli Storage Manager

9. Verify that Tivoli Storage Manager recognizes the server instance by listing your directories. Your home directory appears if you did not change it. Your instance directory does appear if you used the configuration wizard. Issue this command:

```
db2 list database directory
```

If you see TSMDB1 listed, you can start the server.

---

## Part 2. Installing and upgrading Tivoli Monitoring for Tivoli Storage Manager

IBM Tivoli Monitoring for Tivoli Storage Manager is not delivered with Tivoli Storage Manager V7.1.

### **About this task**

You can use Tivoli Monitoring for Tivoli Storage Manager Version 6.3.4 with any Tivoli Storage Manager Version 5.5 or later server. For more information about installing and configuring Tivoli Monitoring for Tivoli Storage Manager, see Technote 1649883 at: <http://www.ibm.com/support/docview.wss?uid=swg21649883>.



---

## Part 3. Installing and upgrading the Operations Center

The IBM Tivoli Storage Manager Operations Center is the web-based interface for managing your storage environment.

### Before you begin

Before you install and configure the Operations Center, review the following information:

- “System requirements for the Operations Center” on page 95
  - “Operations Center computer requirements” on page 96
  - “Hub and spoke server requirements” on page 96
  - “Operating system requirements” on page 99
  - “Web browser requirements” on page 100
  - “Language requirements” on page 100
- “Administrator IDs that the Operations Center requires” on page 101
- “IBM Installation Manager” on page 102
- “Installation checklist” on page 102
- “Obtaining the Operations Center installation package” on page 105

### About this task

Table 21 lists the methods for installing or uninstalling the Operations Center and indicates where to find the associated instructions.

For information about upgrading the Operations Center, see Chapter 11, “Upgrading the Operations Center,” on page 109.

*Table 21. Methods for installing or uninstalling the Operations Center*

Method	Instructions
Graphical wizard	<ul style="list-style-type: none"><li>• “Installing the Operations Center by using a graphical wizard” on page 106</li><li>• “Uninstalling the Operations Center by using a graphical wizard” on page 125</li></ul>
Console mode	<ul style="list-style-type: none"><li>• “Installing the Operations Center in console mode” on page 106</li><li>• “Uninstalling the Operations Center in console mode” on page 125</li></ul>
Silent mode	<ul style="list-style-type: none"><li>• “Installing the Operations Center in silent mode” on page 106</li><li>• “Uninstalling the Operations Center in silent mode” on page 126</li></ul>





---

## Chapter 9. Planning to install the Operations Center

Before you install the Operations Center, you must understand the system requirements, the administrator IDs that the Operations Center requires, and the information that you must provide to the installation program.

### About this task

From the Operations Center, you can manage the following primary aspects of the storage environment:

- Tivoli Storage Manager servers and clients
- Services such as backup and restore, archive and retrieve, and migrate and recall
- Storage pools and storage devices

The Operations Center includes the following features:

#### User interface for multiple servers

You can use the Operations Center to manage one or more Tivoli Storage Manager servers.

In an environment with multiple Tivoli Storage Manager servers, you can designate one Tivoli Storage Manager server as a *hub server* and the others as *spoke servers*. The hub server can receive alerts and status information from the spoke servers and present the information in a consolidated view in the Operations Center.

#### Alert monitoring

An *alert* is a notification of a relevant problem on the Tivoli Storage Manager server and is triggered by a Tivoli Storage Manager server message. You can define which server messages trigger alerts, and only those messages are reported as alerts in the Operations Center or in an email.

This alert monitoring can help you identify and track relevant problems on the Tivoli Storage Manager server.

#### Convenient command-line interface

The Operations Center includes a command-line interface for advanced features and configuration.

---

## System requirements for the Operations Center

Before you install the Operations Center, ensure that your system meets the minimum requirements.

Use the Operations Center System Requirements Calculator to estimate the system requirements for running the Operations Center and the hub and spoke servers that are monitored by the Operations Center.

### Requirements that are verified during the installation

Table 22 on page 96 lists the prerequisite requirements that are verified during the installation and indicates where to find more information about these requirements.

## Planning to install the Operations Center

Table 22. Requirements that are verified during the installation

Requirement	Details
Minimum memory requirement	"Operations Center computer requirements"
Operating system requirement	"Operating system requirements" on page 99
Host name for the computer where the Operations Center will be installed	"Installation checklist" on page 102
Requirements for the Operations Center installation directory	"Installation checklist" on page 102

### Operations Center computer requirements

You can install the Operations Center on the same computer as a Tivoli Storage Manager server or on a different computer. If you install the Operations Center on the same computer as a Tivoli Storage Manager server, that computer must meet the system requirements for both the Operations Center and the Tivoli Storage Manager server.

#### Resource requirements

The following resources are required to run the Operations Center:

- One processor core
- 4 GB of memory
- 1 GB of disk space

The hub and spoke servers that are monitored by the Operations Center require additional resources, as described in "Hub and spoke server requirements."

### Hub and spoke server requirements

When you open the Operations Center for the first time, you must associate the Operations Center with a Tivoli Storage Manager server that is designated as the *hub server*. In a multiple-server environment, you can connect the other servers, called *spoke servers*, to the hub server.

The spoke servers send alerts and status information to the hub server. The Operations Center shows you a consolidated view of alerts and status information for the hub server and any spoke servers.

If only one Tivoli Storage Manager server is monitored by the Operations Center, that server is still called a hub server, even though no spoke servers are connected to it.

Table 23 on page 97 indicates the version of Tivoli Storage Manager server that must be installed on the hub server and on each spoke server that is managed by the Operations Center.

Table 23. Tivoli Storage Manager server version requirements for hub and spoke servers

Operations Center	Tivoli Storage Manager on the hub server	Tivoli Storage Manager on each spoke server
V7.1	V7.1 or later	V6.3.4 or later  <b>Tip:</b> Some Operations Center function is not available for servers that use a version earlier than V7.1.

### Number of spoke servers that a hub server can support

The number of spoke servers that a hub server can support is dependent on the configuration and on the version of Tivoli Storage Manager on each spoke server. However, a general guideline is that a hub server can support 10 - 20 V6.3.4 spoke servers but can support more V7.1 spoke servers.

### Tips for designing the hub and spoke server configuration

In designing the hub and spoke configuration, especially consider the resource requirements for status monitoring. Also, consider how you want to group hub and spoke servers and whether you want to use multiple hub servers.

Use the Operations Center System Requirements Calculator to estimate the system requirements for running the Operations Center and the hub and spoke servers that are monitored by the Operations Center.

### Primary factors that affect performance

The following factors have the most significant impact on the performance of the Operations Center:

- The processor and memory on the computer where the Operations Center is installed
- The system resources of the hub and spoke servers, including the disk system that is in use for the hub server database
- The number of Tivoli Storage Manager client nodes and virtual machine file spaces that are managed by the hub and spoke servers
- The frequency at which data is refreshed in the Operations Center

For information about optimizing performance, see the information about tuning the Operations Center in *Tivoli Storage Manager Optimizing Performance*.

### How to group hub and spoke servers

Consider grouping hub and spoke servers by geographic location. For example, managing the servers within the same data center can help prevent issues that are caused by firewalls or by inadequate network bandwidth between different locations. If necessary, you can further divide servers according to one or more of the following characteristics:

- The administrator who manages the servers
- The organizational entity that funds the servers
- Server operating system
- The language in which the servers run

## Planning to install the Operations Center

**Tip:** If the hub and spoke servers are not running in the same language, you might see corrupted text in the Operations Center.

### When to use multiple hub servers

If you have more than 10 - 20 V6.3.4 spoke servers, or if resource limitations require the environment to be partitioned, you can configure multiple hub servers, and connect a subset of the spoke servers to each hub server.

#### Restrictions:

- A single server cannot be both a hub server and a spoke server.
- Each spoke server can be assigned to only one hub server.
- Each hub server requires a separate instance of the Operations Center, each of which has a separate web address.

### Tips for choosing a hub server

For the hub server, you must choose a Tivoli Storage Manager server that has adequate resources and is located for minimal roundtrip network latency.

For more information about server resource usage and about the effect of the network on performance, see the information about tuning Operations Center performance in *Tivoli Storage Manager Optimizing Performance*.

**Attention:** Do not use the same Tivoli Storage Manager server as the hub server for multiple Operations Centers.

Use the following guidelines in deciding which server to designate as the hub server:

#### Choose a lightly loaded server

Consider a Tivoli Storage Manager server that has a light load for Tivoli Storage Manager operations such as client backup and archive. A lightly loaded server is also a good choice as the host system for the Operations Center.

Ensure that the server has the resources to handle both its typical Tivoli Storage Manager server workload and the estimated workload for acting as the hub server.

#### Locate the server for minimal roundtrip network latency

Locate the hub server so that the network connection between the hub server and the spoke servers has a roundtrip latency that is no greater than 5 ms. This latency can typically be achieved when the servers are on the same local area network (LAN).

Networks that are poorly tuned, are heavily used by other applications, or have roundtrip latency much higher than 5 ms can degrade communications between the hub and spoke servers. For example, roundtrip latencies of 50 ms or higher can result in communication timeouts that cause spoke servers to disconnect or reconnect to the Operations Center. Such high latencies might be experienced in long-distance, wide area network (WAN) communications.

