IBM Tivoli Storage Manager

Blueprint and Server Automated Configuration for Linux on Power Systems

Version 2 Release 3

Note:
Before you use this information and the product it supports, read the information in "Notices" on page 91.

Third edition (August 2016)

This edition applies to Version 7.1.3 and later of the IBM Tivoli Storage Manager server, and to all subsequent releases and modifications until otherwise indicated in new editions or technical newsletters.

Contents

About this document

This information is intended to facilitate the deployment of an IBM® Tivoli® Storage Manager server by using detailed hardware specifications to build a system and automated scripts to configure the software. To complete the tasks, you must have an understanding of Tivoli Storage Manager and scripting.

Support for Tivoli Storage Manager blueprint and server automated configuration

The information in this document is distributed on an "as is" basis without any warranty that is either expressed or implied. Support assistance for the use of this material is limited to situations where Tivoli Storage Manager support is entitled and where the issues are not specific to a blueprint implementation.

What's new in Version 2.3

New topics and other changes are available in the Version 2.3 release of the Tivoli Storage Manager blueprint configuration script and documentation.

V2.3

Added support for IBM Elastic Storage™ Server

If you install a Tivoli Storage Manager server on an IBM AIX®, Linux x86_64, or Linux on Power® operating system, you can integrate IBM Elastic Storage Server as part of the storage solution. In previous releases, IBM Elastic Storage Server was available only on the Linux x86_64 operating system.

IBM Elastic Storage Server is built on IBM Spectrum Scale™ technology (formerly IBM General Parallel File System), and offers a scalable storage system for disk-based storage pools.

Compression of data in container storage pools

If you install Tivoli Storage Manager Version 7.1.5 or later, inline compression of data in container storage pools is enabled by default. Data is compressed as it is written to a storage pool.

If you upgrade a server to V7.1.5 or later, enable compression by using the **UPDATE STGPOOL** command.

Technical and other updates were made throughout the book. Look for the vertical bar (|) in the left margin.

Chapter 1. Introduction

This document provides detailed steps to build a small, medium, or large Tivoli Storage Manager server with disk-only storage that uses data deduplication on Linux on IBM Power Systems.

The configuration is for a big endian architecture.

Two options for the storage architecture are included:

- IBM Storwize® with Fibre Channel attachments
- IBM Elastic Storage Server that uses an Ethernet attachment that is combined with SSDs in internal drive slots (available for medium and large systems)

By following prerequisite steps precisely, you can set up hardware and prepare your system to run the Tivoli Storage Manager blueprint configuration script, `TSMserverconfig.pl`, for a successful deployment. The settings and options that are defined by the script are designed to ensure optimal performance, based on the size of your system.

Overview

The following roadmap lists the main tasks that you must complete to deploy a server.

1. Determine the size of the configuration that you want to implement.
2. Review the requirements and prerequisites for the server system.
3. Set up the hardware by using detailed blueprint specifications for system layout.
4. Configure the hardware and install the Red Hat Enterprise Linux on Power operating system.
5. Prepare storage for Tivoli Storage Manager.
6. Run the Tivoli Storage Manager workload simulation tool to verify that your configuration is functioning properly.
7. Install the Tivoli Storage Manager backup-archive client.
8. Install a licensed version of the Tivoli Storage Manager server. Configuration with the blueprint configuration script is supported by Tivoli Storage Manager V7.1 and later. To use directory-container storage pools with inline data deduplication, you must install Tivoli Storage Manager V7.1.3 or later.
9. Run the blueprint configuration script to validate your hardware configuration, and then configure the server.
10. Complete post-configuration steps to begin managing and monitoring your server environment.

Chapter 2. Implementation requirements

Choose the appropriate size for your Tivoli Storage Manager environment and then review requirements for hardware and software.

Use Table 1 to determine the size of server that you need, based on the amount of data that you manage. Both the total managed data and daily amount of new data are measured as the size before data deduplication.

Data amounts in the table are based on the use of directory-container storage pools with inline data deduplication, a feature that was introduced in Tivoli Storage Manager V7.1.3. The blueprints are also designed to use inline storage pool compression, a feature that was introduced in Tivoli Storage Manager V7.1.5.

Table 1. Determining the size of the Tivoli Storage Manager server

If your total managed data is this much...	**And / or the daily amount of new data that you back up is this much...**	**Build a server of this size**
45 TB - 180 TB	Up to 6 TB per day	Small
200 TB - 800 TB	6 - 20 TB per day	Medium
1000 TB - 4000 TB	20 - 100 TB per day	Large

The daily amount of data is how much new data you back up each day. The daily backup recommendations in Table 1 are based on test results with 128 MB sized objects, which are used by Tivoli Storage Manager for Virtual Environments. Ranges for the daily backup amount account for the fact that backup throughput, and the time that is required to complete maintenance tasks, vary based on the workload.

Workloads with larger average object sizes (512 KB and larger) tend to have higher backup throughputs. Data that reduces favorably from data deduplication is also backed up more quickly. Workloads with smaller average object sizes, such as those that are common with file server backups, typically have lower backup throughputs. If you are unsure of your workload characteristics, use the middle of the range for planning purposes.

Total managed data is the amount of data that is protected. This amount includes all versions. A range is provided because data processing responds differently to data deduplication and compression, depending on the type of data that is backed up. The smaller number in the range represents the physical capacity of the Tivoli Storage Manager storage pool. Although the use of inline compression does not result in additional growth of the Tivoli Storage Manager database, it might result in the ability to store more data in the same amount of storage pool space. In this way, the amount of total managed data can increase causing more database space to be used.

To estimate the total managed data for your environment, you must have the following information:

- The amount of client data (the front-end data amount) that will be protected
- The number of days that backup data needs to be retained

- An estimate of the daily change percentage
- The backup model that is used for a client type, for example, incremental-forever, full backups every day, periodic full

You can calculate the total managed data for different types of clients in groups and then add those groups later.

Client types that perform incremental-forever backups

The following formula can be used to estimate the total managed data:

```
Frontend  + (Frontend * changerate * (retention - 1))
```

For example, if you back up 100 TB of front-end data, use a 30-day retention period, and have a 5% change rate, calculate your total managed data by using the following figures:

```
100 TB + (100TB * 0.05 * (30-1)) = 245 TB total managed data
```

Client types that perform full backups every day

The following formula can be used to estimate the total managed data:

```
Frontend  * retention * (1 + changerate)
```

For example, if you back up 10 TB of front-end data, use a 30-day retention period, and have a 3% change rate, calculate your total managed data by using the following figures:

```
10 TB * 30 * (1 + .03) = 309 TB total managed data
```

Hardware and software prerequisites

Before you set up your system and configure Tivoli Storage Manager, you must meet hardware and software prerequisites.

Hardware requirements

You must acquire hardware that is based on scale size requirements. You can choose equivalent or better components than what are listed.

The following tables list the hardware requirements for a small, medium, or large configuration. The tables contain detailed descriptions, including part numbers and quantities for IBM components that are used in the storage configuration blueprints.

The system memory sizes that are provided are recommendations for optimal performance. They are not minimum requirements. Memory recommendations account for using both data deduplication and node replication with a database that is near maximum capacity. Some workloads can tolerate smaller amounts of memory. When node replication is not used, the memory recommendations can be reduced by 25%.

The hardware specifications that are provided are current at the time of publishing. Part substitutions might be required, depending on hardware availability over time. Be cautious if you plan to substitute a smaller quantity of larger drives, particularly for the database. A smaller quantity of drives might not provide comparable performance.

Small Storwize system

IBM Storwize disks are designed to provide a simple, high-performance solution for managing block-based storage. For this reason, Storwize systems are suited for use by the Tivoli Storage Manager server for both the database and storage pool. For more information about Storwize features, see IBM Storwize family.

Table 2. Hardware requirements for a small system

Hardware	Requirements	Blueprint component	Detailed description	Quantity	Part number
Server and network	• 6 processor cores, 3.42 GHz or faster • 64 GB RAM • 10-Gigabit Ethernet • 8-Gigabit Fibre Channel adapter	IBM Power System S822L	POWER8® processor-based server	1	8247-22L
			10-core 3.42 GHz POWER8 processor card	1 [1]	ELPD
			32 GB DDR3 memory	2	EL3Q
			PCIe2 LP four-port 1 GbE adapter	1	5260
			PCIe LP 8 Gb two-port Fibre Channel adapter	1	EL2N
			PCIe2 LP 4-Port (10 Gb+1 GbE) SR+RJ45 [2]	1	EN0T
			Storage Backplane 12 SFF-3 Bays and DVD Bay	1	EL3T
			146 GB 15 K RPM SAS SFF-3 disk drive (Linux)[3]	3	ELDT
Disks for storage	• 8 GB cache upgrade • 8-Gigabit host interface • Database disks: 146 GB SAS 15k rpm • Storage pool disks: 3 TB NL-SAS	IBM Storwize V3700	IBM Storwize V3700 SFF Dual Control Enclosure	1	2072-24C
			8 GB Cache	1	ACHB
			8 Gb FC 4 Port Host Interface Card	2	ACHK
			6 Gb SAS 146 GB 15 K 2.5-inch HDD	24	ACLA
			IBM Storwize V3700 Large form-factor (LFF) Expansion Enclosure	2	2072-12E
			0.6 m SAS Cable (mSAS HD to mSAS HD)	4	ACTA
			6 Gb SAS NL 3 TB 7.2 K 3.5-inch HDD	24	ACKB

1. Four of the 10 processor cores are factory disabled, leaving 6 active cores.
2. Different 10 GbE network features, such as adapters EN0V and EL3Z, can be substituted if a different connection type is required.
3. Two of the three 146 GB internal hard disks are configured in a RAID 1 pair, and the third drive is assigned as a spare. If a spare is not needed based on business requirements, the system can be configured with only two drives.

Medium Storwize system

Table 3. Hardware requirements for a medium system

Hardware	Requirements	Blueprint component	Detailed description	Quantity	Part number
Server and network	• 10 processor cores, 3.42 GHz or faster • 128 GB RAM • 10-Gigabit Ethernet • 8-Gigabit Fibre Channel	IBM Power System S822L	POWER8 processor-based server	1	8247-22L
			10-core 3.42 GHz POWER8 processor card	1	ELPD
			32 GB DDR3 memory	4	EL3Q
			PCIe LP 8 Gb two-port Fibre Channel adapter	1	EL2N
			PCIe2 LP 4-Port (10 Gb+1 GbE) SR+RJ45 [1]	1	EN0T
			Storage Backplane 12 SFF-3 Bays and DVD Bay	1	EL3T
			146 GB 15 K RPM SAS SFF-3 disk drive (Linux)[2]	3	ELDT
Disks for storage	• 8-Gigabit host interface • Database disks: 400 GB • Archive log and database backup disks: 1.2 TB 10K SAS • Storage pool disks: 6 TB NL-SAS	IBM Storwize V5000	IBM Storwize V5000 SFF Control Enclosure	1	2078-24C
			8 GB Fibre Channel adapter Pair	1	AC00
			1.2 TB 10K 2.5-inch HDD	16	AC62
			400 GB 2.5-inch Flash Drive	8	AC94
			IBM Storwize V5000 Large form-factor (LFF) Expansion Enclosure	4	2078-12E
			0.6 m SAS Cable (mSAS HD to mSAS HD)	8	ACTA
			6 TB 7.2 K 3.5-inch HDD	48	AC33

1. Different 10 GbE network features, such as adapters EN0V and EL3Z, can be substituted if a different connection type is required.
2. Two of the three 146 GB internal hard disks are configured in a RAID 1 pair, and the third drive is assigned as a spare. If a spare is not needed based on business requirements, the system can be configured with only two drives.

Large Storwize system

Table 4. Hardware requirements for a large system

Hardware	Requirements	Blueprint component	Detailed description	Quantity	Part number
Server and network	• 20 processor cores, 3.42 GHz or faster • 192 GB RAM • 10-Gigabit Ethernet • 8-Gigabit Fibre Channel	IBM Power System S822L	POWER8 processor-based server	1	8247-22L
			10-core 3.42 GHz POWER8 processor card	2	ELPD
			16 GB DDR3 Memory	4	EM83
			32 GB DDR3 memory	4	EL3Q
			PCIe LP 8 Gb two-port Fibre Channel adapter	2	EL2N
			PCIe2 LP two-port 10 GbE RoCE SFP+ adapter[1]	2	EN0T
			Storage Backplane 12 SFF-3 Bays and DVD Bay	1	EL3T
			146 GB 15 K RPM SAS SFF-3 disk drive (Linux)[2]	3	ELDT
Disks for storage	• Database disks: 800 GB • Archive log and database backup disks: 1.8 TB 10K SAS • Storage pool disks: 6 TB NL-SAS	IBM Storwize V7000	IBM Storwize V7000 SFF Disk Control Enclosure	1	2076-524
			8 GB Fibre Channel adapter pair	1	AHB1
			1.8 TB 10K 12 GB SAS 2.5-inch HDD	16	AHF4
			800 GB 2.5-inch flash drive	8	AHH3
			IBM Storwize V7000 LFF Expansion Enclosure	19	2076-12F
			6 TB 7.2 K 3.5-inch HDD	228	AHD4
			0.6 m 12 Gb SAS Cable (mSAS HD)	38 (2 per expansion)	ACUA

1. Different 10 GbE network features, such as adapters EN0V and EL3Z, can be substituted if a different connection type is required.
2. Two of the three 146 GB internal hard disks are configured in a RAID 1 pair, and the third drive is assigned as a spare. If a spare is not needed based on business requirements, the system can be configured with only two drives.

IBM Elastic Storage Server systems

The high-level components that are needed to build a medium or large system with IBM Elastic Storage Server storage are listed in the following tables. To complete the configuration tasks by using this information, consult with your IBM representative or Business Partner.

Medium system

Table 5. Hardware requirements for a medium system that uses IBM Elastic Storage Server

Hardware	Requirements	Blueprint component	Detailed description	Quantity	Part number
Server and network	• 10 processor cores, 3.42 GHz or faster • 128 GB RAM • 10-Gigabit Ethernet • 8-Gigabit Fibre Channel	IBM Power System S822L	POWER8 processor-based server	1	8247-22L
			10-core 3.42 GHz POWER8 processor card	1	ELPD
			32 GB DDR3 memory	4	EL3Q
			PCIe2 LP four-port (10 Gb + 1 GbE) SR+RJ45[1]	2	EN0T
			Storage Backplane 12 SFF-3 Bays/DVD Bay	1	EL3T
			146 GB 15 K RPM SAS SFF-3 Disk Drive (Linux)[2]	3	ELDT
			775 GB SFF-3 SSD for Linux[3]	5	EL13
Storage system	Storage disks: 6 TB NL-SAS	IBM Elastic Storage Server	IBM Elastic Storage Server system	1	5146-GL2
			Storage nodes	2	8247-22L
			Management node	1	8247-21L
			Hardware Management Console	1	7042-CR8
			DCS3700 Storage Expansion with 116 6-TB NL-SAS drives and 2 400 GB SSD drives	2	1818-80E
			6 TB 7,200 rpm 6 Gb NL-SAS 3.5-inch HDD	116	AEDF
			400 GB 2.5-inch 6 Gb SAS PI SSD	2	3494

1. The 40 GbE alternative for part number EN0T is part number EC3A (PCIe3 LP two-port 40 GbE NIC RoCE QSFP+ adapter).
2. Two of the three 146 GB internal hard disks are configured in a RAID 1 pair, and the third drive is assigned as a spare. If a spare is not needed based on business requirements, the system can be configured with only two drives.
3. The drives are used for the Tivoli Storage Manager database for the IBM Elastic Storage Server system.

Large system

Table 6. Hardware requirements for a large system that uses IBM Elastic Storage Server

Hardware	Requirements	Blueprint component	Detailed description	Quantity	Part number
Server and network	• 20 processor cores, 3.42 GHz or faster • 192 GB RAM • 10-Gigabit Ethernet • 8-Gigabit Fibre Channel	IBM Power System S822L	POWER8 processor-based server	1	8247-22L
			10-core 3.42 GHz POWER8 processor card	2	ELPD
			16 GB DDR3 memory	4	EL3P
			32 GB DDR3 Memory	4	EL3Q
			PCIe2 LP 4-Port (10 Gb + 1 GbE) SR+RJ45[1]	4	EN0T
			Storage Backplane 12 SFF-3 Bays/DVD Bay	1	EL3T
			146 GB 15 K RPM SAS SFF-3 Disk Drive (Linux)[2]	3	ELDT
			775 GB SFF-3 SSD for Linux[3]	8	EL13
Storage system	Storage disks: 6 TB NL-SAS	IBM Elastic Storage Server	IBM Elastic Storage Server system	1	5146-GL4
			Storage nodes	2	8247-22L
			Management node	1	8247-21L
			Hardware Management Console	1	7042-CR8
			DCS3700 Storage Expansion with 232 6-TB NL-SAS drives and 2 400 GB SSD drives	4	1818-80E
			6 TB 7.2 K rpm 6 Gb NL-SAS 3.5-inch HDD	232	AEDF
			400 GB 2.5-inch 6 Gb SAS PI SSD	2	3494

1. The 40 GbE alternative for part number EN0T is two instances of part number EC3A (PCIe3 LP 2-Port 40 GbE NIC RoCE QSFP+ adapter).
2. Two of the three 300 GB internal hard disks are configured in a RAID 1 pair, and the third drive is assigned as a spare. If a spare is not needed based on business requirements, the system can be configured with only two drives.
3. The drives are used for the Tivoli Storage Manager database for the IBM Elastic Storage Server system.

Software requirements

You must install the Linux operating system and the Tivoli Storage Manager server and backup-archive client.

The following versions are required:

- Red Hat Enterprise Linux x86-64, Version 7.1 (big endian) or later
- Tivoli Storage Manager V7.1 or later backup-archive client
- A licensed version of Tivoli Storage Manager is required to run the blueprint configuration script. Configuration by using the script is supported by Tivoli

Storage Manager server V7.1 and later. To use directory-container storage pools with inline data deduplication, you must install Tivoli Storage Manager V7.1.3 or later.

Planning worksheets

Use the planning worksheets to record values that you will use when you complete the steps to set up your system and then configure the Tivoli Storage Manager server. The preferred method is to use the default values that are listed in the worksheets.

Default values in the following tables correspond to the default values that are used by the blueprint configuration script to configure the server. By using these values to create your file systems and directories, you can accept all defaults for the configuration when you run the script. If you create directories or plan to use values that do not match the defaults, you must manually enter those values for the configuration.

Use Table 7 to plan for the file systems and directories that you create during system setup. All directories that you create for the server must be empty.

Table 7. Values needed for preconfiguration

Item	Default value	Your value	Directory size	Notes®
TCP/IP port address for communications with the server	1500		Not applicable	This value is used when you install and configure the operating system and is assigned by the blueprint configuration script during configuration of the server. If you want to use a value other than the default, you can specify a number in the range 1024 - 32767.
Directory for the server instance	`/home/tsminst1/tsminst1`		50 GB	If you change the value for the server instance directory from the default, modify the DB2® instance owner ID in Table 8 on page 11 as well.
Directory for server installation	`/`		30 GB	The directory size value is the minimum available space that you must have. For information about system requirements on the Linux on Power operating system, see technote 1108042.
Directory for the active log	`/tsminst1/TSMalog`		• Small and medium: 140 GB • Large: 300 GB	
Directory for the archive log	`/tsminst1/TSMarchlog`		• Small: 1 TB • Medium: 3 TB • Large: 4 TB	

Table 7. Values needed for preconfiguration (continued)

Item	Default value	Your value	Directory size	Notes®

Directories for the database	`/tsminst1/TSMdbspace00`
	`/tsminst1/TSMdbspace01`
	`/tsminst1/TSMdbspace02`
	and so on.
			Minimum total space for all directories:
			• Small: At least 1 TB
			• Medium: At least 2 TB
			• Large: 4 TB
				Create a minimum number of file systems for the database, depending on the size of your system:
				• Small: At least 4 file systems
				• Medium: At least 4 file systems
				• Large: At least 8 file systems

Directories for storage	`/tsminst1/TSMfile00`
	`/tsminst1/TSMfile01`
	`/tsminst1/TSMfile02`
	`/tsminst1/TSMfile03`
	and so on.
			Minimum total space for all directories:
			• Small: At least 38 TB
			• Medium: At least 180 TB
			• Large: At least 980 TB
				Create a minimum number of file systems for storage, depending on the size of your system:
				• Small: At least 10 file systems
				• Medium: At least 20 file systems
				• Large: At least 40 file systems

Directories for database backup	`/tsminst1/TSMbkup00`
	`/tsminst1/TSMbkup01`
	`/tsminst1/TSMbkup02`
	`/tsminst1/TSMbkup03`
			Minimum total space for all directories:
			• Small: At least 3 TB
			• Medium: At least 10 TB
			• Large: At least 16 TB
				Create a minimum number of file systems for backing up the database, depending on the size of your system:
				• Small: At least 2 file systems
				• Medium: At least 4 file systems
				• Large: At least 4 file systems
				Note: The first database backup directory is also used for the archive log failover directory.

Use Table 8 when you run the blueprint configuration script to configure the server. The preferred method is to use the default values, except where noted.

Table 8. Values needed for the server configuration

Item	Default value	Your value	Notes
DB2 instance owner ID	`tsminst1`		If you changed the value for the server instance directory in Table 7 on page 10 from the default, modify the value for the DB2 instance owner ID as well.
DB2 instance owner password	`passw0rd`		The preferred method is to select a different value for the instance owner password than the default. Ensure that you record this value in a secure location.

Table 8. Values needed for the server configuration (continued)

Item	Default value	Your value	Notes
Server name	The default value for the server name is the system host name.		
Server password	`passw0rd`		The preferred method is to select a different value for the server password than the default. Ensure that you record this value in a secure location.
Administrator ID (user ID for the server instance)	`admin`		
Administrator ID password	`passw0rd`		The preferred method is to select a different value for the administrator password than the default. Ensure that you record this value in a secure location.
Schedule start time	`22:00`		The default schedule start time begins the client workload phase, which is predominantly the client backup and archive activities. During the client workload phase, server resources support client operations. These operations are usually completed during the nightly schedule window. Schedules for server maintenance operations are defined to begin 10 hours after the start of the client backup window.

Planning worksheets for server configurations

Table 9. Values needed for preconfiguration

Item	Default value	Your value	Directory size	Notes
TCP/IP port address for communications with the server	1500		Not applicable	This value is used when you install and configure the operating system and is assigned by the blueprint configuration script during configuration of the server. If you want to use a value other than the default, you can specify a number in the range 1024 - 32767.

Table 9. Values needed for preconfiguration (continued)

Item	Default value	Your value	Directory size	Notes
Directory for the server instance	`/esstsm1/tsminst1/tsminst1`		Not applicable	If you change the value for the server instance directory from the default, modify the DB2 instance owner ID in Table 8 on page 11 as well.
Directory for the active log	`/esstsm1/tsminst1/database/alog`		Not applicable	
Directory for the archive log	`/esstsm1/tsminst1/database/archlog`		Not applicable	

Directories for the database	`/ssd/database/TSMdbspace00`
	`/ssd/database/TSMdbspace01`
	`/ssd/database/TSMdbspace02`
	and so on.
			• Medium: 2 TB
			• Large: 4 TB
				Create at least 8 directories for the server database.

Directories for storage	`/esstsm1/tsminst1/deduppool/`		Not applicable	
Directories for database backup	`/esstsm1/tsminst1/dbback`		Not applicable	

Table 10. Values needed for the server configuration

Item	Default value	Your value	Notes
DB2 instance owner ID	`tsminst1`		If you changed the value for the server instance directory in Table 7 on page 10 from the default, modify the value for the DB2 instance owner ID as well.
DB2 instance owner password			The preferred method is to select a different value for the instance owner password than the default. Ensure that you record this value in a secure location.
Server name	The default value for the server name is the system host name.		
Server password	`passw0rd`		The preferred method is to select a different value for the server password than the default. Ensure that you record this value in a secure location.
Administrator ID (user ID for the server instance)	`admin`		
Administrator ID password	`passw0rd`		The preferred method is to select a different value for the administrator password than the default. Ensure that you record this value in a secure location.

Table 10. Values needed for the server configuration (continued)

Item	Default value	Your value	Notes
Schedule start time	22:00		The default schedule start time begins the client workload phase, which is predominantly the client backup and archive activities. During the client workload phase, server resources support client operations. These operations are usually completed during the nightly schedule window. Schedules for server maintenance operations are defined to begin 10 hours after the start of the client backup window.

Chapter 3. Storage configuration blueprints

After you acquire hardware for the scale of server that you want to build, you must prepare your storage to be used with Tivoli Storage Manager. Configuration blueprints provide detailed specifications for storage layout. Use them as a map when you set up and configure your hardware.

Specifications in "Hardware requirements" on page 4 and the default values in the "Planning worksheets" on page 10 were used to construct the blueprints for small, medium, and large systems. If you deviate from those specifications, you must account for any changes when you configure your storage.

Storwize layout requirements

A *managed disk*, or *MDisk*, is a logical unit of physical storage. In the blueprint configurations, MDisks are internal-storage RAID arrays and consist of multiple physical disks that are presented as logical volumes to the system. When you configure the disk system, you will create MDisk groups, or data storage pools, and then create MDisk arrays in the groups. In the blueprint configurations, a one-to-one mapping exists between MDisks and MDisk groups.

Volumes, or LUNs, belong to one MDisk group and one I/O group. The MDisk group defines which MDisks provide the storage that makes up the volume. The I/O group defines which nodes provide I/O access to the volume. When you create volumes, make them fully allocated. For IBM Storwize hardware, select the generic volume type when you create volumes.

Table 11 and Table 12 on page 16 describe the layout requirements for MDisk and volume configuration in the storage blueprints.

Table 11. Components of MDisk configuration

Component	Details
Server storage requirement	How the storage is used by the Tivoli Storage Manager server.
Disk type	Size and speed for the disk type that is used for the storage requirement.
Disk quantity	Number of each disk type that is needed for the storage requirement.
Hot spare coverage	Number of disks that are reserved as spares to take over in case of disk failure.
RAID type	Type of RAID array that is used for logical storage.
RAID array quantity and DDM per array	Number of RAID arrays to be created, and how many disk drive modules (DDMs) are to be used in each of the arrays.
Usable size	Size that is available for data storage after accounting for space that is lost to RAID array redundancy.
Suggested MDisk names	Preferred name to use for MDisks and MDisk groups.
Usage	Tivoli Storage Manager server component that uses part of the physical disk.

Table 12. Components of volume (LUN) configuration

Component	Details
Server storage requirement	Requirement for which the physical disk is used.
Volume name	Unique name that is given to a specific volume.
Quantity	Number of volumes to create for a specific requirement. Use the same naming standard for each volume that is created for the same requirement.
Uses MDisk group	The name of the MDisk group from which the space is obtained to create the volume.
Size	The size of each volume.
Intended server mount point	The directory on the Tivoli Storage Manager server system where the volume is mounted. If you plan to use directories other than the defaults that are configured by the blueprint configuration script, you must also use those directory values when you configure your hardware. In this case, do not use the values that are specified in the blueprints.
Usage	Tivoli Storage Manager server component that uses part of the physical disk.

Small Storwize system

A small-scale system is based on IBM Storwize V3700 storage. One dual control enclosure and two expansion enclosures contain Tivoli Storage Manager data.

Logical layout

Figure 1 shows the small system layout and how server and storage hardware is connected to clients. A single cluster and I/O group are used in this configuration. The small system configuration was tested with 8 Gb Fibre Channel connections made directly from the host to the Storwize V3700 system without a SAN switch.

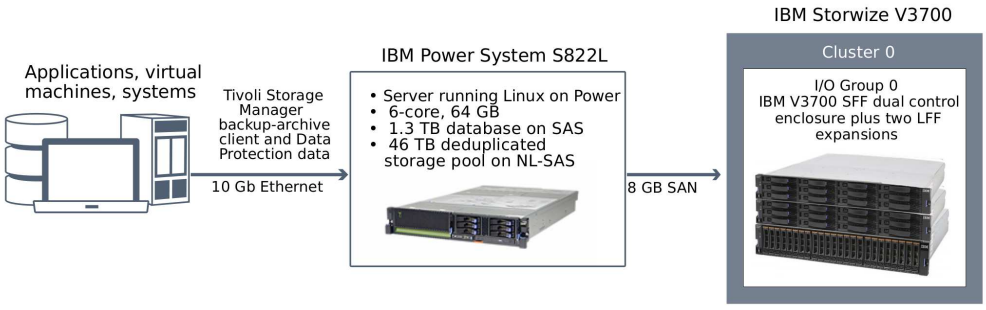

Figure 1. Logical layout for a small system

Storage configuration

Table 13 on page 17 and Table 14 on page 17 show the detailed layout for each Tivoli Storage Manager storage requirement on a small system.

Table 13. MDisk configuration

Server storage requirement	Disk type	Disk quantity	Hot spare coverage	RAID type	RAID array quantity	Usable size	Suggested MDisk group and array names	Usage
Database	146 GB 15k rpm SAS HDD	13	1	RAID 5	2 6 DDM each	679.5 GB each	db_grp0 db_array0 db_grp1 db_array1	Database container
		11	0[1]	RAID 5	1 11 DDM	1.33 TB	log_grp0 log_array0	Active log and archive log
Storage pool	3 TB 7.2k rpm NL-SAS HDD	24	2	RAID 6	2 11 DDM each	24.41 TB each	stgpool_grp0 stgpool_array0 stgpool_grp1 stgpool_array1	Storage pool and database backup

[1]Although zero drives are indicated as spares for this array, spare coverage is provided by one or more of the spares that are listed for other arrays in the table.