If spoke servers are a long distance from the hub server and experience frequent disconnects in the Operations Center, you can increase the value of the **ADMINCOMMTIMEOUT** option on each server to reduce the problem.

### Verify that the hub server meets the resource requirements for status monitoring

Status monitoring requires extra resources on each server on which it is enabled. The resources that are required depend primarily on the number of clients that are managed by the hub and spoke servers. Fewer resources are used on a hub server with a V7.1 spoke server than on a hub server with a V6.3.4 spoke server.

Verify that the hub server meets the resource requirements for processor usage, database space, archive log space, and I/O operations per second (IOPS) capacity.

A hub server with high IOPS capacity can handle a larger amount of incoming status data from spoke servers. Use of the following storage devices for the hub server database can help meet this capacity:

- An enterprise-level solid-state drive (SSD)
- An external SAN disk storage device with multiple volumes or multiple spindles under each volume

In an environment with fewer than 1000 clients, consider establishing a baseline capacity of 1000 IOPS for the hub server database if the hub server manages any spoke servers.

### Determine whether your environment requires multiple hub servers

If more than 10,000 - 20,000 client nodes and virtual machine file spaces are managed by one set of hub and spoke servers, the resource requirements might exceed what the hub server has available, especially if the spoke servers are Tivoli Storage Manager V6.3.4 servers. Consider designating a second server as a hub server and moving spoke servers to the new hub server to balance the load.

## Operating system requirements

The Operations Center is available for AIX, Linux, and Windows systems.

You can run the Operations Center on the following systems:

- Linux x86\_64 and IBM System z systems:
  - Red Hat Enterprise Linux 5, update 6 or later
  - Red Hat Enterprise Linux 6, all updates
  - SUSE Linux Enterprise Server 10, Service Pack 3 or later
  - SUSE Linux Enterprise Server 11, all updates

Although you cannot run the Operations Center on HP-UX or Oracle Solaris systems, you can use the Operations Center to manage Tivoli Storage Manager V6.3.4 or later servers that run on any supported server operating system.

The operating systems on which the server can run are not limited to those on which the Operations Center can run.

### Web browser requirements

The Operations Center can run in Apple, Google, Microsoft, and Mozilla web browsers.

For optimal viewing of the Operations Center in the web browser, ensure that the screen resolution for the system is set to a minimum of 1024 X 768 pixels.

For optimal performance, use a web browser that has good JavaScript performance, and enable browser caching.

The Operations Center can run in the following web browsers:

- Apple Safari on the iPad
- Google Chrome
- Microsoft Internet Explorer 9 and 10
- Mozilla Firefox ESR 10 or later

### Language requirements

By default, the Operations Center uses the language that the web browser uses. However, the installation process uses the language that the operating system uses. Verify that the web browser and the operating system are set to the language that you require.

*Table 24. Operations Center language values that you can use on Linux systems*

Language	Language option value
Chinese, Simplified	zh_CN
Chinese, Simplified (GBK)	zh_CN.gb18030
Chinese, Simplified (UTF-8)	zh_CN.utf8
Chinese, Traditional (Big5)	Zh_TW
Chinese, Traditional (euc_tw)	zh_TW
Chinese, Traditional (UTF-8)	zh_TW.utf8
English, United States	en_US
English (UTF-8)	en_US.utf8
French	fr_FR
French (UTF-8)	fr_FR.utf8
German	de_DE
German (UTF-8)	de_DE.utf8
Italian	it_IT
Italian (UTF-8)	it_IT.utf8
Japanese (EUC)	ja_JP
Japanese (UTF-8)	ja_JP.utf8
Korean	ko_KR
Korean (UTF-8)	ko_KR.utf8
Portuguese, Brazilian	pt_BR
Portuguese, Brazilian (UTF-8)	pt_BR.utf8
Russian	ru_RU
Russian (UTF-8)	ru_RU.utf8

Table 24. Operations Center language values that you can use on Linux systems (continued)

Language	Language option value
Spanish	es_ES
Spanish (UTF-8)	es_ES.utf8

## Administrator IDs that the Operations Center requires

An administrator must have a valid ID and password on the hub server to log in to the Operations Center. An administrator ID is also assigned to the Operations Center so that the Operations Center can monitor servers.

The Operations Center requires the following Tivoli Storage Manager administrator IDs:

### Administrator IDs that are registered on the hub server

Any administrator ID that is registered on the hub server can be used to log in to the Operations Center. The authority level of the ID determines which tasks can be completed. You can create new administrator IDs by using the **REGISTER ADMIN** command.

**Restriction:** To use an administrator ID in a multiple-server configuration, the ID must be registered on the hub and spoke servers with the same password and authority level.

To manage authentication for these servers, consider using one of the following methods:

- A Lightweight Directory Access Protocol (LDAP) server
- The Tivoli Storage Manager enterprise configuration functions to automatically distribute changes to the administrator definitions.

For more information about the enterprise configuration functions, see the information about managing a network of Tivoli Storage Manager servers in the *Administrator's Guide*.

### Monitoring administrator ID

When you initially configure the hub server, an administrator ID named `IBM-OC-server_name` is registered with system authority on the hub server and is associated with the initial password that you specify. This ID, which is sometimes called the *monitoring administrator*, is intended for use only by the Operations Center.

Do not delete, lock, or modify this ID. The same administrator ID with the same password is registered on the spoke servers that you add. The password is automatically changed on the hub and spoke servers every 90 days. You do not need to use or manage this password.

### IBM Installation Manager

The Operations Center uses IBM Installation Manager, which is an installation program that can use remote or local software repositories to install or update many IBM products.

If the required version of IBM Installation Manager is not already installed, it is automatically installed or upgraded when you install the Operations Center. It must remain installed on the system so that the Operations Center can be updated or uninstalled later as needed.

The following list contains explanations of some terms that are used in IBM Installation Manager:

#### **Offering**

An installable unit of a software product.

The Operations Center offering contains all of the media that IBM Installation Manager requires to install the Operations Center.

#### **Package**

The group of software components that are required to install an offering.

The Operations Center package contains the following components:

- IBM Installation Manager installation program
- Operations Center offering

#### **Package group**

A set of packages that share a common parent directory.

The default package group for the Operations Center package is IBM Tivoli Storage Manager.

#### **Repository**

A remote or local storage area for data and other application resources.

The Operations Center package is stored in a repository on IBM Fix Central.

#### **Shared resources directory**

A directory that contains software files or plug-ins that are shared by packages.

IBM Installation Manager stores installation-related files in the shared resources directory, including files that are used for rolling back to a previous version of the Operations Center.

---

### Installation checklist

Before you install the Operations Center, you must verify certain information, such as the installation credentials, and you must determine the input to provide to IBM Installation Manager for the installation.

The following checklist highlights the information that you must verify or determine before you install the Operations Center, and Table 25 on page 103 describes the details of this information:

- Verify the host name for the computer where the Operations Center will be installed.
- Verify the installation credentials.



## Planning to install the Operations Center

- Determine the Operations Center installation directory, if you do not want to accept the default path.
- Determine the IBM Installation Manager installation directory, if you do not want to accept the default path.
- Determine the port number to be used by the Operations Center web server, if you do not want to accept the default port number.
- Determine the password for secure communications.

Table 25. Information to verify or determine before you install the Operations Center

Information	Details
Host name for the computer where the Operations Center will be installed	<p>The host name must meet the following criteria:</p> <ul style="list-style-type: none"> <li>• It must not contain double-byte character set (DBCS) characters or the underscore character (_).</li> <li>• Although the host name can contain the hyphen character (-), it cannot have a hyphen as the last character in the name.</li> </ul>
Installation credentials	<p>To install the Operations Center, you must use the following user account:</p> <ul style="list-style-type: none"> <li>• root</li> </ul>
Operations Center installation directory	<p>The Operations Center is installed in the ui subdirectory of the installation directory.</p> <p>The following path is the default path for the Operations Center installation directory:</p> <ul style="list-style-type: none"> <li>• /opt/tivoli/tsm</li> </ul> <p>For example, if you use this default path, the Operations Center is installed in the following directory:</p> <p>/opt/tivoli/tsm/ui</p> <p>The installation directory path must meet the following criteria:</p> <ul style="list-style-type: none"> <li>• The path must contain no more than 128 characters.</li> <li>• The path must include only ASCII characters.</li> <li>• The path cannot include non-displayable control characters.</li> <li>• The path cannot include any of the following characters:</li> </ul> <p>%   &lt; &gt; ' " \$ &amp; ; *</p>
IBM Installation Manager installation directory	<p>The following path is the default path for the IBM Installation Manager installation directory:</p> <ul style="list-style-type: none"> <li>• /opt/IBM/InstallationManager</li> </ul>

## Planning to install the Operations Center

Table 25. Information to verify or determine before you install the Operations Center (continued)

Information	Details
<p>Port number that is used by the Operations Center web server</p>	<p>The value for the secure (https) port number must meet the following criteria:</p> <ul style="list-style-type: none"> <li>• The number must be an integer in the range 1024 - 65535.</li> <li>• The number cannot be in use or allocated to other programs.</li> </ul> <p>If you do not specify a port number, the default value is 11090.</p> <p><b>Tip:</b> If you later do not remember the port number that you specified, refer to the following file, where <i>installation_dir</i> represents the directory where the Operations Center is installed:</p> <ul style="list-style-type: none"> <li>• <i>installation_dir</i>/ui/Liberty/usr/servers/guiServer/bootstrap.properties</li> </ul> <p>The bootstrap.properties file contains the Tivoli Storage Manager server connection information.</p>
<p>Password for secure communications</p>	<p>The Operations Center uses Hypertext Transfer Protocol Secure (HTTPS) to communicate with web browsers. You can optionally use the Secure Sockets Layer (SSL) protocol to secure communications between the Operations Center and the hub server, and between Tivoli Storage Manager servers.</p> <p>The truststore file of the Operations Center contains the SSL certificate that the Operations Center uses for HTTPS communication with web browsers. During installation of the Operations Center, you create a password for the truststore file.</p> <p><b>Tip:</b> If you later choose to set up SSL communication between the Operations Center and the hub server, you must use the same password to add the SSL certificate of the hub server to the truststore file.</p> <p>The password for the truststore file must meet the following criteria:</p> <ul style="list-style-type: none"> <li>• The password must contain a minimum of 6 characters and a maximum of 64 characters.</li> <li>• The password must contain at least the following characters: <ul style="list-style-type: none"> <li>– One uppercase letter (A – Z)</li> <li>– One lowercase letter (a – z)</li> <li>– One digit (0 – 9)</li> <li>– Two of the following non-alphanumeric characters:  ~ ! @ # \$ % ^ &amp; * _ - + = `    ( ) { } [ ] : ; &lt; &gt; , . ? /</li> </ul> </li> </ul>

### Related tasks:

“Configuring for SSL communication” on page 115

“Resetting the password for the Operations Center truststore file” on page 120

---

## Chapter 10. Installing the Operations Center

You can install the Operations Center by using any of the following methods: a graphical wizard, the command line in console mode, or silent mode.

### Before you begin

You cannot configure the Operations Center until you install, configure, and start the Tivoli Storage Manager server. Therefore, before you install the Operations Center, install the appropriate Tivoli Storage Manager server package, according to the server version requirements in “Hub and spoke server requirements” on page 96.

You can install the Operations Center on a computer with the Tivoli Storage Manager server or on a separate computer.

---

### Obtaining the Operations Center installation package

You can obtain the installation package from the product DVD or from an IBM download site such as IBM Passport Advantage or IBM Fix Central.

#### About this task

If you obtain the package from the product DVD, ensure that the installation files are visible on the DVD drive.

If you obtain the package from an IBM download site, you must extract the installation files.

#### Procedure

Use the following procedure to extract the Operations Center installation files:

- On Linux systems:
  1. Download one of the following package files to the directory of your choice:
    - 7.1.0.000-TIV-TSMOC-LinuxS390.bin
    - 7.1.0.000-TIV-TSMOC-Linuxx64.bin
  2. Ensure that you have executable permission for the package file.  
If necessary, change the file permissions by issuing the following command:  
`chmod a+x package_name.bin`
  3. Issue the following command to extract the installation files:  
`./package_name.bin`  
The self-extracting package file is extracted to the directory.

### Installing the Operations Center by using a graphical wizard

You can install or update the Operations Center by using the graphical wizard of IBM Installation Manager.

#### Procedure

1. From the directory where the Operations Center installation package file is extracted, issue the following command:  

```
./install.sh
```
2. Follow the wizard instructions to install the IBM Installation Manager and Operations Center packages.

#### What to do next

See “Configuring the Operations Center” on page 111.

---

### Installing the Operations Center in console mode

You can install or update the Operations Center by using the command line in console mode.

#### Procedure

1. From the directory where the installation package file is extracted, run the following program:  

```
./install.sh -c
```
2. Follow the console instructions to install the Installation Manager and Operations Center packages.

#### What to do next

See “Configuring the Operations Center” on page 111.

---

### Installing the Operations Center in silent mode

You can install or update the Operations Center in silent mode. In silent mode, the installation does not send messages to a console but instead stores messages and errors in log files. A silent installation can use response files for data input.

#### Before you begin

The input directory, which is in the directory where the installation package is extracted, contains the following sample response files for installing, updating, and uninstalling the Operations Center:

- `install_response_sample.xml`
- `update_response_sample.xml`
- `uninstall_response_sample.xml`

You can use these sample files as they are, with the default values, or you can customize them.

#### Procedure

1. Create a response file, or use one of the following default response files:
  - `install_response_sample.xml`

- `update_response_sample.xml`

If you use a default response file, update the following line of the file to create a password for the truststore file of the Operations Center, where *mypassword* represents the password:

```
<data key='user.SSL_PASSWORD' value='mypassword' />
```

For more information about this password, see Installation checklist.

To generate a response file as part of a console-mode installation, complete the selection of the console-mode installation options. Then, in the Summary panel, enter `G` to generate the response file according to the previously selected options.

2. From the directory where the installation package file is extracted, issue the following command, where *response\_file* represents the response file path, including the file name:
  - `./install.sh -s -input response_file -acceptLicense`

### What to do next

See “Configuring the Operations Center” on page 111.



---

## Chapter 11. Upgrading the Operations Center

You can upgrade the Operations Center by using any of the following methods: a graphical wizard, the command line in console mode, or silent mode.

### About this task

The instructions for upgrading the Operations Center are the same as the instructions for installing the Operations Center, with the following exceptions:

- You use the **Update** function of IBM Installation Manager rather than the **Install** function.

**Tip:** In IBM Installation Manager, the term *update* means to discover and install updates and fixes to installed software packages. In this context, *update* and *upgrade* are synonymous.

- If you are upgrading the Operations Center in silent mode, you can skip the step of creating a password for the truststore file.

## Upgrading the Operations Center



---

## Chapter 12. Getting started with the Operations Center

Before you can use the Operations Center to manage your storage environment, you must configure it.

### About this task

After you install the Operations Center, complete the following basic configuration steps:

1. Designate the hub server.
2. Add any spoke servers.
3. Optionally, configure email alerts on the hub and spoke servers.

Figure 3 illustrates an Operations Center configuration.

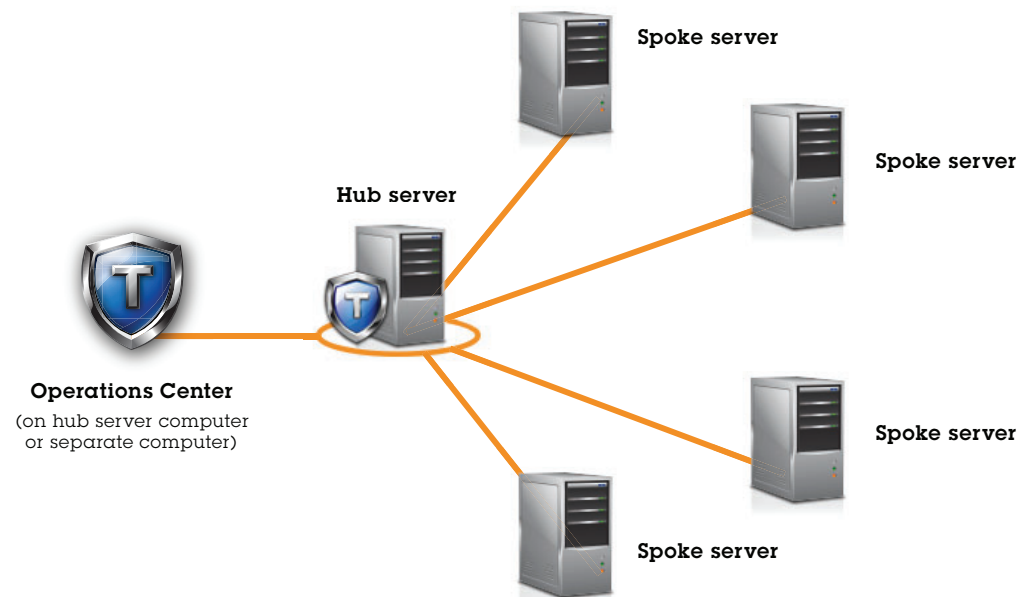


Figure 3. Example of an Operations Center configuration with the hub and spoke servers

---

## Configuring the Operations Center

When you open the Operations Center for the first time, you must configure it to manage your storage environment. You must associate the Operations Center with a Tivoli Storage Manager server that is designated as the hub server. You can then connect additional Tivoli Storage Manager servers as spoke servers.

### Designating the hub server

When you connect to the Operations Center for the first time, you must designate which Tivoli Storage Manager server is the hub server.

#### Procedure

In a web browser, enter the following address, where *hostname* represents the name of the computer where the Operations Center is installed, and *secure\_port* represents the port number that the Operations Center uses for HTTPS communication on that computer:

```
https://hostname:secure_port/oc
```

For more information about this port number, see Installation checklist. Assuming that you are connecting to the Operations Center for the first time, you must provide the following information:

- Connection information for the Tivoli Storage Manager server that you want to designate as a hub server
- Login credentials for an administrator ID that is defined for that Tivoli Storage Manager server

**Tip:** If the event-record retention period of the Tivoli Storage Manager server is less than 14 days, the period is automatically reset to 14 days if you configure the server as a hub server.

#### What to do next

If you have multiple Tivoli Storage Manager servers in your environment, add the other Tivoli Storage Manager servers as spoke servers to the hub server.