Table 14. Fully allocated volume configuration

Server storage requirement	Volume name	Quantity	Uses MDisk group	Size	Intended server mount point	Usage
Database	db_00 db_01	2	db_grp0	339.75 GB each	/tsminst1/TSMdbspace00 /tsminst1/TSMdbspace01	Database container
	db_02 db_03	2	db_grp1	339.75 GB each	/tsminst1/TSMdbspace02 /tsminst1/TSMdbspace03	
	alog	1	log_grp0	145.25 GB	/tsminst1/TSMalog	Active log
	archlog	1	log_grp0	1.19 TB	/tsminst1/TSMarchlog	Archive log

Table 14. Fully allocated volume configuration (continued)

Server storage requirement	Volume name	Quantity	Uses MDisk group	Size	Intended server mount point	Usage
Storage pool	backup_0	1	stgpool_grp0	2 TB	/tsminst1/TSMbkup00	Database backup
	backup_1	1	stgpool_grp1	2 TB	/tsminst1/TSMbkup01	
	filepool_00 - filepool_18	10	stgpool_grp0	2.24 TB each	/tsminst1/TSMfile00 /tsminst1/TSMfile02 /tsminst1/TSMfile04 ... /tsminst1/TSMfile18 (mounted on even directories)	Tivoli Storage Manager file systems for a directory-container storage pool
	filepool_01 - filepool_19	10	stgpool_grp1	2.24 TB each	/tsminst1/TSMfile01 /tsminst1/TSMfile03 /tsminst1/TSMfile05 ... /tsminst1/TSMfile19 (mounted on odd directories)	

Medium Storwize system

A medium-scale system is based on IBM Storwize V5000 hardware. One dual control enclosure and four expansion enclosures contain Tivoli Storage Manager data.

Logical layout

Figure 2 on page 19 shows the medium system layout and how server and storage hardware is connected to clients. A single cluster and I/O group are used. Testing for the medium system configuration was completed by using a SAN switch with 8 GB Fibre Channel connections.

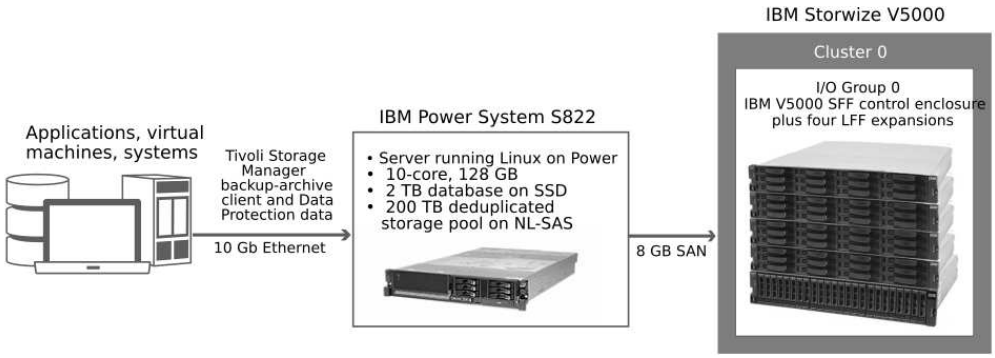

Figure 2. Logical layout for a medium system

Storage configuration

Table 15 and Table 16 on page 20 show the detailed layouts for MDisk and volume configurations on a medium system.

Table 15. MDisk configuration

Server storage requirement	Disk type	Disk quantity	Hot spare coverage	RAID type	RAID array quantity	Usable size	Suggested MDisk group and array names	Usage
Database	400 GB SSD	8	1	RAID 5	1 7 DDM	2.17 TB	db_grp0 db_array0	Database container and active log
	1.2 TB 10k rpm SAS HDD	8	0[1]	RAID 5	1 8 DDM	7.63 TB	arch_bkup_grp0 arch_bkup_array0	Archive log and database backup
		8	1	RAID 5	1 7 DDM	6.54 TB	arch_bkup_grp1 arch_bkup_array1	Archive log and database backup
Storage pool	6 TB NL-SAS	24	0[1]	RAID 6	2 12 DDM each	54.29 TB each	stgpool_grp0 stgpool_array0 stgpool_grp1 stgpool_array1	Storage pool
		24	1	RAID 6	2 11 DDM each	48.83 TB each	stgpool_grp2 stgpool_array2 stgpool_grp3 stgpool_array3	

[1]Although zero drives are indicated as spares for this array, spare coverage is provided by one or more of the spares that are listed for other arrays in the table.

Table 16. Fully allocated volume configuration

Server storage requirement	Volume name	Quantity	Uses MDisk group	Size	Intended server mount point	Usage
Database	db_00 db_01 db_02 db_03	4	db_grp0	520 GB each	/tsminst1/TSMdbspace00 /tsminst1/TSMdbspace01 /tsminst1/TSMdbspace02 /tsminst1/TSMdbspace03	Database container
	alog	1	db_grp0	147 GB	/tsminst1/TSMalog	Active log
	archlog_00	1	arch_bkup_grp0	1.50 TB	/tsminst1/TSMarchlog	Archive log
	archlog_01	1	arch_bkup_grp1	1.50 TB		
	backup_00 backup_01	2	arch_bkup_grp0	3.07 TB each	/tsminst1/TSMbkup00 /tsminst1/TSMbkup01	Database backup
	backup_02 backup_03	2	arch_bkup_grp1	2.52 TB each	/tsminst1/TSMbkup02 /tsminst1/TSMbkup03	
Storage pool	filepool_00 - filepool_09	10	stgpool_grp0 stgpool_grp1 (Five volumes per array)	10.86 TB each	**Mount points skip three** stgpool_grp0: /tsminst1/TSMfile00 /tsminst1/TSMfile04 /tsminst1/TSMfile08 /tsminst1/TSMfile12 /tsminst1/TSMfile16 stgpool_grp1: /tsminst1/TSMfile01 /tsminst1/TSMfile05 /tsminst1/TSMfile09 /tsminst1/TSMfile13 /tsminst1/TSMfile17	Tivoli Storage Manager file systems for a directory-container storage pool
	filepool_10 filepool_19	10	stgpool_grp2 stgpool_grp3 (Five volumes per array)	9.77 TB each	**Mount points skip three** stgpool_grp2: /tsminst1/TSMfile02 /tsminst1/TSMfile06 /tsminst1/TSMfile10 /tsminst1/TSMfile14 /tsminst1/TSMfile18 stgpool_grp3: /tsminst1/TSMfile03 /tsminst1/TSMfile07 /tsminst1/TSMfile11 /tsminst1/TSMfile15 /tsminst1/TSMfile19	

Large Storwize system

A large-scale system is based on IBM Storwize V7000 hardware. One controller with 19 expansions contains the data.

Logical layout

Figure 3 shows the large system layout and how server and storage hardware is connected to clients. Testing for the large system configuration was completed by using a SAN switch with four 8 Gb Fibre Channel connections and four bonded 10 Gb Ethernet connections.

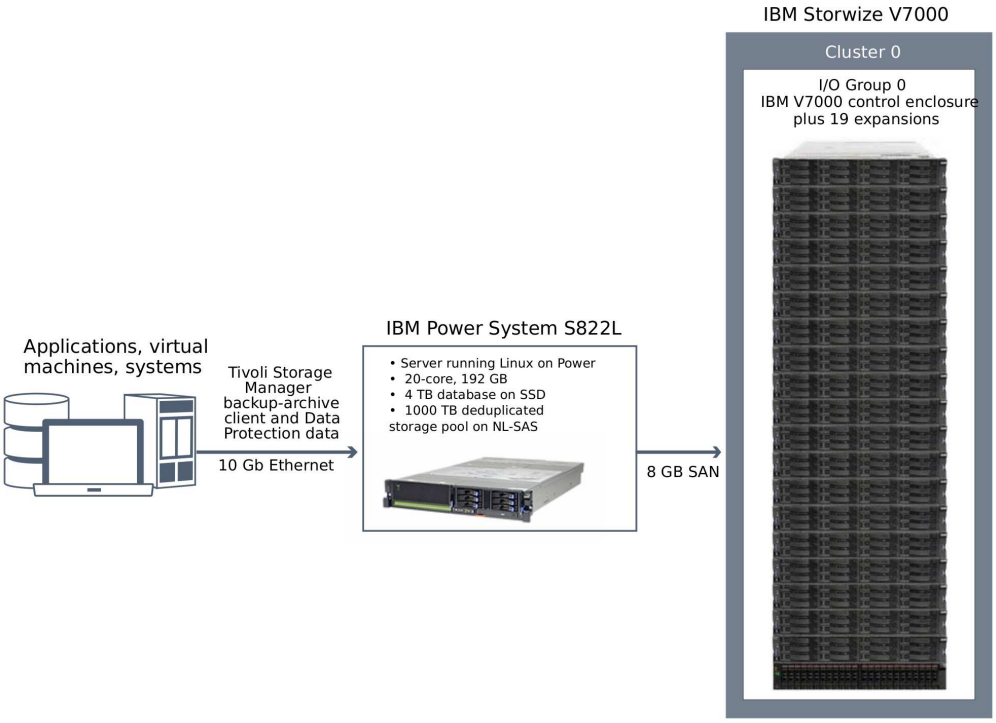

Figure 3. Logical layout for a large system

Storage configuration

Table 17 on page 22 and Table 18 on page 22 show the detailed layouts for MDisk and volume configurations on a large system. To allocate arrays across 19 expansions, the memory that is available for RAIDs must be increased to 75 MB, as described in Step 2 on page 73.

Table 17. MDisk configuration

Server storage requirement	Disk type	Disk quantity	Hot spare coverage	RAID type	RAID array quantity	Usable size	Suggested MDisk group and array names	Usage
Database	800 GB Flash Drive	8	1	RAID 5	1 7 DDM	4.36 TB	db_grp0 db_array0	Database container and active log
	1.8 TB 10K rpm SAS	8	0[1]	RAID 5	1 8 DDM	11.41 TB	arch_bkup_grp0 arch_bkup_array0	Database backup and archive log
		8	1	RAID 5	1 7 DDM	9.78 TB	arch_bkup_grp1 arch_bkup_array1	
Storage pool	6 TB NL-SAS	168	0[1]	RAID 6	14 12 DDM each	54.29 TB each	stgpool_grp00 - stgpool_grp13 stgpool_array00 - stgpool_array13	Storage pool
		60	5	RAID 6	5 11 DDM each	48.83 TB each	stgpool_grp14 - stgpool_grp18 stgpool_array14 - stgpool_array18	

[1]Although zero drives are indicated as spares for this array, spare coverage is provided by one or more of the spares that are listed for other arrays in the table.

Table 18. Fully allocated volume configuration

Server storage requirement	Volume name	Quantity	Uses MDisk group	Size	Intended server mount point	Usage
Database	db_00 - db_07	8	db_grp0	521 GB each	/tsminst1/TSMdbspace00 - /tsminst1/TSMdbspace07	Database container
	alog	1	db_grp0	300 GB	/tsminst1/TSMalog	Active log
	archlog_00	1	arch_bkup_grp0	2 TB	/tsminst1/TSMarchlog	Archive log
	archlog_01	1	arch_bkup_grp1	2 TB		
	backup_00 backup_01	2	arch_bkup_grp0	4.7 TB each	/tsminst1/TSMbkup00 /tsminst1/TSMbkup01	Database backup
	backup_02 backup_03	2	arch_bkup_grp1	3.8 TB each	/tsminst1/TSMbkup02 /tsminst1/TSMbkup03	

Table 18. Fully allocated volume configuration (continued)

Server storage requirement	Volume name	Quantity	Uses MDisk group	Size	Intended server mount point	Usage
Storage pool	filepool_00 - filepool 55	56	stgpool_grp00 - stgpool_grp13 (Four volumes per array)	13.57 TB each	**Mount points skip 18** stgpool_grp00: /tsminst1/TSMfile00 /tsminst1/TSMfile19 /tsminst1/TSMfile38 /tsminst1/TSMfile57 stgpool_grp01: /tsminst1/TSMfile01 /tsminst1/TSMfile20 /tsminst1/TSMfile39 /tsminst1/TSMfile58 . . . stgpool_grp13: /tsminst1/TSMfile13 /tsminst1/TSMfile32 /tsminst1/TSMfile51 /tsminst1/TSMfile70	Tivoli Storage Manager file systems for a directory-container storage pool
	filepool_56 - filepool_83	20	stgpool_grp14 - stgpool_grp18 (Four volumes per array)	12.21 TB each	**Mount points skip 18** stgpool_grp14: /tsminst1/TSMfile14 /tsminst1/TSMfile33 /tsminst1/TSMfile52 /tsminst1/TSMfile71 stgpool_grp15: /tsminst1/TSMfile15 /tsminst1/TSMfile34 /tsminst1/TSMfile53 /tsminst1/TSMfile72 . . . stgpool_grp18: /tsminst1/TSMfile18 /tsminst1/TSMfile37 /tsminst1/TSMfile56 /tsminst1/TSMfile75	

IBM Elastic Storage Server systems

IBM Elastic Storage Server is a scalable storage system that is suited for Tivoli Storage Manager disk-based storage pools. IBM Elastic Storage Server is built on IBM Spectrum Scale technology.

Storage configuration

Some configuration steps are completed at the factory and by IBM services so that the system will be ready for you to provision storage as a single file system for use by the Tivoli Storage Manager server. This includes hardware installation and cabling, software installation on the storage nodes, and configuration of the IBM Elastic Storage Server cluster and recovery groups.

Medium system layout

Figure 4 shows the medium system layout and how the server and storage hardware is connected to clients. Clients communicate with the server by using 10 Gb Ethernet connections.

The Tivoli Storage Manager server communicates with IBM Elastic Storage Server by using either 10 Gb or 40 Gb Ethernet connections. The IBM Spectrum Scale client is installed on the Tivoli Storage Manager server. High-speed access to the storage is possible by using the network shared disk (NSD) protocol that provides direct access to the IBM Elastic Storage Server system through the Ethernet network.

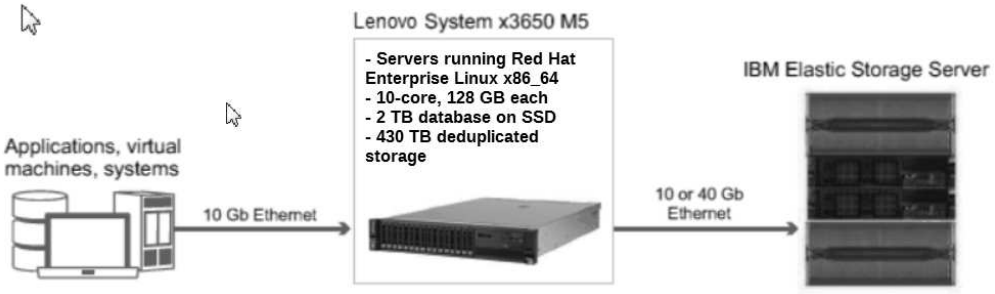

Figure 4. Logical layout for a medium IBM Elastic Storage Server system

Large system layout

Figure 5 on page 25 shows an optional system layout with a single IBM Elastic Storage Server providing sufficient storage for two Tivoli Storage Manager servers to share. Each server protects a different set of clients. Clients communicate with a Tivoli Storage Manager server by using 10 Gb Ethernet connections.

The Tivoli Storage Manager servers communicate with the IBM Elastic Storage Server system by using either 10 Gb or 40 Gb Ethernet connections. The IBM Spectrum Scale client is installed on each Tivoli Storage Manager server. High-speed access to the storage is possible by using the network shared disk (NSD) protocol that provides direct access to the IBM Elastic Storage Server system through the Ethernet network.