**Attention:** Do not change the name of a Tivoli Storage Manager server after it is configured as a hub or spoke server.

#### Related concepts:

“Hub and spoke server requirements” on page 96

“Administrator IDs that the Operations Center requires” on page 101

### Adding a spoke server

After you configure the hub server for the Operations Center, you can add one or more spoke servers to the hub server.

#### Procedure

1. In the Operations Center menu bar, click **Servers**. The TSM Servers page opens. In the table on the TSM Servers page, a server might have a status of “Unmonitored.” This status means that although an administrator defined this server to the hub server by using the **DEFINE SERVER** command, the server is not yet configured as a spoke server.
2. Complete one of the following steps:
  - Click the server to highlight it, and in the table menu bar, click **Monitor Spoke**.
  - If the server that you want to add is not shown in the table, click **Connect Spoke** in the table menu bar.
3. Provide the necessary information, and complete the steps in the spoke configuration wizard.

**Tip:** If the event-record retention period of the Tivoli Storage Manager server is less than 14 days, the period is automatically reset to 14 days if you configure the server as a spoke server.

### Sending email alerts to administrators

An alert is a notification of a relevant problem on the Tivoli Storage Manager server and is triggered by a Tivoli Storage Manager server message. Alerts can be shown in the Operations Center and can be sent from the server to administrators by email.

#### Before you begin

Before you configure email notification for administrators about alerts, ensure that the following requirements are met:

- An SMTP server is required to send and receive alerts by email, and the Tivoli Storage Manager server that sends the alerts by email must have access to the SMTP server.

**Tip:** If the Operations Center is installed on a separate computer, that computer does not need access to the SMTP server.

- An administrator must have system privilege to configure email notification.

#### About this task

An email notification is sent only for the first occurrence of an alert. Also, if an alert is generated before you configure email notification, no email notification is sent for that alert.

You can configure email notification in the following ways:

- Send notification for individual alerts
- Send alert summaries

An alert summary contains information about current alerts. The summary includes the total number of alerts, the total number of active and inactive alerts, the oldest alert, the newest alert, and the most frequently occurring alert.

You can specify a maximum of three administrators to receive alert summaries by email. Alert summaries are sent approximately every hour.

#### Procedure

To configure email notification for administrators about alerts, complete the following steps on each hub and spoke server from which you want to receive email alerts:

1. To verify that alert monitoring is turned on, issue the following command:  
`query monitorsettings`
2. If the command output indicates that alert monitoring is turned off, issue the following command. Otherwise, proceed to the next step.  
`set alertmonitor on`
3. To enable the sending of email notification, issue the following command:  
`set alertemail on`
4. To define the SMTP server that is used to send email notification, issue the following command:

## Getting started with the Operations Center

```
set alertemailsmtp host_name
```

5. To specify the port number for the SMTP server, issue the following command:

```
set alertemailsmtpport port_number
```

The default port number is 25.

6. To specify the email address of the sender of the alerts, issue the following command:

```
set alertemailfromaddr email_address
```

7. For each administrator ID that must receive email notification, issue one of the following commands to activate email notification and to specify the email address:

```
register admin admin_name alert=yes emailaddress=email_address
```

```
update admin admin_name alert=yes emailaddress=email_address
```

8. Choose either, or both, of the following options, and specify the administrator IDs to receive email notification:

- Send notification for individual alerts

To specify or update the administrator IDs to receive email notification for an individual alert, issue one of the following commands:

```
define alerttrigger message_number ADmin=admin_name1,admin_name2
```

```
update alerttrigger message_number ADDadmin=admin_name3 DELadmin=admin_name1
```

- Send alert summaries

To specify or update the administrator IDs to receive alert summaries by email, issue the following command:

```
set alertsummarytoadmins admin_name1,admin_name2,admin_name3
```

If you want to receive alert summaries but do not want to receive notification about individual alerts, complete the following steps:

- a. Suspend notification about individual alerts, as described in “Suspending email alerts temporarily” on page 115.
- b. Ensure that the respective administrator ID is listed in the following command:

```
set alertsummarytoadmins admin_name1,admin_name2,admin_name3
```

### Sending email alerts to multiple administrators

The following example illustrates the commands that cause any alerts for ANR1075E messages to be sent in an email to the administrators myadmin, djadmin, and csadmin:

```
set alertmonitor on
set alertmail on
set alertemailsmtp host mymailserver.domain.com
set alertemailsmtpport 450
set alertemailfromaddr srvadmin@mydomain.com
update admin myadmin alert=yes emailaddress=myaddr@anycompany.com
update admin djadmin alert=yes emailaddress=djaddr@anycompany.com
update admin csadmin alert=yes emailaddress=csaddr@anycompany.com
define alerttrigger anr0175e admin=myadmin,djadmin,csadmin
```

## Suspending email alerts temporarily

In certain situations, you might want to suspend email alerts temporarily. For example, you might want to receive alert summaries but suspend notification about individual alerts, or you might want to suspend email alerts when an administrator is on vacation.

### Before you begin

Configure email notification for administrators, as described in “Sending email alerts to administrators” on page 113.

### Procedure

Suspend email notification for individual alerts or for alert summaries.

- Suspend notification about individual alerts

Use either of the following methods:

#### UPDATE ADMIN command

To turn off email notification for the administrator, issue the following command:

```
UPDATE ADMIN admin_name ALERT=NO
```

To turn on email notification again later, issue the following command:

```
UPDATE ADMIN admin_name ALERT=YES
```

#### UPDATE ALERTTRIGGER command

To prevent a specific alert from being sent to an administrator, issue the following command:

```
UPDATE ALERTTRIGGER message_number DELADMIN=admin_name
```

To start sending that alert to the administrator again, issue the following command:

```
UPDATE ALERTTRIGGER message_number ADDADMIN=admin_name
```

- Suspend notification about alert summaries

To prevent alert summaries from being sent to an administrator, remove the administrator ID from the list in the following command:

```
set alertsummarytoadmins admin_name1,admin_name2,admin_name3
```

If an administrator ID is listed in the preceding command, the administrator receives alert summaries by email, even if notification about individual alerts is suspended for the respective administrator ID.

---

## Configuring for SSL communication

The Operations Center uses Hypertext Transfer Protocol Secure (HTTPS) to communicate with web browsers. You can optionally use the Secure Sockets Layer (SSL) protocol to secure communications between the Operations Center and the hub server, and between the hub server and associated spoke servers.

# Configuring for SSL communication between the Operations Center and the hub server

To use the Secure Sockets Layer (SSL) protocol to secure communications between the Operations Center and the hub server, you must add the SSL certificate of the hub server to the truststore file of the Operations Center.

### Before you begin

The truststore file of the Operations Center is a container for SSL certificates that the Operations Center can access. The truststore file contains the SSL certificate that the Operations Center uses for HTTPS communication with web browsers.

During the installation of the Operations Center, you create a password for the truststore file. To set up SSL communication between the Operations Center and the hub server, you must use the same password to add the SSL certificate of the hub server to the truststore file. If you do not remember this password, you can reset it. See “Resetting the password for the Operations Center truststore file” on page 120.

### Procedure

1. To ensure that SSL ports are set on the hub server, complete the following steps:

- a. From a Tivoli Storage Manager command line, issue the following command to the hub server:

```
QUERY OPTION SSL*
```

The results include four server options, as shown in the following example:

```
Server Option Option Setting
-----
SSLTCPPort 3700
SSLTCPADMINPort 3800
SSLTLS12 No
SSLFIPSMODE No
```

- b. If the **SSLTCPPORT** option has a value in the Option Setting column, proceed to the next step. Otherwise, to assign a port value to this option, edit the `dsmserv.opt` file of the hub server, and restart the hub server.
2. Note which certificate is set as the default certificate in the key database file of the hub server. Also, note whether the **SSLTLS12** option is set to YES or NO. In step 16 on page 117, you must know the default certificate and the **SSLTLS12** option value.

**Tip:** To verify the certificates in the key database file of the hub server, issue the following command:

```
gsk8capicmd_64 -cert -list -db cert.kdb -stashed
```

3. If the **SSLTLS12** option is set to YES, specify the `cert256.arm` certificate as the default certificate in the key database file of the hub server.

The `cert256.arm` certificate must be used for SSL connections to the hub server if the **SSLTLS12** option is set to YES. To specify `cert256.arm` as the default certificate, complete the following steps:

- a. Issue the following command from the hub server instance directory:

```
gsk8capicmd_64 -cert -setdefault -db cert.kdb -stashed
-label "TSM Server SelfSigned SHA Key"
```

- b. Restart the hub server so that it can receive the changes to the key database file.
  4. Stop the Operations Center web server.
  5. Go to the command line of the operating system on which the Operations Center is installed.
  6. Go to the following directory, where *installation\_dir* represents the directory in which the Operations Center is installed:
    - *installation\_dir/ui/jre/bin*
  7. Open the IBM Key Management window by issuing the following command:

```
ikeyman
```
  8. Click **Key Database File > Open**.
  9. In the Open window, click **Browse**, and go to the following directory, where *installation\_dir* represents the directory in which the Operations Center is installed:
    - *installation\_dir/ui/Liberty/usr/servers/guiServer*
  10. In the guiServer directory, select the gui-truststore.jks file.
  11. Click **Open**, and click **OK**.
  12. Enter the password for the truststore file, and click **OK**.
  13. In the **Key database content** area of the IBM Key Management window, click the arrow, and select **Signer Certificates** from the list.
  14. Click **Add**.
  15. In the Open window, click **Browse**, and go to the hub server instance directory, as shown in the following example:
    - */opt/tivoli/tsm/server/bin*The directory contains the following SSL certificates:
    - cert.arm
    - cert256.armIf you cannot access the hub server instance directory from the Open window, complete the following steps:
    - a. Use FTP or another file-transfer method to copy the cert.arm and cert256.arm files from the hub server to the following directory on the computer where the Operations Center is installed:
      - *installation\_dir/ui/Liberty/usr/servers/guiServer*
    - b. In the Open window, go to the guiServer directory.
  16. Select one of the two SSL certificates.
    - Choose cert256.arm if the **SSLTLS12** server option is set to YES. If the **SSLTLS12** option is set to YES, the Transport Layer Security (TLS) protocol version 1.2 is used for communication.
    - Choose cert.arm if the **SSLTLS12** server option is set to NO. If the **SSLTLS12** option is set to NO, the TLS protocol version 1.1 is used for communication.
- Tip:** The certificate that you choose must be set as the default certificate in the key database file of the hub server. For more information, see step 2 on page 116 and step 3 on page 116.
17. Click **Open**, and click **OK**.
  18. Enter a label for the certificate. For example, enter the name of the hub server.
  19. Click **OK**. The SSL certificate of the hub server is added to the truststore file, and the label is displayed in the **Key database content** area of the IBM Key Management window.

## Getting started with the Operations Center

20. Close the IBM Key Management window.
21. Start the Operations Center web server.
22. To configure the Operations Center, complete the following steps in the login window of the configuration wizard:
  - a. In the **Connect to** field, enter the value of one of the following server options as the port number:
    - **SSLTCPPORT**
    - **SSLTCPADMINPORT**
  - b. Select the **Use SSL** option.

**Tip:** If the **SSLTCPADMINPORT** option has a value, use that value. Otherwise, use the value of the **SSLTCPPORT** option.

- b. Select the **Use SSL** option.

If the Operations Center was previously configured, you can review the contents of the `serverConnection.properties` file to verify the connection information. The `serverConnection.properties` file is in the following directory on the computer where the Operations Center is installed:

- `installation_dir/ui/Liberty/usr/servers/guiServer`

### What to do next

To set up SSL communication between the hub server and a spoke server, see “Configuring for SSL communication between the hub server and a spoke server.”

## Configuring for SSL communication between the hub server and a spoke server

To use the Secure Sockets Layer (SSL) protocol to secure communications between the hub server and a spoke server, you must define the SSL certificate of the spoke server to the hub server. You must also configure the Operations Center to monitor the spoke server.

### Before you begin

Ensure that the Operations Center is configured to use the SSL protocol for communication between the Operations Center and the hub server.

### Procedure

1. To ensure that SSL ports are correctly set on the hub server and each spoke server, complete the following steps:
  - a. From a Tivoli Storage Manager command line, issue the following command to each server:

```
QUERY OPTION SSL*
```

The results include four server options, as shown in the following example:

```
Server Option Option Setting
-----
SSLTCPPort 3700
SSLTCPADMINPort 3800
SSLTLS12 No
SSLFIPSMODE No
```



- b. If the `SSLTCPPORT`, `SSLTCPADMINPORT`, and `SSLTLS12` options have values in the Option Setting column, proceed to the next step. Otherwise, to assign port values to these options, edit the `dsmserv.opt` file of the respective server, and restart that server.

These options are required for all Tivoli Storage Manager servers that use SSL. The options trigger the generation of the following files in the server instance directory:

- `cert.arm` (SSL certificate)
- `cert256.arm` (SSL certificate)
- `cert.kdb` (key database file)

**Restriction:** Because server-to-server connections are not supported by the `cert.arm` certificate, you must use the `cert256.arm` certificate.

2. On the spoke server, change to the directory of the spoke server instance.
3. To specify the required `cert256.arm` certificate as the default certificate in the key database file of the spoke server, issue the following command:

```
gsk8capicmd_64 -cert -setdefault -db cert.kdb -stashed
-label "TSM Server SelfSigned SHA Key"
```

4. To verify the certificates in the key database file of the spoke server, issue the following command:

```
gsk8capicmd_64 -cert -list -db cert.kdb -stashed
```

The following output is an example of the command output:

```
Certificates found
* default, - personal, ! trusted
!      Entrust.net Secure Server Certification Authority
!      Entrust.net Certification Authority (2048)
!      Entrust.net Client Certification Authority
!      Entrust.net Global Client Certification Authority
!      Entrust.net Global Secure Server Certification Authority
!      VeriSign Class 1 Public Primary Certification Authority
!      VeriSign Class 2 Public Primary Certification Authority
!      VeriSign Class 3 Public Primary Certification Authority
!      VeriSign Class 1 Public Primary Certification Authority - G2
!      VeriSign Class 2 Public Primary Certification Authority - G2
!      VeriSign Class 3 Public Primary Certification Authority - G2
!      VeriSign Class 4 Public Primary Certification Authority - G2
!      VeriSign Class 1 Public Primary Certification Authority - G3
!      VeriSign Class 2 Public Primary Certification Authority - G3
!      VeriSign Class 3 Public Primary Certification Authority - G3
!      VeriSign Class 3 Public Primary Certification Authority - G5
!      VeriSign Class 4 Public Primary Certification Authority - G3
!      VeriSign Class 3 Secure Server CA
!      Thawte Primary Root CA
!      Thawte Primary Root CA - G2 ECC
!      Thawte Server CA
!      Thawte Premium Server CA
!      Thawte Personal Basic CA
!      Thawte Personal Freemail CA
!      Thawte Personal Premium CA
-      TSM Server SelfSigned Key
*-     TSM Server SelfSigned SHA Key
```

5. Securely transfer the `cert256.arm` file of the spoke server to the hub server.
6. On the hub server, change to the directory of the hub server instance.
7. To define the spoke server SSL certificate to the hub server, issue the following command from the hub server instance directory, where `spoke_servoername` is the name of the spoke server, and `spoke_cert256.arm` is the file name of the spoke server SSL certificate:

## Getting started with the Operations Center

```
gsk8capicmd_64 -cert -add -db cert.kdb -stashed -format ascii  
-label spoke_servername -file spoke_cert256.arm
```

The spoke server does not require the hub server SSL certificate for hub-to-spoke communication. However, other Tivoli Storage Manager server configurations that require cross-defined servers do require the spoke server to have the hub server SSL certificate.

**Tip:** From each server, you can view the certificates in the key database file by issuing the following command:

```
gsk8capicmd_64 -cert -list -db cert.kdb -stashed
```

8. Restart the hub server and the spoke server.
9. For the hub server, issue the DEFINE SERVER command, according to the following example:

```
DEFINE SERVER spoke_servername HLA=spoke_address  
LLA=spoke_SSLTCPADMINPort SERVERPA=spoke_serverpassword SSL=YES
```

10. In the Operations Center menu bar, click **Servers**.  
In the table on the TSM Servers page, the spoke server that you defined in step 9 should have a status of “Unmonitored.” However, depending on the setting for the status refresh interval, you might not see the spoke server immediately.
11. Click the spoke server to highlight it, and in the table menu bar, click **Monitor Spoke**.

## Resetting the password for the Operations Center truststore file

To set up SSL communication between the Operations Center and the hub server, you must know the password for the truststore file of the Operations Center. You create this password during the installation of the Operations Center. If you do not know the password, you can reset it.

### About this task

To reset the password, you must create a new password, delete the truststore file of the Operations Center, and restart the Operations Center web server.

### Procedure

1. Stop the Operations Center web server.
2. Go to the following directory, where *installation\_dir* represents the directory in which the Operations Center is installed:  

```
installation_dir/ui/Liberty/usr/servers/guiServer
```
3. Open the `bootstrap.properties` file, which contains the password for the truststore file. If the password is unencrypted, you can use it to open the truststore file without having to reset it.

The following examples indicate the difference between an encrypted and an unencrypted password:

#### Encrypted password example

Encrypted passwords begin with the text string `{xor}`.

The following example shows the encrypted password as the value of the `tsm.truststore.pswd` parameter:

```
tsm.truststore.pswd={xor}MiYPPiwsKDat0w==
```

### Unencrypted password example

The following example shows the unencrypted password as the value of the `tsm.truststore.pswd` parameter:

```
tsm.truststore.pswd=J8b%^B
```

4. Reset the password by replacing the password in the `bootstrap.properties` file with a new password. You can replace the password with an encrypted or unencrypted password. Remember the unencrypted password for future use.

To create an encrypted password, complete the following steps:

- a. Create an unencrypted password.