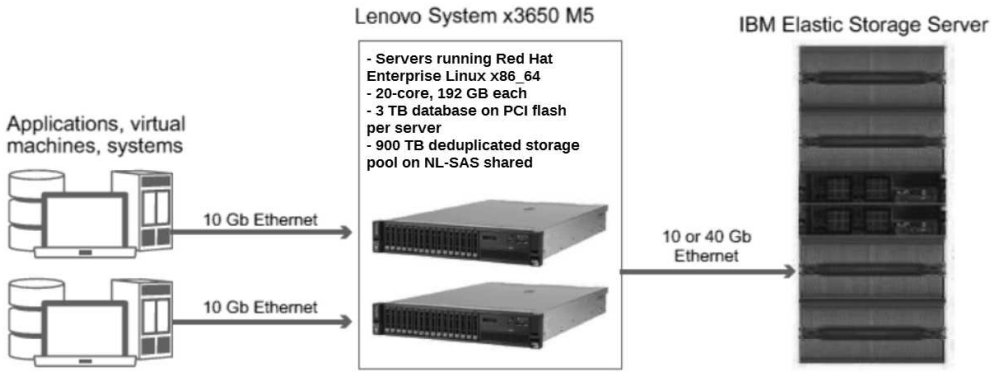

Figure 5. Logical layout for a large IBM Elastic Storage Server system

Chapter 4. Setting up the system

You must set up hardware and preconfigure the system before you run the Tivoli Storage Manager blueprint configuration script.

About this task

Some steps are unique based on the type of storage that you are configuring for your system. Steps are marked for Storwize or IBM Elastic Storage Server systems as applicable.

Procedure

1. Configure your storage hardware according to the blueprint specifications and manufacturer instructions. Follow the instructions in "Step 1: Set up and configure hardware" on page 26.
2. Install the Linux operating system on the server. Follow the instructions in "Step 2: Install the operating system" on page 27.
3. **Storwize systems:** Configure multipath I/O for disk storage devices. Follow the instructions in "Step 3, Storwize systems: Configure multipath I/O" on page 29.
4. **Storwize systems:** Create file systems for Tivoli Storage Manager. Follow the instructions in "Step 4, Storwize systems: Configure file systems for Tivoli Storage Manager" on page 30.
5. **IBM Elastic Storage Server systems:** Configure the IBM Elastic Storage Server system. Follow the instructions in "Step 5, IBM Elastic Storage Server systems: Configuring the system" on page 32.
6. Test system performance with the Tivoli Storage Manager workload simulation tool, `tsmdiskperf.pl`. Follow the instructions in "Step 6: Test system performance" on page 35.
7. Install the Tivoli Storage Manager backup-archive client. Follow the instructions in "Step 7: Install the Tivoli Storage Manager backup-archive client" on page 39.
8. Install the Tivoli Storage Manager license and server. Follow the instructions in "Step 8: Install the Tivoli Storage Manager server" on page 39.

Step 1: Set up and configure hardware

Set up and configure storage hardware by using the blueprint specifications and hardware documentation.

Procedure

1. Connect your hardware according to manufacturer instructions. For optimal system performance, use 8-Gigabit SAN fabric for connections. If you are using a SAN switch, ensure that it is capable of 8 Gb connection speeds.
   - For server SAN cabling, use both Fibre Channel connection ports in the dual-port adapter on small and medium systems for optimal throughput. Use all four ports in the two dual-port adapters on large systems. All configurations should support a Fibre Channel connection directly to storage or to a SAN switch.
   - For storage subsystem SAN cabling, connect four cables to each storage device.
2. Configure the disk system.

   To configure a Storwize system, complete the following steps.

   Tips:
   - For details about using the command line to complete Steps c - e, see Appendix B, "Configuring the disk system by using commands," on page 67.
   - Small, medium, and large systems were tested by using Storwize software level 7.4.0.3.

   a. Configure licensed functions by following the instructions in your hardware documentation.

   b. Set up disks in enclosures according to the manufacturer instructions for the size of system that you are building.

   c. Create RAIDs and LUNs, or volumes. For details about storage configuration layout, see the storage blueprints:
      - "Small Storwize system" on page 16
      - "Medium Storwize system" on page 18
      - "Large Storwize system" on page 21

   d. Define the Tivoli Storage Manager server as a host to the disk system.

   e. Assign or map all of the volumes that were created in Step 2c to the new host. To obtain the Fibre Channel worldwide port name (WWPN) to use for the Storwize host mapping, issue the following command:

      ```
      cat /sys/class/fc_host/host*/port_name
      ```

      You should see output similar to the following example:

      ```
      0x10000090fa49009e
      0x10000090fa49009f
      0x10000090fa3d8f12
      0x10000090fa3d8f13
      ```

Step 2: Install the operating system

Complete the following steps to install Linux on Power on the server system.

Before you begin

The operating system is installed on internal hard disk drives. Configure the drives by using a hardware RAID 1 schema. If you are configuring a small, medium, or large system, configure the three 146 GB internal drives by assigning two drives to a RAID 1 pair and the third drive as a spare. If a spare is not needed to meet business requirements, you can configure the system with only two drives.

You can connect to the Linux on Power system by using a Hardware Management Console (HMC). For information about other console options that you can use for a Linux operating system, see IBM Power Systems documentation.

Procedure

1. Install Red Hat Enterprise Linux Version 7.1 or later, according to the manufacturer instructions, for a big endian architecture.

   Obtain a bootable DVD that contains Red Hat Enterprise Linux Version 7.1 and start your system from this DVD. Blueprint systems were tested by using DVD image RHEL-7.1-20150219.1-Server-ppc64-dvd1.iso.
2. Start the installation. Review the following guidance for installation options. If an item is not mentioned in the following list, leave the default selection.
   a. Set your language preference.
   b. Select your location to set the correct time zone.
   c. For the **Software Selection**, select **Minimal Install**.
   d. For the **Installation Destination**, select 300 GB disk and press **'c'** to continue.
   e. **Autopartitioning Options:** If this is a new installation, choose **Use All Space**. Or, if you are reinstalling over an existing system, select **Replace Existing system**.
   f. **Partition Scheme Options:** Select **LVM**.
   g. Enter network settings, including the host name.
   h. Set the root user password.
   i. Create a non-root user and set a non-root user password.

   After you choose installation options, a summary is displayed. Press **'b'** to begin the installation. When the system restarts, log in as the root user.
3. Configure your TCP/IP settings according to the operating system installation instructions.

   For optimal throughput and reliability, consider bonding multiple network ports together. This can be accomplished by creating a Link Aggregation Control Protocol (LACP) network connection, which aggregates several subordinate ports into a single logical connection. Configuration recommendations include using a bond mode of 802.3ad, **`miimon`** setting of 100, and a **`xmit_hash_policy`** setting of layer3+4.

   For additional instructions on configuring bonded network connections with Red Hat Enterprise Linux Version 7, see Create a Channel Bonding Interface.
4. Open the `/etc/hosts` file and complete the following actions:
   - Update the file to include the IP address and host name for the server. For example:

```
192.0.2.7  server.yourdomain.com  server
```

- Verify that the file contains an entry for localhost with an address of 127.0.0.1. For example:

```
127.0.0.1  localhost
```

5. Install components that are required for Tivoli Storage Manager server installation. Complete the following steps to create a Yellowdog Updater Modified (YUM) repository and install the prerequisite packages.
   a. Mount your Red Hat Enterprise Linux installation DVD to a system directory. For example, to mount it to the `/mnt` directory, issue the following command:

      ```
      mount -t iso9660 -o ro /dev/cdrom /mnt
      ```

   b. Verify that the DVD mounted by issuing the **mount** command. You should see output similar to this example:

      ```
      /dev/sr0 on /mnt type iso9660
      ```

   c. Change to the YUM repository directory by issuing the following command:

      ```
      cd /etc/yum/repos.d
      ```

      If the `repos.d` directory does not exist, create it.

   d. List directory contents:

      ```
      ls rhel-source.repo
      ```

   e. Rename the original repo file by issuing the **mv** command. For example:

      ```
      mv rhel-source.repo rhel-source.repo.orig
      ```

   f. Create a new repo file by using a text editor. For example, to use the vi editor, issue the following command:

      ```
      vi rhel71_dvd.repo
      ```

   g. Add the following lines to the new repo file. The **baseurl** parameter specifies your directory mount point:

      ```
      [rhel71_dvd]
      name=DVD Redhat Enterprise Linux 7.1
      baseurl=file:///mnt
      enabled=1
      gpgcheck=0
      ```

   h. Install the operating system prerequisite packages that are required for Tivoli Storage Manager, by issuing the **yum** command. For example:

      ```
      yum install libstdc++.ppc
      yum install ksh.ppc64
      ```

   i. Install the iostat tool and multipath device mapper. Issue the following commands:

      ```
      yum install sysstat.ppc64
      yum install device-mapper-multipath.ppc64
      ```

6. When the software installation is complete, you can restore the original YUM repository values by completing the following steps:
   a. Unmount the Red Hat Enterprise Linux installation DVD by issuing the following command:

      ```
      unmount /mnt
      ```

   b. Change to the YUM repository directory by issuing the following command:

      ```
      cd /etc/yum/repos.d
      ```

   c. Rename the repo file that you created:

      ```
      mv rhel71_dvd.repo rhel71_dvd.repo.orig
      ```

   d. Rename the original file to the original name:

      ```
      mv rhel-source.repo.orig rhel-source.repo
      ```

7. Install the VACPP prerequisite.
   a. Download and install IBM XL C/C++ Runtime for Linux 12.1.0.7 from technote 4037632.
   b. Issue commands similar to the following to decompress and install the software:

```
gzip -d vacpp.rte.121.linux_ppc.may2014.update.tar.gz
tar –xvf vacpp.rte.121.linux_ppc.may2014.update.tar
rpm -ivh vacpp.rte-12.1.0.7-140429.ppc64.rpm xlsmp.msg.rte-3.1.0.7-
  140509.ppc64.rpm xlsmp.rte-3.1.0.7-140509.ppc64.rpm
```

8. Open firewall ports that Tivoli Storage Manager will use. Complete the following steps:
   a. Determine the zone that is used by the network interface. The zone is public, by default.

      Issue the following command:

```
#  firewall-cmd --get-active-zones
public
  interfaces: ens4f0
```

   b. To use the default port address for communications with the Tivoli Storage Manager server, open TCP/IP port 1500 in the Linux firewall.

      Issue the following command:

```
firewall-cmd --zone=public --add-port=1500/tcp --permanent
```

      If you want to use a value other than the default, you can specify a number in the range 1024 - 32767. If you open a port other than the default, you must specify that port when you run the configuration script.
   c. If you plan to use this system as a Tivoli Storage Manager Operations Center hub, you can open port 11090, which is the default port for secure (https) communications.

      Issue the following command:

```
firewall-cmd --zone=public --add-port=11090/tcp --permanent
```

   d. Reload the firewall definitions for the changes to take effect.

      Issue the following command:

```
firewall-cmd --reload
```

Step 3, Storwize systems: Configure multipath I/O

Complete the steps to enable and configure multipathing for disk storage. For detailed instructions, see the documentation that is provided with your hardware.

Procedure

1. Edit the `/etc/multipath.conf` file to enable multipathing for Linux hosts. If the `multipath.conf` file does not exist, you can create it by issuing the following command:

```
mpathconf --enable
```

   The following parameters were set in `multipath.conf` for testing on an IBM Storwize system:

```
defaults {
        user_friendly_names no
}

devices {
        device {
                vendor "IBM "
```

```
                product "2145"
                path_grouping_policy group_by_prio
                user_friendly_names no
        }
}
```

2. Set the multipath option to start when the system is started. Issue the following commands:

   ```
   systemctl enable multipathd.service
   systemctl start multipathd.service
   ```

3. To verify that disks are visible to the operating system and are managed by multipath, issue the following command:

   ```
   multipath -l
   ```

4. Ensure that each device is listed and that it has as many paths as you expect. You can use size and device ID information to identify which disks are listed.

   For example, the following output shows that a 2 TB disk has two path groups and four active paths. The 2 TB size confirms that the disk corresponds to a pool file system. Use part of the long device ID number (12, in this example) to search for the volume on the disk-system management interface.

   ```
   [root@tapsrv01 code]# multipath -l
   36005076802810c509800000000000012 dm-43 IBM,2145
    size=2.0T features='1 queue_if_no_path' hwhandler='0' wp=rw
   |-+- policy='round-robin 0' prio=0 status=active
   | |- 2:0:1:18 sdcw 70:64   active undef running
   | `- 4:0:0:18 sdgb 131:112 active undef running
   `-+- policy='round-robin 0' prio=0 status=enabled
     |- 1:0:1:18 sdat 66:208  active undef running
     `- 3:0:0:18 sddy 128:0   active undef running
   ```

   a. If needed, correct disk LUN host assignments and force a bus rescan. For example:

      ```
      echo "- - -" > /sys/class/scsi_host/host0/scan
      echo "- - -" > /sys/class/scsi_host/host1/scan
      echo "- - -" > /sys/class/scsi_host/host2/scan
      ```

      You can also restart the system to rescan disk LUN host assignments.

   b. Confirm that disks are now available for multipath I/O by reissuing the **multipath -l** command.

5. Use the multipath output to identify and list device IDs for each disk device.

   For example, the device ID for your 2 TB disk is `36005076802810c509800000000000012`.

   Save the list of device IDs to use in the next step.

Step 4, Storwize systems: Configure file systems for Tivoli Storage Manager

You can use the storage preparation script to automate file system configuration or you can complete the process by using manual steps.

About this task

You must format file systems for each of the disk LUNs that the Tivoli Storage Manager server will use. Format database-related file systems with `ext3`. Format storage pool LUNS with `xfs`.

Complete the steps in one of the following sections.

Configure a file system by using the script

To use the configuration script, `storage_prep_lnx.pl`, extract the blueprint configuration script package and then run the script.

Procedure

1. Open a terminal window and change to the directory where you downloaded the `tsmconfig_v23.tar.Z` file.
2. Extract the file by issuing the following commands:

   ```
   gzip -d tsmconfig_v23.tar.Z
   tar -xvf tsmconfig_v23.tar
   ```

   The process creates a directory that is called `tsmconfig`. This directory contains the storage preparation script, the workload simulation tool, and the blueprint configuration script.
3. Change to the `tsmconfig` directory by issuing the following command:

   ```
   cd tsmconfig
   ```
4. Run the Perl script and specify the size of system that you are configuring. For example, for a medium system, issue the following command:

   ```
   perl storage_prep_lnx.pl medium
   ```

   If you did not map the disks to the host according to the specifications in "Step 3, Storwize systems: Configure multipath I/O" on page 29, the script requires customization.
5. List all file systems by issuing the **df** command. Verify that file systems are mounted at the correct LUN and mount point. Also, verify the available space. The amount of used space should be approximately 1%. For example:

   ```
   [root@tapsrv04 ~]# df -h /tsminst1/*
   Filesystem                                      Size  Used Avail Use% Mounted on
   /dev/mapper/3600507630081010578000000000000003 134G  188M 132G  1%   /tsminst1/TSMalog
   ```

Configure a file system by using the manual procedure

You can configure a file system manually by using commands.