The password for the truststore file must meet the following criteria:

- The password must contain a minimum of 6 characters and a maximum of 64 characters.
- The password must contain at least the following characters:
  - One uppercase letter (A – Z)
  - One lowercase letter (a – z)
  - One digit (0 – 9)
  - Two of the following non-alphanumeric characters:

```
~ ! @ # $ % ^ & * _ - + = ` |
```

```
( ) { } [ ] : ; < > , . ? /
```

- b. From the command line of the operating system, go to the following directory:

```
installation_dir/ui/Liberty/bin
```

- c. To encrypt the password, issue the following command, where *myPassword* represents the unencrypted password:

```
securityUtility encode myPassword
```

5. Close the `bootstrap.properties` file.
6. Go to the following directory:

```
installation_dir/ui/Liberty/usr/servers/guiServer
```
7. Delete the `gui-truststore.jks` file, which is the truststore file of the Operations Center.
8. Start the Operations Center web server.

## Results

A new truststore file is automatically created for the Operations Center, and the SSL certificate of the Operations Center is automatically included in the truststore file.

## Starting and stopping the web server

The web server of the Operations Center runs as a service and starts automatically. You might need to stop and start the web server, for example, to make configuration changes.

### Procedure

Stop and start the web server.

- Issue the following commands:
  - To stop the server:

```
service opscenter.rc stop
```

## Getting started with the Operations Center

- To start the server:  
`service opscenter.rc start`
- To restart the server:  
`service opscenter.rc restart`

To determine whether the server is running, issue the following command:

```
service opscenter.rc status
```

---

## Chapter 13. Troubleshooting the Operations Center installation

If a problem occurs with the Operations Center installation and you cannot solve it, you can consult the descriptions of known problems for a possible solution.

---

### Chinese, Japanese, or Korean fonts are displayed incorrectly

Chinese, Japanese, or Korean fonts are displayed incorrectly in the Operations Center on Red Hat Enterprise Linux 5.

#### **Solution**

Install the following font packages, which are available from Red Hat:

- fonts-chinese
- fonts-japanese
- fonts-korean



---

## Chapter 14. Uninstalling the Operations Center

You can uninstall the Operations Center by using any of the following methods: a graphical wizard, the command line in console mode, or silent mode.

---

### Uninstalling the Operations Center by using a graphical wizard

You can uninstall the Operations Center by using the graphical wizard of IBM Installation Manager.

#### Procedure

1. Open IBM Installation Manager.  
In the directory where IBM Installation Manager is installed, go to the `eclipse` subdirectory (for example, `/opt/IBM/InstallationManager/eclipse`), and issue the following command:  

```
./IBMIM
```
2. Click **Uninstall**.
3. Select **IBM Tivoli Storage Manager Operations Center**, and click **Next**.
4. Click **Uninstall**.
5. Click **Finish**.

---

### Uninstalling the Operations Center in console mode

To uninstall the Operations Center by using the command line, you must run the uninstallation program of IBM Installation Manager from the command line with the parameter for console mode.

#### Procedure

1. In the directory where IBM Installation Manager is installed, go to the following subdirectory:  

```
eclipse/tools
```

  
For example:  

```
/opt/IBM/InstallationManager/eclipse/tools
```
2. From the `tools` directory, issue the following command:  

```
./imcl -c
```
3. To uninstall, enter 5.
4. Choose to uninstall from the IBM Tivoli Storage Manager package group.
5. Enter N for Next.
6. Choose to uninstall the IBM Tivoli Storage Manager Operations Center package.
7. Enter N for Next.
8. Enter U for Uninstall.
9. Enter F for Finish.

### Uninstalling the Operations Center in silent mode

To uninstall the Operations Center in silent mode, you must run the uninstallation program of IBM Installation Manager from the command line with the parameters for silent mode.

#### Before you begin

The input directory, which is in the directory where the installation package is extracted, contains the following sample response files for installing, updating, and uninstalling the Operations Center:

- `install_response_sample.xml`
- `update_response_sample.xml`
- `uninstall_response_sample.xml`

You can use these sample files as they are, with the default values, or you can customize them.

#### Procedure

1. In the directory where IBM Installation Manager is installed, go to the following subdirectory:

```
eclipse/tools
```

For example:

```
/opt/IBM/InstallationManager/eclipse/tools
```

2. From the `tools` directory, issue the following command, where *response\_file* represents the response file path, including the file name:

```
./imcl -input response_file -silent
```

The following command is an example:

```
./imcl -input /tmp/input/uninstall_response.xml -silent
```



---

## Chapter 15. Rolling back to a previous version of the Operations Center

By default, IBM Installation Manager saves earlier versions of a package to roll back to if you experience a problem with later versions of updates, fixes, or packages.

### Before you begin

The rollback function is available only after the Operations Center is updated.

### About this task

When IBM Installation Manager rolls back a package to a previous version, the current version of the package files is uninstalled, and an earlier version is reinstalled.

To roll back to a previous version, IBM Installation Manager must access files for that version. By default, these files are saved during each successive installation. Because the number of saved files increases with each installed version, you might want to delete these files from your system on a regular schedule. However, if you delete the files, you cannot roll back to a previous version.

To delete saved files or to update your preference for saving these files in future installations, complete the following steps:

1. In IBM Installation Manager, click **File > Preferences**.
2. On the Preferences page, click **Files for Rollback**, and specify your preference.

### Procedure

To roll back to a previous version of the Operations Center, use the **Roll Back** function of IBM Installation Manager.



---

## Part 4. Appendixes



---

## Appendix A. Installation log files

If you experience errors during installation, these errors are recorded in log files that are stored in the IBM Installation Manager logs directory.

You can view installation log files by clicking **File > View Log** from the Installation Manager tool. To collect these log files, click **Help > Export Data for Problem Analysis** from the Installation Manager tool.



---

## Appendix B. Tivoli support information

You can find support information for Tivoli and other IBM products from various sources.

From the IBM Support Portal at <http://www.ibm.com/support/entry/portal/>, you can select the products that you are interested in and search for a wide variety of relevant information.

---

## Communities and other learning resources

In addition to product documentation, many forms of assistance are available to help you get started as you deploy and use the Tivoli Storage Manager family of products. These resources can also help you to solve problems that you might have.

You can use forums, wikis, and other social media tools to ask questions, talk to experts, and learn from others.

### User groups

#### Tivoli Global Storage Virtual User Group

Access this user group at <http://www.tivoli-ug.org/storage>.

This group makes it possible for individuals from many different industries and types of organizations to share information and work directly with the IBM product experts. Local chapters also exist where members meet in person to share experiences and hear from guest speakers.

#### ADSM.ORG

Access this mailing list at <http://adsm.org>.

This independently managed Storage Management discussion forum started when Tivoli Storage Manager was known as ADSTAR Distributed Storage Manager (ADSM). The members of this forum have many years of experience with Tivoli Storage Manager in almost every type of IT environment.

To subscribe to the forum, send an email to [listserv@vm.marist.edu](mailto:listserv@vm.marist.edu). The body of the message must contain the following text: `SUBSCRIBE ADSM-L your_first_name your_family_name`.

### Tivoli Storage Manager community on Service Management Connect

Access Service Management Connect at <http://www.ibm.com/developerworks/servicemanagement>. In the Storage Management community of Service Management Connect, you can connect with IBM in the following ways:

- Become involved with transparent development, an ongoing, open engagement between users and IBM developers of Tivoli products. You can access early designs, sprint demonstrations, product roadmaps, and prerelease code.
- Connect one-on-one with the experts to collaborate and network about Tivoli and the Tivoli Storage Manager community.
- Read blogs to benefit from the expertise and experience of others.

- Use wikis and forums to collaborate with the broader user community.

### **Tivoli Storage Manager wiki on developerWorks®**

Access this wiki at <https://www.ibm.com/developerworks/servicemanagement/sm/index.html>.

Find the latest best practices, white papers, and links to videos and other resources. When you log on, you can comment on content, or contribute your own content.

### **Tivoli Support Technical Exchange**

Find information about upcoming Tivoli Support Technical Exchange webcasts at [http://www.ibm.com/software/sysmgmt/products/support/supp\\_tech\\_exch.html](http://www.ibm.com/software/sysmgmt/products/support/supp_tech_exch.html). Replays of previous webcasts are also available.

Learn from technical experts who share their knowledge and then answer your questions. The sessions are designed to address specific technical issues and provide in-depth but narrowly focused training.

### **Other social media sites**

#### **LinkedIn**

You can join groups on LinkedIn, a social media site for professionals. For example:

- **Tivoli Storage Manager Professionals:** <http://www.linkedin.com/groups/Tivoli-Storage-Manager-Professionals-54572>
- **TSM:** <http://www.linkedin.com/groups?gid=64540>

#### **Twitter**

Follow @IBMStorage on Twitter to see the latest news about storage and storage software from IBM.

### **Tivoli education resources**

Use these education resources to help you increase your Tivoli Storage Manager skills:

#### **Tivoli Education and Certification website**

View available education at <http://www.ibm.com/software/tivoli/education>.

Use the Search for Training link to find local and online offerings of instructor-led courses for Tivoli Storage Manager.

#### **Education Assistant**

Access resources at <http://publib.boulder.ibm.com/infocenter/ieduasst/tivv1r0/index.jsp>.

Scroll to view the list of available training videos. Recorded product demonstrations are also available on a YouTube channel.



---

## Searching knowledge bases

If a problem occurs while you are using one of the Tivoli Storage Manager family of products, you can search several knowledge bases.

Begin by searching the Tivoli Storage Manager Information Center at <http://pic.dhe.ibm.com/infocenter/tsminfo/v7r1>. Within the information center, you can enter words, phrases, or message numbers in the **Search** field to find relevant topics.

## Searching the Internet

If you cannot find an answer to your question in the Tivoli Storage Manager information center, search the Internet for the information that might help you resolve the problem.

To search multiple Internet resources, go to the IBM support website at <http://www.ibm.com/support/entry/portal/>. You can search for information without signing in.

Sign in using your IBM ID and password if you want to customize the site based on your product usage and information needs. If you do not already have an IBM ID and password, click **Sign in** at the top of the page and follow the instructions to register.

From the support website, you can search various resources:

- IBM technotes.
- IBM downloads.
- IBM Redbooks® publications.
- IBM Authorized Program Analysis Reports (APARs). Select the product and click **Downloads** to search the APAR list.

## Using IBM Support Assistant

IBM Support Assistant is a complimentary software product that can help you with problem determination. It is available for some Tivoli Storage Manager and Tivoli Storage FlashCopy® Manager products.

IBM Support Assistant helps you gather support information when you must open a problem management record (PMR), which you can then use to track the problem. The product-specific plug-in modules provide you with the following resources:

- Support links
- Education links
- Ability to submit problem management reports

You can find more information and download the IBM Support Assistant web page at <http://www.ibm.com/software/support/isa>.

You can also install the stand-alone IBM Support Assistant application on any workstation. You can then enhance the application by installing product-specific plug-in modules for the IBM products that you use. Find add-ons for specific products at <http://www.ibm.com/support/docview.wss?uid=swg27012689>.

## Finding product fixes

A product fix to resolve a software problem might be available from the IBM software support website.

### Procedure

Determine what fixes are available by checking the IBM software support website at <http://www.ibm.com/support/entry/portal/>.

**If you previously customized the site based on your product usage:**

1. Click the link for the product, or a component for which you want to find a fix.
2. Click **Downloads**, and then click **Search for recommended fixes**.

**If you have not previously customized the site:**

Click **Downloads** and search for the product.

## Receiving notification of product fixes

You can receive notifications about fixes, flashes, upgrades, and other news about IBM products.

### Procedure

1. From the support page at <http://www.ibm.com/support/entry/portal/>, click **Sign in** and sign in using your IBM ID and password. If you do not have an ID and password, click **register now** and complete the registration process.
2. Click **Manage all my subscriptions** in the Notifications pane.
3. Click the **Subscribe** tab, and then click **Tivoli**.
4. Select the products for which you want to receive notifications and click **Continue**.
5. Specify your notification preferences and click **Submit**.

---

## Contacting IBM Software Support

You can contact IBM Software Support if you have an active IBM subscription and support contract, and if you are authorized to submit problems to IBM.

### Procedure

1. Ensure that you have completed the following prerequisites:
  - a. Set up a subscription and support contract.
  - b. Determine the business impact of the problem.
  - c. Describe the problem and gather background information.
2. Follow the instructions in “Submitting the problem to IBM Software Support” on page 138.

## Setting up and managing support contracts

You can set up and manage your Tivoli support contracts by enrolling in IBM Passport Advantage. The type of support contract that you need depends on the type of product you have.

### Procedure

Enroll in IBM Passport Advantage in one of the following ways:

- **Online:** Go to the Passport Advantage website at <http://www.ibm.com/software/lotus/passportadvantage/>, click **How to enroll**, and follow the instructions.
- **By telephone:** For critical, system-down, or high-severity issues, you can call 1-800-IBMSERV (1-800-426-7378) in the United States. For the telephone number to call in your country, go to the IBM Software Support Handbook web page at <http://www14.software.ibm.com/webapp/set2/sas/f/handbook/home.html> and click **Contacts**.

## Determining the business impact

When you report a problem to IBM, you are asked to supply a severity level. Therefore, you must understand and assess the business impact of the problem you are reporting.

Severity level	Description
Severity 1	<b>Critical</b> business impact: You are unable to use the program, resulting in a critical impact on operations. This condition requires an immediate solution.
Severity 2	<b>Significant</b> business impact: The program is usable but is severely limited.
Severity 3	<b>Some</b> business impact: The program is usable with less significant features (not critical to operations) unavailable.
Severity 4	<b>Minimal</b> business impact: The problem causes little impact on operations, or a reasonable circumvention to the problem has been implemented.

## Describing the problem and gathering background information

When explaining a problem to IBM, it is helpful to be as specific as possible. Include all relevant background information so that IBM Software Support specialists can help you solve the problem efficiently.

To save time, know the answers to these questions:

- What software versions were you running when the problem occurred?
- Do you have logs, traces, and messages that are related to the problem symptoms? IBM Software Support is likely to ask for this information.
- Can the problem be re-created? If so, what steps led to the failure?
- Have any changes been made to the system? For example, hardware, operating system, networking software, and so on.
- Are you using a workaround for this problem? If so, be prepared to explain it when you report the problem.

## Submitting the problem to IBM Software Support

You can submit the problem to IBM Software Support online or by telephone.

### Online

Go to the IBM Software Support website at [http://www.ibm.com/support/entry/portal/Open\\_service\\_request/Software/Software\\_support\\_\(general\)](http://www.ibm.com/support/entry/portal/Open_service_request/Software/Software_support_(general)). Sign in to access IBM Service Requests and enter your information into the problem submission tool.

### By telephone

For critical, system-down, or severity 1 issues, you can call 1-800-IBMSERV (1-800-426-7378) in the United States. For the telephone number to call in your country, go to the IBM Software Support Handbook web page at <http://www14.software.ibm.com/webapp/set2/sas/f/handbook/home.html> and click **Contacts**.

---

## Appendix C. Accessibility features for the Tivoli Storage Manager product family

Accessibility features help users who have a disability, such as restricted mobility or limited vision to use information technology products successfully.

### Accessibility features

The IBM Tivoli Storage Manager family of products includes the following accessibility features:

- Keyboard-only operation using standard operating-system conventions
- Interfaces that support assistive technology such as screen readers

The command-line interfaces of all products in the product family are accessible.

Tivoli Storage Manager Operations Center provides the following additional accessibility features when you use it with a Mozilla Firefox browser on a Microsoft Windows system:

- Screen magnifiers and content zooming
- High contrast mode

The Operations Center and the Tivoli Storage Manager Server can be installed in console mode, which is accessible.

The Tivoli Storage Manager Information Center is enabled for accessibility. For information center accessibility information, see “Accessibility features in the information center” ([http://pic.dhe.ibm.com/infocenter/tsminfo/v7r1/topic/com.ibm.help.ic.doc/iehs36\\_accessibility.html](http://pic.dhe.ibm.com/infocenter/tsminfo/v7r1/topic/com.ibm.help.ic.doc/iehs36_accessibility.html)).

### Vendor software

The Tivoli Storage Manager product family includes certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for the accessibility information about its products.

### IBM and accessibility

See the IBM Human Ability and Accessibility Center (<http://www.ibm.com/able>) for information about the commitment that IBM has to accessibility.



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## Glossary

A glossary is available with terms and definitions for the IBM Tivoli Storage Manager family of products.

You can view the glossary in the Tivoli Storage Manager information center at <http://pic.dhe.ibm.com/infocenter/tsminfo/v7r1>.

To view glossaries for other IBM products, see <http://www.ibm.com/software/globalization/terminology/>.



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# Index

## Special characters

- (TLS) Transport Layer Security 51
- IBM Tivoli Storage Manager
  - uninstalling 87

## A

- access rights
  - setting
    - before server startup 56
- accessibility features 139
- activating
  - server
    - AIX, HP-UX, Linux, Solaris 55
- active log
  - space requirements 17
- Administration Center vii
- administrative commands
  - HALT 60
  - REGISTER LICENSE 60
- administrator ID 101
- administrator password 101
- alerts
  - sending by email 113
- API 52
- API configuration 52
- archive failover log space
  - description 28
- archive log
  - space requirements 17
- archive log directory 44
- automatic starting, server 58

## B

- BACKUP DB command 52
- backups
  - database 61

## C

- capacity planning
  - database space requirements
    - estimates based on number of files 13
    - estimates based storage pool capacity 15
    - starting size 13
  - recovery log space requirements
    - active and archive logs 17
    - active log mirror 28
- client nodes
  - reverting to previous server version
    - data affected 79
- client options
  - for shared memory communications 50
- clustered environment
  - upgrading server on Linux
    - V6 to V7.1 78
  - upgrading the server to V7.1 78

- commands
  - administrative, SET DBRECOVERY 61
  - DSMSERV FORMAT 52
- commands, administrative
  - HALT 60
  - REGISTER LICENSE 60
- communication methods
  - Shared Memory 50
  - SNMP 51
  - TCP/IP 49
- compatibility, server with other DB2 products 10
- components
  - installable v
- configuration
  - Operations Center 96
- configuring 41, 45, 47
  - hub server 112
  - Operations Center 111
  - spoke server 112
- configuring, manually 45, 47
- configuring, server instance 45
- configuring, wizard 45, 46
- Console language support 38
- console mode 36
- create server instance 41, 45
- customer support
  - contacting 136