Procedure

1. Using the list of device IDs that you generated in "Step 3, Storwize systems: Configure multipath I/O" on page 29, issue the **mkfs** command to create and format a file system for each storage LUN device. Specify the device ID in the command. For example, for a database file system:

   ```
   mkfs -t ext3 -i 524288 -m 2 /dev/mapper/3600507630081010578000000000002f6
   ```

   For a storage pool LUN:

   ```
   mkfs -t xfs /dev/mapper/3600507630081010578000000000002c3
   ```

   Repeat the **mkfs** command for each volume.
2. Create mount point directories for Tivoli Storage Manager file systems.

   Issue the **mkdir** command for each directory that you must create. Use the directory values that you recorded in the "Planning worksheets" on page 10. For example, to create the server instance directory by using the default value, issue the following command:

   ```
   mkdir /tsminst1
   ```

   Repeat the **mkdir** command for each file system.

   If you are not using the default paths for your directories, you must manually list directory paths during configuration of the Tivoli Storage Manager server.

3. Add an entry in the /etc/fstab file for each file system so that file systems are mounted automatically when the server is started.

   For example, for a database file system:

   ```
   /dev/mapper/36005076802810c509800000000000012 /tsminst1/TSMdbspace00 ext3
    defaults 0 0
   ```

   For a storage pool file system:

   ```
   /dev/mapper/360050763008102618000000000000172 /tsminst1/TSMfile00 xfs
    defaults,inode64 0 0
   ```

4. Mount the file systems that you added to the /etc/fstab file by issuing the **mount -a** command.
5. List all file systems by issuing the **df** command. Verify that file systems are mounted at the correct LUN and correct mount point. Also, verify the available space. The amount of used space should be approximately 1%.

   For example:

   ```
   [root@tapsrv04 ~]# df -h /tsminst1/*
   Filesystem                                      Size  Used Avail Use% Mounted on
   /dev/mapper/360050763008101057800000000000003 134G  188M 132G  1%   /tsminst1/TSMalog
   ```

Step 5, IBM Elastic Storage Server systems: Configuring the system

To configure IBM Elastic Storage Server for a medium or large system, review the following information and work with your IBM representative or IBM Business Partner to complete the setup.

Before you begin

This procedure requires IBM Spectrum Scale software:

- Ensure that you can access the installation package for IBM Spectrum Scale Version 4.1.1 or later at the IBM Passport Advantage® website.
- Ensure that you can access IBM Spectrum Scale V4.1.1, Fix Pack 2 or later, at Fix Central.

Procedure

1. On the Tivoli Storage Manager system, configure TCP/IP settings according to the manufacturer instructions. If you use multiple 10 Gb Ethernet network adapters, the preferred method is to use different adapters for communication between the server and clients, and the server and the IBM Elastic Storage Server system.
2. On the Tivoli Storage Manager system, install IBM Spectrum Scale V4.1.1, Fix Pack 2 or later:
   a. Download the IBM Spectrum Scale base software package at Passport Advantage.
   b. Download the latest IBM Spectrum Scale fix pack at Fix Central.
   c. Install the IBM Spectrum Scale base software.

      Follow the instructions in Installing GPFS™ on Linux nodes.
   d. Install the IBM Spectrum Scale fix pack.
   e. Ensure that the kernel is portable by issuing the following commands:

      ```
      cd /usr/lpp/mmfs/src
      make Autoconfig
      make World
      make InstallImages
      mmstartup
      ```

Tip: You can view the progress of the operation by monitoring the log file in the `/var/mmfs/gen/mmfslog` directory.

3. Configure a Secure Shell (SSH) automatic login procedure without a password between the Tivoli Storage Manager server and the IBM Elastic Storage Server management node and storage nodes. Take one of the following actions:
   - If the `/root/.ssh/id_rsa.pub` file is not available on the Tivoli Storage Manager server, generate an `id_rsa.pub` file. The file contains a public key. Issue the following commands from an IBM Elastic Storage Server storage node that is part of the cluster:

     ```
     sh-keygen –t rsa
     cd /root/.ssh
     chmod 640 /root/.ssh/authorized_keys
     ```

   - If the `/root/.ssh/id_rsa.pub` file is available on the Tivoli Storage Manager server, complete the following steps:
     a. Append the contents of the `id_rsa.pub` file to the end of the `authorized_keys` file on each of the systems in the IBM Spectrum Scale cluster.
     b. Append the contents of the `id_rsa.pub` file from each of the other systems in the cluster to the `authorized_keys` file on the Tivoli Storage Manager server.
4. Verify that the login procedure is configured. Log in to the other computers in the cluster from the Tivoli Storage Manager server by running the **ssh** command without using a password.
5. If the operating system on the Tivoli Storage Manager server is running a firewall, open several ports for incoming network connections from other systems in the IBM Spectrum Scale cluster. For instructions, see the IBM Spectrum Scale documentation.
6. Add the Tivoli Storage Manager system as an IBM Spectrum Scale node in the cluster by running the **mmaddnode** command. Issue the command from an IBM Elastic Storage Server node that is part of the cluster. For example, if the Tivoli Storage Manager IP address is *192.0.2.7*, you would issue the following command:

   ```
   mmaddnode -N 192.0.2.7
   ```

7. Assign an IBM Spectrum Scale license to the Tivoli Storage Manager server. From an IBM Elastic Storage Server node that is part of the cluster, issue the following command:

   ```
   mmchlicense server -N server_ip_address
   ```

   where *server_ip_address* specifies the IP address of the Tivoli Storage Manager server.
8. To optimize the Tivoli Storage Manager server workload, tune IBM Spectrum Scale client-side parameters by using the **mmchconfig** command. Issue the following command from an IBM Elastic Storage Server node that is part of the cluster:

   ```
   mmchconfig disableDIO=yes,aioSyncDelay=10,pagepool=24G -N server_ip_address
   ```

   where *server_ip_address* specifies the IP address of the Tivoli Storage Manager server.
9. Create the IBM Spectrum Scale file system on the IBM Elastic Storage Server system:
   a. Verify that the expected factory configuration of a left and right recovery group is in place by using the **mmlsrecoverygroup** command:

1) Review the command output to verify that two recovery groups exist, and each group has three predefined declustered arrays.
2) Record the recovery group names, which are required in step 9b.

b. Create a stanza file that defines parameters for each virtual disk:
   1) Specify VDisks in the DA1 declustered array from both recovery groups.
   2) Use an 8+2p RAID code for the storage pool data and the 3WayReplication RAID code for the IBM Spectrum Scale file system metadata.

   For example, create a file that is named `/tmp/ess_vdisk` that contains the following information:

```
# cat /tmp/ess_vdisk
%vdisk: vdiskName=GL2_A_L_meta_2m_1 rg=GL2_A_L da=DA1 blocksize=256k
     size=500g raidCode=3WayReplication diskUsage=metadataOnly pool=system
%vdisk: vdiskName=GL2_A_R_meta_2m_1 rg=GL2_A_R da=DA1 blocksize=256k
     size=500g raidCode=3WayReplication diskUsage=metadataOnly pool=system
%vdisk: vdiskName=GL2_A_L_data_2m_1 rg=GL2_A_L da=DA1 blocksize=2m
     raidCode=8+2p diskUsage=dataOnly pool=data
%vdisk: vdiskName=GL2_A_R_data_2m_1 rg=GL2_A_R da=DA1 blocksize=2m
     raidCode=8+2p diskUsage=dataOnly pool=data
```

   Because a size is not specified for the two storage pool VDisks, they use all of the remaining space on the declustered arrays.

   Tip: For larger file systems, you might have to specify more than two VDisks to meet business requirements. Create VDisks in multiples of 50 TB. Specify the size of the VDisk by using the **SIZE** parameter. For example, to create a 400 TB file system, create eight 50 TB VDisks. Stanza entries are similar to the following example:

```
%vdisk: vdiskName=GL2_A_L_data_2m_1
rg=GL2_A_L da=DA1 blocksize=2m size=50t raidCode=8+2p
diskUsage=dataOnly pool=data
```

c. Create disks by running the **mmcrvdisk** and **mmcrnsd** commands and by using the stanza file that you created in step 9b. The **mmcrvdisk** command creates virtual disks, and the **mmcrnsd** command creates IBM Spectrum Scale disks by using the virtual disks.

   For example, if the VDisk stanza is called `/tmp/ess_vdisk`, you would issue the following commands:

```
mmcrvdisk-F /tmp/ess_vdisk
mmcrnsd -F /tmp/ess_vdisk
```

d. Create a single IBM Spectrum Scale file system by using the **mmcrfs** command and specifying the stanza file. Use the 2 MB block size for data and 256 KB for metadata. For example:

```
mmcrfs esstsm1 -F /tmp/ess_vdisk -D nfs4 -B 2m --metadata-block-size 256k
     -A yes -L 128M -k nfs4 -m 1 -M 2 -Q no -r 1 -R 2 -S relatime
     -T /esstsm1 -z no
```

e. Mount the IBM Spectrum Scale file system on the Tivoli Storage Manager system. On the Tivoli Storage Manager system, issue **mmmount** command. For example:

```
mmmount /esstsm1
```

f. Verify the amount of free space in the IBM Spectrum Scale file system. The command and output are similar to the following example:

```
[root@tapsrv03 ~]# df -h /esstsm1

Filesystem      Size  Used Avail Use% Mounted on
/dev/esstsm1    401T 1.7G  401T   1% /esstsm1
```

g. Set IBM Spectrum Scale to automatically start when the system starts by using the **chkconfig** command. For example:

```
chkconfig gpfs on
```

h. Verify that the VDisks and file system were created correctly by using the **mmlsvdisk** and **mmlsfs** commands. For example:

```
mmlsvdisk
mmlsfs /dev/esstsm1
```

10. Configure the internal SSD drives. Follow the instructions in Common IBM SAS RAID controller tasks. Complete the following steps:
    a. Create an array with RAID level 5 by using the IBM Power RAID Configuration Utility.
    b. Designate one of the drives as a spare.
    c. Create file systems to meet your business requirements. The procedure is similar to the procedure described in "Step 4, Storwize systems: Configure file systems for Tivoli Storage Manager" on page 30.

What to do next

If you upgrade the Linux operating system to newer kernel levels or you upgrade IBM Spectrum Scale, you must rebuild the portability layer. Follow the instructions in step 2e on page 32.

For detailed information about completing the steps in the procedure, see the following information:

- Instructions for configuring IBM Elastic Storage Server
- Instructions for installing IBM Spectrum Scale
- IBM Spectrum Scale command reference information

Step 6: Test system performance

Before you install the Tivoli Storage Manager server and client, use the workload simulation tool, `tsmdiskperf.pl`, to identify performance issues with your hardware setup and configuration.

About this task

The Tivoli Storage Manager workload simulation tool can test the performance of the Tivoli Storage Manager server database and storage pool disks. The tool, which is a Perl script, uses the Linux operating system **dd** command to run a non-destructive workload on the system. Use the **iostat** command to monitor the workload for IBM Storwize systems.

IBM Elastic Storage Server systems: The tool can report performance statistics only for local devices that are monitored by the **iostat** or **mmpmon** commands. The tool drives loads against other network-attached devices, but does not collect and report on performance statistics. Use the **mmpmon** command to monitor workloads that are tested on IBM Elastic Storage Server systems.

Sample data from the **iostat** command is extracted for the specific disks that were involved in the test. Then, peak and average measurements for input/output

operations per second (IOPS) and throughput are calculated. The script uses the **dd** command across multiple threads to drive the I/O by using direct I/O.

Tips:

- The **iostat** tool monitors and reports on all I/O for the related disks, even activity that is being driven by applications other than the workload tool. For this reason, ensure that other activity is stopped before you run the tool.
- New storage arrays go through an initialization process. Allow this process to end before you measure disk performance. On Storwize disk systems, you can monitor the initialization progress in the **Running Tasks** view.

The workload simulation tool can run the following types of workloads:

Storage pool workload
The storage pool workload simulates Tivoli Storage Manager server-side data deduplication, in which large, 256 KB block-size sequential read and write operations are overlapped. The write process simulates incoming backups while the read operation simulates identification of duplicate data. The tool creates a read and write thread for every file system that is included in the test, allowing multiple sessions and processes to be striped across more than one file system.

Database workload
The database workload simulates Tivoli Storage Manager database disk access in which small, 8 KB read and write operations are performed randomly across the disk. For this workload, 5 GB files are pre-created on each of the specified file systems and then read and write operations are run to random ranges within these files. Multiple threads are issued against each file system, sending I/O requests simultaneously.

For the database workload, configurations typically have one file system for each pool on the storage array. Include all database file systems when you are testing the database workload.

To use the tool effectively, experiment with test runs by including different quantities of file systems in the simulation until the performance of the system diminishes.

Depending on disk speed and the number of systems that you are testing, the time that is needed to run the script can be 3 - 10 minutes. Complete the following steps to use the workload simulation tool.

Procedure

1. Plan to test either the storage pool file systems or the database file systems.
2. Collect a list of the file systems that are associated with your chosen type of storage. Break the file systems into groups according to which pool they belong to on the disk system. Grouping is used to ensure that physical disks from all volumes on all arrays for the storage type are engaged in the test. To review groupings for file systems, see the volume configuration tables in Chapter 3, “Storage configuration blueprints,” on page 15.

   IBM Elastic Storage Server systems: Because only a single IBM Spectrum Scale file system is defined for storage, you must create temporary directories to use when you run the workload simulation tool and specify the `-fslist` option. For example, issue the **mkdir** command to create temporary directories:

```
mkdir /esstsm1/perftest/1
mkdir /esstsm1/perftest/2
< ... >
mkdir /esstsm1/perftest/14
```

3. To run the tool, change to the `tsmconfig` directory by issuing the following command:

   ```
   cd tsmconfig
   ```

   If you did not extract the blueprint configuration script compressed file to prepare file systems for Tivoli Storage Manager, follow the instructions in "Configure a file system by using the script" on page 31.

4. Run an initial test of the workload that includes one file system of the storage type from each pool on the storage array. For example, to simulate the Tivoli Storage Manager storage pool workload on a medium-scale system, issue the following command:

   ```
   perl tsmdiskperf.pl workload=stgpool
   fslist=/tsminst1/TSMfile00,/tsminst1/TSMfile01,/tsminst1/TSMfile02,/tsminst1/TSMfile03,
   /tsminst1/TSMfile04,/tsminst1/TSMfile05,/tsminst1/TSMfile06,/tsminst1/TSMfile07
   ```

   To simulate the database workload on a small-scale system and include all four of the database file systems, issue the following command:

   ```
   perl tsmdiskperf.pl workload=db fslist=/tsminst1/TSMdbspace00,/tsminst1/TSMdbspace01,
   /tsminst1/TSMdbspace02,/tsminst1/TSMdbspace03
   ```

   Record the reported results for each test run.

5. Rerun the previous test, but modify it to include one additional file system from each pool. For example, if you have two pools on the array that is dedicated to the storage pool, your test sequence will include a count of file systems at 2, 4, 6, 8, 10, and so on.
6. Continue repeating these tests while the reported performance measurements improve. When performance diminishes, capture the results of the last test that indicated improvement. Use these results as the measurements for comparison.

Results

The performance results that are provided when you run the workload simulation tool might not represent the maximum capabilities of the disk subsystem that is being tested. The intent is to provide measurements that can be compared against the lab results that are reported for medium and large systems.