## D

- data deduplication
  - effects when reverting to previous server version 79
- database
  - backups 61
  - installing 52
  - name 30
- database directories 44
- database manager 16, 52
- DB2
  - commands 83
- DB2 commands 83
- DB2 directories 32
- DB2 products, compatibility with the server 10
- DB2 Version 10.5 vii
- db2icrt command 47
- db2profile 58
- default installation directories 32
- device driver, Tivoli Storage Manager vi
- directories
  - DB2 32
  - default installation 32
  - devices 32
  - languages 32
  - naming for server 30
- directories, instance 44
- disability 139
- disk space 5, 8
- DSMSERV FORMAT command 52
- dsmserv.v6lock 60

## E

- email alerts 113
  - suspending temporarily 115
- enabling communications 48
- expiration
  - server option 55

## F

- files
  - dsm serv.opt.smp 48
- first steps 41
- fix packs 65
- fixes 33
- fixes, obtaining 136

## G

- group 44

## H

- HALT command 60
- halting the server 60
- hardware requirements
  - Tivoli Storage Manager 5, 8
- home directory 47
- HTTPS 115, 116, 118
  - password for truststore file 102, 120
- hub server 96
  - configuring 112

## I

- IBM Installation Manager vii, 11, 102
- IBM Support Assistant 135
- IBM Tivoli Storage Manager
  - uninstalling
    - in silent mode 88
    - using a graphical installation wizard 87
    - using command line in console mode 88
- IBM Tivoli Storage Manager Operations Center vii
- installable components vi
- installation directories
  - Operations Center
    - Installation Manager 102
- installation log 35, 36
- Installation Manager vii, 11, 102
  - logs directory 131
- installation packages 33
  - Operations Center 105
- installation wizard 35
- installing
  - database 52
  - device support 33
  - fix packs 65
  - graphical user interface
    - using 35
  - minimum requirements for 5, 8
  - Operations Center 105
  - recovery log 52
  - server 3, 33
  - using command line in console mode
    - using 36
  - what to know before 3

- installing the Tivoli Storage Manager server 37
  - silently 37
- installing Operations Center 93
- instance directories 44
- instance user ID 30
- interim fix 65
- Internet, searching for problem resolution 135, 136

## K

- kernel parameters, tuning
  - overview 42
  - suggested minimum values 42
  - updating 42
- keyboard 139
- KILL command 60
- knowledge bases, searching 135

## L

- LANGUAGE option 38, 39
- language package 40
- language packages 38
- language support 39
- languages
  - set 39
- license, Tivoli Storage Manager 60
- licenses
  - installable package vi
- Linux on System z
  - system requirements 8
- Linux X86\_64
  - system requirements 5
- log files
  - installation 131

## M

- maintenance updates 65
- memory requirements 5, 8
- monitoring
  - logs 62
- monitoring administrator 101
- multiple DB2 copies 10
- multiple servers
  - upgrading
    - multiple servers 61

## N

- names, best practices
  - database name 30
  - directories for server 30
  - instance user ID 30
  - server instance 30
  - server name 30
- new features vii

## O

- offering 11, 102
- operating system requirements
  - Operations Center 99
- Operations Center v
  - administrator IDs 101

- Operations Center *(continued)*
  - Chrome 100
  - computer requirements 96
  - configuring 111
  - credentials for installing 102
  - Firefox 100
  - hub server 96
  - IE 100
  - installation directory 102
  - installation packages 105
  - installing 93, 105
    - in silent mode 106
    - using a graphical wizard 106
    - using command line in console mode 106
  - Internet Explorer 100
  - language requirements 100
  - opening 112
  - operating system requirements 99
  - overview 95
  - password for secure communications 102, 120
  - port number 102
  - prerequisite checks 95
  - rollback
    - Operations Center 127
  - rolling back to a previous version 127
  - Safari 100
  - spoke server 96, 112
  - SSL 115, 116, 118
  - system requirements 95
  - troubleshooting the installation 123
  - uninstalling 125
    - in silent mode 126
    - using a graphical wizard 125
    - using command line in console mode 125
  - upgrading 93, 109
  - web browser requirements
    - Operations Center 100
  - web server 121
- options
  - starting the server 55
- options file
  - editing 48
- options, client
  - SSLTCPADMINPORT 50
  - SSLTCPPOINT 49
  - TCPADMINPORT 49
  - TCPPOINT 49
  - TCPWINDOWSIZE 49
- overview
  - Operations Center 93, 95

## P

- package 11, 102
- package group 11, 102
- Passport Advantage 33, 137
- password
  - Operations Center truststore file 102, 120
- password for secure communications 102
- performance
  - Operations Center 96
  - user limits, setting for optimal performance 55
- planning, capacity
  - database space requirements
    - estimates based on number of files 13
    - estimates based storage pool capacity 15
    - starting size 13

- planning, capacity *(continued)*
  - recovery log space requirements
    - active log mirror 28
    - recovery log space requirementsv 17
- port number
  - Operations Center 102
- prerequisite checks
  - Operations Center 95
- problem determination
  - describing problem for IBM Software Support 137
  - determining business impact for IBM Software Support 137
  - submitting a problem to IBM Software 138

## R

- recovery log
  - archive failover log space 28
  - installing 52
- reference, DB2 commands 83
- REGISTER LICENSE command 60
- repository 11, 102
- resource requirements
  - Operations Center 96
- reverting to previous server version 79

## S

- scripts
  - dsmserv.rc 58
  - starting servers automatically 58
- secure communications 115, 116, 118
- Secure Sockets Layer 115, 116, 118
- Secure Sockets Layer (SSL) 49
  - communication using 51
  - Transport Layer Security (TLS) 51
- server
  - after upgrade
    - reverting to previous server version 79
  - before upgrade
    - importance of preparation steps 79
  - compatibility
    - DB2 products 10
  - naming best practices 30
  - starting
    - automatic 58
  - stopping 60
  - upgrading
    - V6 to V7.1 69
    - V6.1 to V7.1 77
    - V6.2 to V7.1 70
    - V6.3 to V7.1 70
- server database
  - reorganization options 54
- server instance 45, 47
- server instance, creating 47
- server instances
  - naming 30
  - naming best practices 30
- server license 60
- server options
  - dsmserv.opt.smp 48
  - tailoring 48
- server options file
  - setting 48

- server, Tivoli Storage Manager
  - activating 55
  - halting 60
  - options 48, 49
  - setting up 55
  - starting 55
- SET DBRECOVERY 61
- shared memory client options 50
- shared memory communications method 50
- shared resources directory 11, 102
- silent installation
  - Tivoli Storage Manager 37
- SNMP communication method 51
- software requirements
  - Tivoli Storage Manager 5, 8
- software support
  - describing problem for IBM Software Support 137
  - determining business impact for IBM Software Support 137
  - submitting a problem 138
- Software Support
  - contacting 136
- spoke server 96
  - adding 112
- SSL 115, 116, 118
  - password for truststore file 102, 120
- SSL (Secure Sockets Layer)
  - (TLS) Transport Layer Security 51
  - communication using 51
- SSLTCPADMINPORT option 50
- SSLTCPSPORT option 49
- starting
  - server 55
- starting server
  - from user ID 58
- starting servers automatically 58
- status monitoring 96
- stopping
  - server 60
- storage pools
  - reverting to previous server version 79
- summary of amendments
  - Version 7.1 vii
- support contract 137
- support information 133
- support subscription 137
- system requirements 4
  - Operations Center 95, 96, 99, 100

## T

- TCP/IP
  - setting options 49
  - Version 4 49
  - Version 6 49
- TCPNODELAY option 49
- TCPSPORT option 49
- TCPWINDOWSIZE option 49
- technical changes vii
- temporary disk space 16
- temporary space 16
- Tivoli Monitoring for Tivoli Storage Manager vii
- Tivoli Storage Manager
  - installation 35, 36
  - installation packages 33
  - server changes vii
  - uninstalling 87

- Tivoli Storage Manager (*continued*)
  - in silent mode 88
  - using a graphical installation wizard 87
  - using command line in console mode 88
  - upgrading
    - V6 to V7.1 69
    - V6.1 to V7.1 77
    - V6.2 to V7.1 70
    - V6.3 to V7.1 70
    - Version 7.1 vii
  - Tivoli Storage Manager device driver, installable package vi
  - Tivoli Storage Manager fix packs 65
  - Tivoli Storage Manager support site 33
  - Tivoli Storage Manager, setting up 55
  - TLS 116, 118
  - translation features 38
  - translations 38
  - Transport Layer Security (TLS) 51
  - Transport Layer Security protocol 116, 118
  - troubleshooting
    - Operations Center installation 123
    - Chinese fonts on RHEL 5 123
    - Japanese fonts on RHEL 5 123
    - Korean fonts on RHEL 5 123
  - truststore file 116, 118
    - Operations Center 102
    - resetting password 120
  - tuning
    - Operations Center 96

## U

- ulimits
  - setting
    - before server startup 56
- uninstalling 89
- uninstalling and reinstalling 89
- updating 40, 109
- upgrade
  - server
    - V6 to V7.1 69
    - V6.1 to V7.1 77
    - V6.2 to V7.1 70
    - V6.3 to V7.1 70
- upgrading Operations Center 93
- US English 39
- user ID 44
- user limits 55
  - setting
    - before server startup 56

## V

- Version 7.1 vii

## W

- web server
  - starting 121
  - stopping 121
- Windows service 44
- wizard 41
- worksheet
  - server space planning 12







Product Number: 5608-E01  
5608-E02  
5608-E03

Printed in USA