The workload simulation tool is not intended to be a replacement for disk performance analysis tools. Instead, you can use it to spot configuration problems that affect performance before you run Tivoli Storage Manager workloads in a production environment. Problems will be evident if the measurements from test runs are significantly lower than what is reported for test lab systems. If you are using hardware other than the Storwize components that are included in this document, use your test results as a rough estimate of how other disk types compare with the tested configurations.

Example

This example shows the output from a storage pool workload test on a small system. Eight file systems are included. The following command is issued:

```
perl tsmdiskperf.pl workload=stgpool fslist=/tsminst1/TSMfile00,
/tsminst1/TSMfile01,/tsminst1/TSMfile02,/tsminst1/TSMfile03,/tsminst1/TSMfile04,
/tsminst1/TSMfile05,/tsminst1/TSMfile06,/tsminst1/TSMfile07
```

The output shows the following results:

```
================================================================
: TSM disk performance test     (Program version 2.3)
:
: Workload type:                stgpool
: Number of filesystems:        8
: Files to write per fs:        5
: File size:                    1 GB
:
================================================================
:
: Beginning I/O test.
: The test can take upwards of ten minutes, please be patient ...
: Starting write thread ID: 1 on filesystem /tsminst1/TSMfile00
: Starting read thread ID: 2 on filesystem /tsminst1/TSMfile00
: Starting write thread ID: 3 on filesystem /tsminst1/TSMfile01
: Starting read thread ID: 4 on filesystem /tsminst1/TSMfile01
: Starting write thread ID: 5 on filesystem /tsminst1/TSMfile02
: Starting read thread ID: 6 on filesystem /tsminst1/TSMfile02
: Starting write thread ID: 7 on filesystem /tsminst1/TSMfile03
: Starting read thread ID: 8 on filesystem /tsminst1/TSMfile03
: Starting write thread ID: 9 on filesystem /tsminst1/TSMfile04
: Starting read thread ID: 10 on filesystem /tsminst1/TSMfile04
: Starting write thread ID: 11 on filesystem /tsminst1/TSMfile05
: Starting read thread ID: 12 on filesystem /tsminst1/TSMfile05
: Starting write thread ID: 13 on filesystem /tsminst1/TSMfile06
: Starting read thread ID: 14 on filesystem /tsminst1/TSMfile06
: Starting write thread ID: 15 on filesystem /tsminst1/TSMfile07
: Starting read thread ID: 16 on filesystem /tsminst1/TSMfile07
: All threads are finished.  Stopping iostat process with id 15732
================================================================
:  RESULTS:
:  Devices reported on from  output:
:  dm-25
:  dm-28
:  dm-7
:  dm-6
:  dm-4
:  dm-8
:  dm-12
:  dm-15
:
:  Average R Throughput (KB/sec):       227438.06
:  Average W Throughput (KB/sec):       224826.38
:  Avg Combined Throughput (MB/sec):    441.66
:  Max Combined Throughput (MB/sec):    596.65
:
:  Average IOPS:                        1767.16
:  Peak IOPS:                           2387.43 at 08/05/2015 09:38:27
:
:  Total elapsed time (seconds):        171
================================================================
```

What to do next

Compare your performance results against test lab results by reviewing sample outputs for storage pool and database workloads on both medium and large systems:

- For the storage pool workload, the measurement for average combined throughput in MB per second combines the read and write throughput. This is the most useful value when you compare results.
- For the database workload, the peak IOPS measurements add the peak read and write operations per second for a specific time interval. This is the most useful value when you compare results for the database workload.

To review the sample outputs, see Appendix A, “Performance results,” on page 61.

Step 7: Install the Tivoli Storage Manager backup-archive client

Install the Tivoli Storage Manager for Linux backup-archive client so that the administrative command-line client is available.

About this task

Install the backup-archive client and API on the server system.

Procedure

1. Change to the directory where you downloaded the client package files.
2. Install the software by issuing the appropriate commands. For example:

```
rpm -ivh gskcrypt64-8.0.50.42.linux.ppc.rpm gskssl64-8.0.50.42.linux.ppc.rpm
rpm -ivh TIVsm-API64.ppc64.rpm TIVsm-BA.ppc64.rpm
```

   For detailed installation instructions, see Installing the Tivoli Storage Manager backup-archive clients in IBM Knowledge Center.

   Tip: If available, you can display different versions of the same topic by using the **Other versions** menu at the bottom of the page.

Step 8: Install the Tivoli Storage Manager server

To run the blueprint configuration script, you must have a Tivoli Storage Manager license.

Before you begin

To use the script configuration, you must install Tivoli Storage Manager Version 7.1.3 and later. To enable inline compression of data in container storage pools, you must install Tivoli Storage Manager V7.1.5 or later.

About this task

Use the installation instructions in one of the following sections to install the Tivoli Storage Manager server and license.

Install Version 7.1.3 or later

Install Tivoli Storage Manager V7.1.3 or later by using the command line in console mode. You can install from a downloaded package file or from DVD media.

Before you begin

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: You can 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"
```

To determine whether SELinux is installed and in enforcing mode, complete one of the following tasks:

- Check the `/etc/sysconfig/selinux` file.
- Run the **sestatus** operating system command.
- Check the `/var/log/messages` file for SELinux notices.

To disable SELinux, complete the following tasks:

- Set permissive mode by issuing the **setenforce 0** command as a superuser.
- Modify the `/etc/sysconfig/selinux` file to set `SELINUX=disabled`.

After the installation finishes, re-enable SELinux.

Results

If errors occur during the installation process, they 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 Tivoli Storage Manager support portal. Click **Support and downloads** and apply any applicable fixes.

For more information about installation, see Installing and upgrading the server in IBM Knowledge Center.

Installing from a downloaded package file

To install from a downloaded file, obtain the installation package from an IBM download site.

Before you begin

Set the system user limit for maximum file size to unlimited to ensure that the files can be downloaded correctly. To query the maximum file size value, issue the following command:

```
ulimit -Hf
```

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.

To install from a downloaded package, the installation files must be extracted. Complete the following steps to extract the files and then install by using the command line in console mode.

Procedure

1. 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: technote 4040363
   - Tivoli Storage Manager Extended Edition: technote 4040365
   - System Storage® Archive Manager: technote 4040366
2. 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.

3. If necessary, change the file permissions by issuing the following command:

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

4. Issue the following command to extract the installation files:

   ```
   ./package_name.bin
   ```

   where *package_name* is like the following example:

   ```
   7.1.3.000-TIV-TSMSRV-LIC-Linuxppc64.bin
   ```

5. Change to the directory where you downloaded the package file.
6. Start the installation wizard in console mode, by issuing the following command:

   ```
   ./install.sh -c
   ```

   You can generate a response file as part of a console mode installation. Complete the console mode installation options, and in the Summary page, specify `G` to generate the responses.

Installing from DVD media

Obtain the installation package from the product DVD.

Before you begin

Ensure that the installation files are visible on the DVD drive.

Procedure

1. Insert the DVD into the DVD drive.
2. Start the installation wizard in console mode, by issuing the following command:

   ```
   ./install.sh -c
   ```

   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 `G` to generate the responses.

Chapter 5. Configuring the Tivoli Storage Manager server

Run the blueprint configuration script, `TSMserverconfig.pl`, to configure the Tivoli Storage Manager server.

Before you begin

You can run the blueprint configuration script in interactive or non-interactive mode. In interactive mode, you provide responses for each step in the script and accept defaults or enter values for the configuration. In non-interactive mode, the script uses a response file that contains answers to the script prompts.

To run the script in non-interactive mode, use one of the response files that are included in the blueprint configuration compressed file. For instructions about how to use a response file, see Appendix C, "Using a response file with the blueprint configuration script," on page 79.

About this task

When you start the script and select the size of server that you want to configure, the script verifies the following hardware and system configuration prerequisites:

- Sufficient memory is available for server operations.
- Processor core count meets blueprint specifications.
- Kernel parameters are set correctly. If the values are not set as recommended, they are automatically updated when you run the blueprint configuration script to configure the server. For details on kernel parameter settings, see Table 20 on page 49.
- All required file systems are created.
- The minimum number of file system types exist and the minimum level of free space is available in each file system.

If all prerequisites checks are passed, the script begins server configuration. The following tasks are completed to configure the server for optimal performance, based on the scale size that you select:

- A DB2 database instance is created.
- The `dsmserv.opt` options file with optimum values is created.
- The server database is formatted.
- The system configuration is updated to automatically start the server when the system starts.
- Definitions that are required for database backup operations are created.
- A directory-container storage pool with optimal performance settings for data deduplication is defined.

  You can use the `-legacy` option with the blueprint configuration script to force the creation of a deduplicated storage pool, which uses a FILE device class.
- Policy domains for each type of client workload are defined.
- Schedules for client backup are created.
- Server maintenance schedules that are sequenced for optimal data deduplication scalability are created.
- The client options file is created.

The blueprint configuration script includes a compression option that enables compression for both the archive log and database backups. You can save significant storage space by using this option, but the amount of time that is needed to complete database backups increases. The preferred method is to enable the option if you are configuring a small blueprint system because limited space is configured for the archive log and database backups.

The default setting for the `compression` option is disabled. The option should be used only with Tivoli Storage Manager Version 7.1.3 and later.

Tip: Do not confuse the blueprint configuration script compression option with inline compression of data in container storage pools, which is enabled by default with Tivoli Storage Manager V7.1.5 and later.

Complete the following steps as the root user to run the blueprint configuration script.

Procedure

1. Open a terminal window.
2. If you did not extract the blueprint configuration script compressed file to prepare file systems for Tivoli Storage Manager, follow the instructions in "Configure a file system by using the script" on page 31.
3. Change to the `tsmconfig` directory by issuing the following command:
   ```
   cd tsmconfig
   ```
4. Run the configuration script in one of the following modes:
   - To run the configuration script in interactive mode and enter your responses at the script prompts, issue the following command:
     ```
     perl TSMserverconfig.pl
     ```
     If you want to enable compression for the archive log and database backups on a small system, issue the following command:
     ```
     perl TSMserverconfig.pl -compression
     ```
     Depending on how you preconfigured the system, you can accept the default values that are presented by the script. Use the information that you recorded in the "Planning worksheets" on page 10 as a guide. If you changed any of the default values during the preconfiguration step, manually enter your values at the script prompts.
   - To run the configuration script in non-interactive mode by using a response file to set configuration values, specify the response file when you run the script. For example:
     - To use the default response file for a medium system, issue the following command:
       ```
       perl TSMserverconfig.pl responsefilemed.txt
       ```
     - To use the default response file for a small system and enable compression for the archive log and database backups, issue the following command:
       ```
       perl TSMserverconfig.pl responsefilesmall.txt -compression
       ```
     - To use the default response file for a system that uses IBM Elastic Storage Server, issue the following command:
       ```
       perl TSMserverconfig.pl responsefile_ess.txt
       ```

   If you encounter a problem during the configuration and want to pause temporarily, use the quit option. When you run the script again, it resumes at the point that you stopped. You can also open other terminal windows to

correct any issues, and then return to and continue the script. When the script finishes successfully, a log file is created in the current directory.

5. Save the log file for future reference.

   The log file is named `setupLog_datestamp.log` where *datestamp* is the date that you ran the configuration script. If you run the script more than once on the same day, a version number is appended to the end of the name for each additional version that is saved. For example, if you ran the script three times on July 27, 2013, the following logs are created:

   - *setupLog_130727.log*
   - *setupLog_130727_1.log*
   - *setupLog_130727_2.log*

Results

After the script finishes, the server is ready to use. Review Table 19 and the setup log file for details about your system configuration.

Table 20 on page 49 provides details about kernel parameter values for the system.

Table 19. Summary of configured elements

Item	Details
DB2 database instance	• The DB2 instance is created by using the instance user ID and instance home directory. • DB2 instance variables that are required by the server are set. • The DB2 **LOCKLIST** parameter is set as follows to allow the maximum backup of deduplicated data: – Small system: 1500160 – Medium system: 3000320 – Large system: 5000192
Tivoli Storage Manager API	• An API `dsm.sys` file is created in the `/opt/tivoli/tsm/server/bin/dbbkapi/` directory. The following parameters are set. Some values might vary, depending on selections that were made during the configuration: **servername TSMDBMGR_tsminst1** **tcpserveraddr localhost** **commmethod tcpip** **tcpserveraddr localhost** **tcpport 1500** **passworddir /home/tsminst1/tsminst1** **errorlogname /home/tsminst1/tsminst1/tsmdbmgr.log** **nodename $$_TSMDBMGR_$$** • The API password is set.

Table 19. Summary of configured elements (continued)

Item	Details
Server settings	• The server is configured to start automatically when the system is started. • An initial system level administrator is registered. • The server name and password are set. • The following values are specified for SET commands: – **SET ACTLOGRETENTION** is set to 60 – **SET EVENTRETENTION** is set to 30 • The maximum number of sessions is set by using the MAXSESSIONS server option and is based on system size: – Small system: **SETOPT MAXSESSIONS 200** – Medium system: **SETOPT MAXSESSIONS 400** – Large system: **SETOPT MAXSESSIONS 800** The maximum number of scheduled sessions (**SET MAXSCHEDSESSIONS**) is set to 80 percent of the maximum simultaneous client sessions for each sized system.
Tivoli Storage Manager server options file	The dsmserv.opt file is set with optimal parameter values for server scale. The following server options are specified: • **ACTIVELOGSIZE** is set according to scale size: – Small system: 131072 – Medium system: 131072 – Large system: 262144 • If you enabled compression for the blueprint configuration, **ARCHLOGCOMPRESS** is set to Yes. • **COMMTIMEOUT** is set to 3600 seconds. • If you are using the -legacy option for data deduplication, **DEDUPDELETIONTHREADS** is set according to scale size: – Small system: 8 – Medium system: 8 – Large system: 12 • **DIOENABLED** is set to NO for IBM Elastic Storage Server configurations when a directory-container storage pool is created. • **DIRECTIO** is set to NO for IBM Elastic Storage Server configurations. For Storwize configurations, the preferred method is to use the default value of YES. • **DEDUPREQUIRESBACKUP** is set to NO. • **DEVCONFIG** is specified as devconf.dat, which is where a backup copy of device configuration information will be stored. • **EXPINTERVAL** is set to 0, so that expiration processing runs according to schedule. • **IDLETIMEOUT** is set to 60 minutes. • **MAXSESSIONS** is set according to scale size: – Small system: 250 maximum simultaneous client sessions – Medium system: 500 maximum sessions – Large system: 1000 maximum sessions • **NUMOPENVOLSALLOWED** is set to 20 open volumes. • **VOLUMEHISTORY** is specified as volhist.dat, which is where the server will store a backup copy of volume history information.

Table 19. Summary of configured elements (continued)

Item	Details
Tivoli Storage Manager server options file: database reorganization options	Server options that are related to database reorganization are specified in the following sections. Servers at version 7.1.1 or later: • **ALLOWREORGINDEX** is set to YES. • **ALLOWREORGTABLE** is set to YES. • **DISABLEREORGINDEX** is not set. • **DISABLEREORGTABLE** is set to BF_AGGREGATED_BITFILES,BF_BITFILE_EXTENTS, ARCHIVE_OBJECTS,BACKUP_OBJECTS • **REORGBEGINTIME** is set to 12:00. • **REORGDURATION** is set to 6. Servers at versions earlier than 7.1.1: • **ALLOWREORGINDEX** is set to NO. • **ALLOWREORGTABLE** is set to NO. • **REORGBEGINTIME** is set to 12:00. • **REORGDURATION** is set to 6.
Directory-container storage pool	A directory-container storage pool is created, and all of the storage pool file systems are defined as container directories for this storage pool. The following parameters are set in the **DEFINE STGPOOL** command: • **STGTYPE** is set to DIRECTORY • **MAXWRITERS** is set to NOLIMIT If the server is at V7.1.5 or later, compression is automatically enabled for the storage pool.
Storage pool if the -legacy option is specified	• A FILE device class is created and tuned for configuration size: – All storage pool file systems are listed with the **DIRECTORY** parameter in the **DEFINE DEVCLASS** command. – The **MOUNTLIMIT** parameter is set to 4000 for all size systems. – The **MAXCAP** parameter is set to 50 GB for all size systems. • The storage pool is created with settings that are tuned for configuration size: – Data deduplication is enabled. – The value of the **IDENTIFYPROCESS** parameter is set to 0 so that duplicate identification can be scheduled. – Threshold reclamation is disabled so that it can be scheduled. – The **MAXSCRATCH** parameter value is tuned based on the amount of storage that is available in the FILE storage pool.

Table 19. Summary of configured elements (continued)

Item	Details
Server schedules	The following server maintenance schedules are defined: • A replication schedule is defined to run 10 hours after the start of the backup window. This schedule is inactive unless replication is enabled. Then, you must activate the schedule. Sessions are based on system size: – Small system: 20 – Medium system: 40 – Large system: 60 • Database backup is scheduled to run until it is complete. The schedule starts 13 hours after the beginning of the client backup window. A device class that is named DBBACK_FILEDEV is created for the database backup. If the configuration script is started with the `compression` option, the **`BACKUP DB`** command will run with `compress=yes`. • Expiration processing is scheduled to run until it is complete. The schedule starts 14 hours after the beginning of the client backup window. The **`RESOURCE`** parameter is set according to scale size and type of data deduplication storage pool: Directory-container storage pools: – Small system: 10 – Medium system: 30 – Large system: 40 Legacy storage pools: – Small system: 6 – Medium system: 8 – Large system: 10 If you are using the `-legacy` option for data deduplication, the following schedules are also defined: • Duplicate identification is set for a duration of 12 hours. The schedule starts at the beginning of the client backup window. The **`NUMPROCESS`** parameter is set according to scale size: – Small system: 12 – Medium system: 16 – Large system: 32 • Reclamation processing is set for a duration of 8 hours. The reclamation threshold is 25%. The schedule starts 14 hours after the beginning of the client backup window. The **`RECLAIMPROCESS`** parameter is set as part of the storage pool definition, according to scale size: – Small system: 10 – Medium system: 20 – Large system: 32

Table 19. Summary of configured elements (continued)

Item	Details
Policy domains	The following policy domains are created: • STANDARD – The default policy domain • *server name*_DATABASE – Policy domain for database backups • *server name*_FILE – Policy domain for file backups that use the backup-archive client • *server name*_MAIL – Policy domain for mail application backups • *server name*_VIRTUAL – Policy domain for virtual machine backups Policy domains other than the STANDARD policy are named by using a default value with the server name. For example, if your server name is TSMSERVER1, the policy domain for database backups is TSMSERVER1_DATABASE.
Management classes	Management classes are created within the policy domains that are listed in the previous row. Retention periods are defined for 7, 30, 90, and 365 days. The default management class uses the 30-day retention period.
Client schedules	Client schedules are created in each policy domain with the start time that is specified during configuration. The type of backup schedule that is created is based on the type of client: • File server schedules are set as incremental forever. • Data protection schedules are set as full daily. Some data protection schedules include command file names that are appropriate for the data protection client. For details about the schedules that are predefined during configuration, see Appendix D, "Using predefined client schedules," on page 81.

Table 20. Linux kernel parameter optimum settings

Parameter	Description	Preferred value
kernel.shmmni	The maximum number of segments.	256 x *size of RAM in GB* Values for blueprint systems: • Small: 16,384 • Medium: 32,768 • Large: 49,152
kernel.shmmax	The maximum size of a shared memory segment (bytes). This parameter must be set before automatically starting the server on system startup.	*Size of RAM in bytes* Values for blueprint systems: • Small: 68,719,476,736 • Medium: 137,438,953,472 • Large: 206,158,430,208
kernel.shmall	The maximum allocation of shared memory pages (pages)	2 x *size of RAM in bytes* (setting is in 4 KB pages) Value that is used for all blueprint systems: 4,294,967,296 Changes to the factory settings for this parameter are not required.

Table 20. Linux kernel parameter optimum settings (continued)

Parameter	Description	Preferred value

kernel.sem
 	
You must specify four values for the kernel.sem parameter. When you update this parameter, include all values on one line in the following order:
`kernel.sem = SEMMSL SEMMNS SEMOPM SEMMNI`
 	
For example, to update the parameter for a medium system, enter the following values on one line in the `/etc/sysctl.conf` file:
`kernel.sem = 250 256000 32 32768`
	(SEMMSL)
	
	The maximum semaphores per array
		250

	(SEMMNS) The maximum semaphores per system	256,000
	(SEMOPM) The maximum operations per semaphore call	32
	(SEMMNI) The maximum number of arrays	256 x *size of RAM in GB* Values for blueprint systems: • Small: 16,384 • Medium: 32,768 • Large: 49,152
kernel.msgmni	The maximum number of system-wide message queues	1024 x *size of RAM in GB* Values for blueprint systems: • Small: 65,536 • Medium: 131,072 • Large: 196,608
kernel.msgmax	The maximum size of messages (bytes)	65,536
kernel.msgmnb	The default maximum size of queue (bytes)	65,536
kernel.randomize_va_space	The **`kernel.randomize_va_space`** parameter configures the use of memory ASLR for the kernel. When you set the value to 0, `kernel.randomize_va_space=0`, 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 technote 1365583.	0
vm.swappiness	The **`vm.swappiness`** parameter defines whether the kernel can swap application memory out of physical random access memory (RAM). For more information about kernel parameters, see DB2 information in IBM Knowledge Center.	0
vm.overcommit_memory	The **`vm.overcommit_memory`** parameter influences how much virtual memory can be allocated, based on kernel parameter settings. For more information about kernel parameters, see the DB2 information in IBM Knowledge Center.	0
Tip: On Linux, DB2 might automatically increase interprocess communication (IPC) kernel parameter values to the preferred settings. If DB2 updates the values that you set, you do not need to change them back to the values that are listed in this table.		

Removing a Tivoli Storage Manager blueprint configuration

If your blueprint configuration fails, you can use a cleanup script to remove the Tivoli Storage Manager server and stored data.

Before you begin

CAUTION:
The automated script `cleanupserversetup.pl` is destructive and will completely remove a Tivoli Storage Manager server and all stored data.

About this task

The script can be used to clean up your system during initial testing and troubleshooting for blueprint configurations. If a configuration attempt fails, running the script removes the server and all associated Tivoli Storage Manager data. The script uses the file, `serversetupstatefileforcleanup.txt`, which is generated when you run the blueprint configuration script, `TSMserverconfig.pl`.

The cleanup script is available in the `diag` folder of the blueprint `tsmconfig` directory.

Procedure

To clean up your system by using the script, complete the following steps:

1. Edit the `cleanupserversetup.pl` script by commenting out the exit on the first line. For example:

   ```
   #exit;    # This script is destructive, so by default it exits.  Comment-out
     this line to proceed.
   ```

2. Copy the `cleanupserversetup.pl` script into the folder where the `TSMserverconfig.pl` script is located.
3. Issue the following command:

   ```
   perl TSMserverconfig.pl
   ```

4. Issue the following command:

   ```
   perl cleanupserversetup.pl
   ```

Chapter 6. Completing the system configuration

Complete the following tasks after your Tivoli Storage Manager server is configured and running.

About this task

For more information about the configuration tasks, see the documentation for your Tivoli Storage Manager server version in IBM Knowledge Center.

Tip: To display a different version of the same topic in IBM Knowledge Center, you can use the **Other Versions** menu, if available, at the bottom of the page.

Changing default passwords

If you accepted the default value for any of the passwords that are configured by the blueprint configuration script, the preferred method is to change those passwords to more secure values.

About this task

By default, the script sets a value of *passw0rd* for the following passwords:

- Initial Tivoli Storage Manager administrator
- Tivoli Storage Manager server
- DB2 instance owner

Procedure

You can update password information for the server and administrator by using server commands. For more information, see the **UPDATE ADMIN** and **UPDATE SERVER** server commands.

Registering nodes and associating them with predefined client schedules

When you are ready to register nodes to the Tivoli Storage Manager server, use the **REGISTER NODE** command. Then, you can associate nodes with a predefined client schedule.

Before you begin

When you register nodes, the host name of the protected system is typically used for the node name. In the following example, assume that you want to register a node named *newnode1* to the TSMSERVER1_FILE domain for backup-archive client backups, and associate the node with a predefined client schedule. You can use the administrative command line to issue server commands for the operation.

When you issue the **REGISTER NODE** server command, increase the default value for the maximum number of mount points that a node is allowed to use on the server. Specify a value of 99 for the **MAXNUMMP** parameter instead of using the default.

Complete the following example steps to register *newnode1*, associate it with a schedule, and then verify that the schedule is ready to use for backups.

Procedure

1. Register *newnode1* to the TSMSERVER1_FILE domain. Specify a value for the client node password, for example, *pw4node1*. Set the **MAXNUMMP** parameter to 99:

   ```
   register node newnode1 pw4node1 dom=TSMSERVER1_FILE maxnummp=99
   ```

2. To use a predefined client schedule, determine which schedule to associate *newnode1* with by querying the list of available schedules. Issue the **QUERY SCHEDULE** command. The output lists all defined schedules. For example, the following output shows the details for the FILE _INCRFOREVER_10PM schedule:

   ```
   Domain          * Schedule Name          Action  Start Date/Time     Duration  Period  Day
   --------------- - ----------------       ------  ---------------     --------  ------  ---
   TSMSERVER1_FILE   FILE_INCRFOREVER_10PM  Inc Bk  07/24/2013 22:00:00 60 M      1 D     Any
   ```

3. Define an association between *newnode1* and the FILE _INCRFOREVER_10PM schedule. You must specify the domain for the node and schedule. For example:

   ```
   define association TSMSERVER1_FILE FILE_INCRFOREVER_10PM newnode1
   ```

4. Verify that *newnode1* is associated with the correct schedule by issuing the **QUERY ASSOCIATION** command. For example, issue the following command, specifying the schedule domain and the schedule name:

   ```
   query association TSMSERVER1_FILE FILE_INCRFOREVER_10PM
   ```

   The output shows that *newnode1* is associated with the queried domain and schedule name.

   ```
   Policy Domain Name: TSMSERVER1_FILE
        Schedule Name: FILE_INCRFOREVER_10PM
     Associated Nodes: NEWNODE1
   ```

5. Display details about the client schedule by issuing the **QUERY EVENT** command. Specify the domain and name of the schedule for which you want to display events. For example, issue the following command:

   ```
   query event TSMSERVER1_FILE FILE_INCRFOREVER_10PM
   ```

   The output shows that the backup for *newnode1* is scheduled, but has not yet occurred.

   ```
   Scheduled Start      Actual Start   Schedule Name          Node Name   Status
   -------------------  -------------  -------------          ---------   ------
   08/23/2013 22:00:00                 FILE_INCRFOREVER_10PM  NEWNODE1    Future
   ```

6. After you register a node and assign it to a schedule, configure the client and client schedule on the client system and then start the scheduler daemon on the client system so that the backup operation starts at the scheduled time.

   To configure the client schedules that are predefined by the blueprint configuration script, see Appendix D, “Using predefined client schedules,” on page 81.

   For more information about starting the client scheduler, see the Tivoli Storage Manager client documentation in IBM Knowledge Center.

Reorganizing database tables and indexes

Schedule database table and index reorganization to ensure that the server is running efficiently.

About this task

If tables or the indexes that are associated with tables are not reorganized, unexpected database and log growth and reduced server performance can occur over time. The blueprint configuration script configures the server differently for index and table reorganization, depending on version:

Servers at version 7.1.1 or later:
The blueprint configuration script enables online database table and index reorganization for most tables by setting the **ALLOWREORGTABLE** and **ALLOWREORGINDEX** server options to YES.

Table reorganization is disabled for some larger tables by specifying the **DISABLEREORGTABLE** server option. For the tables in the following list, you must still perform offline reorganization by using the procedure in the next section:

- BF_AGGREGATED_BITFILES
- BF_BITFILE_EXTENTS
- ARCHIVE_OBJECTS
- BACKUP_OBJECTS

Servers at versions earlier than 7.1.1:
The blueprint configuration script disables online database table and index reorganization by setting the **ALLOWREORGTABLE** and **ALLOWREORGINDEX** server options to NO. To avoid issues with database growth and server performance, plan to run offline reorganization periodically.

To run offline reorganization, you must have a file system with enough temporary space to hold an entire table during reorganization. Space within the file systems that are used for database backups can be freed up for this purpose.

Because the Tivoli Storage Manager server database grows over time, there might be insufficient space in the database backup file systems to use as free space for the reorganization process. To release space in database backup file systems, you can remove old backup versions.

Complete the following steps to prepare temporary space in the database file systems, and then run offline reorganization.

Procedure

1. Remove the oldest database backups. For example, to remove the two oldest database backups, issue the following command:
   ```
   delete volhistory type=dbb todate=today-5
   ```
2. Back up the current version of the database with the **BACKUP DB** command:
   ```
   backup db devc=DBBACK_FILEDEV type=full numstreams=3
   ```
3. Locate the database backup file system with the most free space to use for the reorganization.
4. Complete the procedure for offline table reorganization. During this step, you might be prompted to back up the database but it is unnecessary for you to do so.

- For servers at V7.1.1.200 and later, follow the instructions in technote 1683633.
- For servers earlier than V7.1.1.200, follow the instructions in technote 1452146.

Chapter 7. Next steps

After you complete the setup and configuration for your Tivoli Storage Manager implementation, you can monitor your system and plan for maintenance.

Monitor your system with the IBM Tivoli Storage Manager Operations Center

For information about the Operations Center, see the following topics.

Getting started with the Operations Center
Installing and upgrading the Operations Center

Monitoring with the Operations Center
Monitoring a single-site disk solution

Access the administrative command-line client

The administrative command-line client is installed when you set up your system to run the Tivoli Storage Manager blueprint configuration script. You can use the administrative client to issue server commands.

For details about using the **DSMADMC** command to start and stop the administrative client, see Issuing commands from the administrative client.

Review documentation

For documentation in IBM Knowledge Center, see the following links.

Tip: If available, you can display different versions of the same topic in IBM Knowledge Center by using the **Other versions** menu at the bottom of the page.

Tivoli Storage Manager server and client software
Tivoli Storage Manager V7.1.3 documentation

POWER8
POWER8 systems information

IBM Storwize v3700 disk storage systems
Storwize V3700 welcome page

Storwize v5000 disk storage systems
Storwize V5000 welcome page

Storwize v7000 disk storage systems
Storwize V7000 welcome page

IBM Elastic Storage Server

- IBM Elastic Storage Server
- General Parallel File System V4.1.0.4

Additional documentation is available at other locations:

IBM Redbooks® for Lenovo System x
Lenovo Press

Optional: Set up node replication and storage pool protection

Two Tivoli Storage Manager servers that are configured by using the blueprint configuration script can be updated to replicate nodes and protect storage pools.

About this task

Node replication

You can use node replication to create additional copies of data on another server.

Tip: To learn the basic concepts of node replication, see Replication of client node data (V7.1.1) in IBM Knowledge Center.

You can set up node replication by using the Add Server Pair wizard in the Operations Center or by following the Procedure.

Storage pool protection

You can use storage pool protection to protect data in a directory-container storage pool by storing the data in another directory-container storage pool on the target server.

Tip: To learn the basic concepts of storage pool protection, see PROTECT STGPOOL (Protect data that belongs to a storage pool) in IBM Knowledge Center.

Procedure

The following manual example assumes that two servers, TAPSRV01 and TAPSRV02, were configured by using the blueprint specifications. The procedure sets up node replication so that client nodes back up data to TAPSRV01 and this data is replicated to TAPSRV02.

1. Set up server-to-server communication.

   On TAPSRV01, issue the following command:

   ```
   define server tapsrv02 serverpassword=passw0rd hla=tapsrv02.yourdomain.com
    lla=1500
   ```

   On TAPSRV02, issue the following command:

   ```
   define server tapsrv01 serverpassword=passw0rd hla=tapsrv01.yourdomain.com
    lla=1500
   ```

2. Test the communication path.

   On TAPSRV01, issue the following command:

   ```
   ping server tapsrv02
   ```

   On TAPSRV02, issue the following command:

   ```
   ping server tapsrv01
   ```

   If the test is successful, you see results similar to the following example:

   ```
   ANR1706I Ping for server 'TAPSRV02' was able to establish a connection.
   ```

3. Export policy definitions from TAPSRV01 to TAPSRV02. Issue the following command on TAPSRV01:

   ```
   export policy * toserver=tapsrv02
   ```

4. Define TAPSRV02 as the replication target of TAPSRV01. Issue the following command on TAPSRV01:

   ```
   set replserver tapsrv02
   ```

5. Enable replication for certain nodes or all nodes. To enable replication for all nodes, issue the following command on TAPSRV01:

   ```
   update node * replstate=enabled
   ```

6. Enable storage pool protection for your directory-container storage pool. For example, issue the following command:

   ```
   update stgpool sourcestgpool protectstgpool=targetstgpool
   ```

7. Activate the administrative schedule that the blueprint configuration script created to run replication every day. Issue the following command:

   ```
   update schedule REPLICATE type=admin active=yes
   ```

   The REPLICATE schedule enables both storage pool protection and node replication.

Appendix A. Performance results

You can compare IBM system performance results against your Tivoli Storage Manager storage configuration as a reference for expected performance.

Observed results are based on measurements that were taken in a test lab environment. Test systems were configured according to the blueprints in this document. Backup-archive clients communicated across a 10 Gb Ethernet connection to the Tivoli Storage Manager server, and deduplicated data was stored in directory-container storage pools. Because many variables can influence throughput in a system configuration, you should not expect to see exact matches with the results. Storage pool compression was included in the test configuration on which these performance results are based.

The following typical factors can cause variations in actual performance:

- Average object size of your workload
- Number of client sessions that are used in your environment
- Amount of duplicate data

This information is provided to serve only as a reference.

Small system performance measurements

Data was recorded for a small system in the IBM test lab environment.

Table 21. Data intake processes

Metric		Limit	Notes
Maximum supported client sessions		250	
Daily amount of new data (before data deduplication)		Up to 6 TB per day	The daily amount of data is how much new data is backed up each day.
Backup ingestion rate	Server-side inline data deduplication	0.9 TB per hour	
	Client-side data deduplication	1.2 TB per hour	

Table 22. Protected data

Metric	Range	Notes
Total managed data (size before data deduplication)	45 TB - 180 TB	Total managed data is the volume of data that the server manages, including all versions.

Table 23. Data restore processes

Metric	Number of restore processes	Limit
Throughput of restore processes	1	422.8 GB per hour
	2	720.8 GB per hour
	4	1241.7 GB per hour
	8	1805.4 GB per hour

Medium system performance measurements

Data was recorded for a medium system in the IBM test lab environment.

Table 24. Data intake processes

Metric		Limit or range	Notes
Maximum supported client sessions		500	
Daily amount of new data (before data deduplication)		6 - 20 TB per day	The daily amount of data is how much new data is backed up each day.
Backup ingestion rate	Server-side inline data deduplication	3.4 TB per hour	
	Client-side data deduplication	4.6 TB per hour	

Table 25. Protected data

Metric	Range	Notes
Total managed data (size before data deduplication)	200 TB - 800 TB	Total managed data is the volume of data that the server manages, including all versions.

Table 26. Data restore processes

Metric	Number of restore processes	Limit
Throughput of restore processes	1	500.3 GB per hour
	2	1050.9 GB per hour
	4	1825.1 GB per hour
	6	2699.8 GB per hour
	8	3306.7 GB per hour
	10	3793.9 GB per hour

Large system performance measurements

Data was recorded for a large system in the IBM test lab environment.

IBM Elastic Storage Server performance results

The following performance results are for a single Tivoli Storage Manager server and do not represent the upper limits of the IBM Elastic Storage Server. Additional aggregate throughput is possible when the IBM Elastic Storage Server storage is shared by more than one Tivoli Storage Manager server. Performance results were also limited by constraints in the test lab. Constraints included the available I/O bandwidth of the source disks on the client systems and having client and storage traffic combined on the same shared network.

The results were measured for an IBM Elastic Storage Server system that uses a legacy data deduplication storage pool and the IBM Elastic Storage Server GL-2 model. The results were obtained on a Linux x86_64 operating system.

Table 27. Data intake from a single Tivoli Storage Manager server

Metric		Limit or range	Notes
Maximum supported client sessions		1000	
Daily amount of new data (before data deduplication)		8 - 20 TB per day	The daily amount of data is how much new data is backed up each day.
Backup ingestion rate	Server-side inline data deduplication	2.9 TB per hour	
	Client-side data deduplication	4 TB per hour	

Table 28. Protected data per Tivoli Storage Manager server

Metric	Range	Notes
Total managed data (size before data deduplication)	80 TB - 400 TB	Total managed data is the volume of data that the server manages, including all versions.

Table 29. Data movement per Tivoli Storage Manager server

Metric	Number of restore processes	Limit
Throughput of restore processes	1	348 GB per hour
	2	552 GB per hour
	4	1040 GB per hour

Workload simulation tool results

Sample data from the workload simulation tool is provided for blueprint test lab systems. Both a storage pool workload and a database workload were tested on each system.

Small system - storage pool workload

The storage pool workload test included eight file systems. The following command was issued:

```
perl tsmdiskperf.pl workload=stgpool fslist=/tsminst1/TSMfile00,
/tsminst1/TSMfile01,/tsminst1/TSMfile02,/tsminst1/TSMfile03,
/tsminst1/TSMfile04,/tsminst1/TSMfile05,
/tsminst1/TSMfile06,/tsminst1/TSMfile07
```

These results were included in the output:

```
:  Average R Throughput (KB/sec):       227438.06
:  Average W Throughput (KB/sec):       224826.38
:  Avg Combined Throughput (MB/sec):    441.66
:  Max Combined Throughput (MB/sec):    596.65
:
:  Average IOPS:                        1767.16
:  Peak IOPS:                           2387.43 at 08/05/2015 09:38:27
:
:  Total elapsed time (seconds):        171
```

Small system - database workload

The database workload test included four file systems. The following command was issued:

```
perl tsmdiskperf.pl workload=db fslist=/tsminst1/TSMdbspace00,
/tsminst1/TSMdbspace01,/tsminst1/TSMdbspace02,/tsminst1/TSMdbspace03
```

These results were included in the output:

```
:  Average R Throughput (KB/sec):       14156.58
:  Average W Throughput (KB/sec):       20426.81
:  Avg Combined Throughput (MB/sec):    33.77
:  Max Combined Throughput (MB/sec):    48.38
:
:  Average IOPS:                        4269.85
:  Peak IOPS:                           6193.43 at 08/05/2015 09:52:46
:
:  Total elapsed time (seconds):        127
```

Medium system - storage pool workload

The storage pool workload test included 14 file systems. The following command was issued:

```
perl tsmdiskperf.pl workload=stgpool
fslist=/tsminst1/TSMfile00,/tsminst1/TSMfile01,
/tsminst1/TSMfile03,/tsminst1/TSMfile04,/tsminst1/TSMfile05,
/tsminst1/TSMfile06,/tsminst1/TSMfile08,/tsminst1/TSMfile09,
/tsminst1/TSMfile10,/tsminst1/TSMfile11,/tsminst1/TSMfile12,
/tsminst1/TSMfile13,/tsminst1/TSMfile15,/tsminst1/TSMfile18
```

These results were included in the output:

```
:  Average R Throughput (KB/sec):       398103.52
:  Average W Throughput (KB/sec):       434791.70
:  Avg Combined Throughput (MB/sec):    813.37
:  Max Combined Throughput (MB/sec):    1289.00
```

```
:
:  Average IOPS:                        3254.58
:  Peak IOPS:                           5157.14 at 11/13/2015 10:49:12
:
:  Total elapsed time (seconds):        151
```

Medium system - database workload

The database workload test included four file systems. The following command was issued:

```
perl tsmdiskperf.pl
workload=db fslist=/tsminst1/TSMdbspace00,
/tsminst1/TSMdbspace01,/tsminst1/TSMdbspace02,
/tsminst1/TSMdbspace03
```

These results were included in the output:

```
:  Average R Throughput (KB/sec):       40890.15
:  Average W Throughput (KB/sec):       60644.34
:  Avg Combined Throughput (MB/sec):    99.15
:  Max Combined Throughput (MB/sec):    130.90
:
:  Average IOPS:                        12409.48
:  Peak IOPS:                           16605.14 at 11/13/2015 11:23:42
:
:  Total elapsed time (seconds):        39
```

IBM Elastic Storage Server system - storage pool workload

Workload simulation results are not currently available.

Appendix B. Configuring the disk system by using commands

You can use the IBM Storwize command line to configure storage arrays and volumes on the disk system. Example procedures are provided for the V3700 (small), V5000 (medium), and V7000 (large) systems.

Refer to Chapter 3, "Storage configuration blueprints," on page 15 for layout specifications.

Small Storwize system

1. Connect to and log in to the disk system by issuing the **ssh** command. For example:

   ```
   ssh superuser@your3700hostname
   ```

2. List drive IDs for each type of disk so that you can create the managed disk (MDisk) arrays in Step 4 on page 68. Issue the **lsdrive** command. The output can vary, based on slot placement for the different disks. The output is similar to the following example:

```
id status   use          tech_type          capacity ... enclosure_id  slot_id ...
0  online   candidate    sas_hdd            136.2GB      1               22
1  online   candidate    sas_hdd            136.2GB      1               21
2  online   candidate    sas_hdd            136.2GB      1               19
3  online   candidate    sas_hdd            136.2GB      1               20
4  online   candidate    sas_hdd            136.2GB      1               18
5  online   candidate    sas_hdd            136.2GB      1               16
6  online   candidate    sas_hdd            136.2GB      1               17
7  online   candidate    sas_hdd            136.2GB      1               15
8  online   candidate    sas_hdd            136.2GB      1               14
9  online   candidate    sas_hdd            136.2GB      1               13
10 online   candidate    sas_hdd            136.2GB      1               12
11 online   candidate    sas_hdd            136.2GB      1               11
12 online   candidate    sas_hdd            136.2GB      1               10
13 online   candidate    sas_hdd            136.2GB      1               9
14 online   candidate    sas_hdd            136.2GB      1               8
15 online   candidate    sas_hdd            136.2GB      1               7
16 online   candidate    sas_hdd            136.2GB      1               6
17 online   candidate    sas_hdd            136.2GB      1               5
18 online   candidate    sas_hdd            136.2GB      1               4
19 online   candidate    sas_hdd            136.2GB      1               3
20 online   candidate    sas_hdd            136.2GB      1               2
21 online   candidate    sas_hdd            136.2GB      1               1
22 online   candidate    sas_hdd            136.2GB      1               24
23 online   candidate    sas_hdd            136.2GB      1               23
24 online   candidate    sas_nearline_hdd   2.7TB        2               4
25 online   candidate    sas_nearline_hdd   2.7TB        2               12
26 online   candidate    sas_nearline_hdd   2.7TB        2               8
27 online   candidate    sas_nearline_hdd   2.7TB        2               3
28 online   candidate    sas_nearline_hdd   2.7TB        2               11
29 online   candidate    sas_nearline_hdd   2.7TB        2               7
30 online   candidate    sas_nearline_hdd   2.7TB        2               10
31 online   candidate    sas_nearline_hdd   2.7TB        2               2
32 online   candidate    sas_nearline_hdd   2.7TB        2               6
33 online   candidate    sas_nearline_hdd   2.7TB        2               5
34 online   candidate    sas_nearline_hdd   2.7TB        2               9
35 online   candidate    sas_nearline_hdd   2.7TB        2               1
36 online   candidate    sas_nearline_hdd   2.7TB        3               4
37 online   candidate    sas_nearline_hdd   2.7TB        3               8
38 online   candidate    sas_nearline_hdd   2.7TB        3               3
39 online   candidate    sas_nearline_hdd   2.7TB        3               11
40 online   candidate    sas_nearline_hdd   2.7TB        3               12
41 online   candidate    sas_nearline_hdd   2.7TB        3               2
42 online   candidate    sas_nearline_hdd   2.7TB        3               6
43 online   candidate    sas_nearline_hdd   2.7TB        3               10
44 online   candidate    sas_nearline_hdd   2.7TB        3               7
```

```
45 online   candidate    sas_nearline_hdd   2.7TB        3               9
46 online   candidate    sas_nearline_hdd   2.7TB        3               5
47 online   candidate    sas_nearline_hdd   2.7TB        3               1
```

3. Create the MDisk groups for the Tivoli Storage Manager database and storage pool. Issue the **mkmdiskgroup** command for each pool, specifying 256 for the extent size:

```
mkmdiskgrp -name db_grp0 -ext 256
mkmdiskgrp -name db_grp1 -ext 256
mkmdiskgrp -name log_grp0 -ext 256
mkmdiskgrp -name stgpool_grp0 -ext 256
mkmdiskgrp -name stgpool_grp1 -ext 256
```

4. Create MDisk arrays by using **mkarray** commands. Specify the commands to complete the following actions:
   - Add the MDisk arrays to the data pools that you created in the previous step.
   - Identify the drives to include in the array by creating drive lists and separating each drive ID number with a colon.

     Tip: To identify drive ID numbers, use the output from the **lsdrive** command.

   For example:

```
mkarray -name db_array0 -drive 0:1:2:3:4:5 -level raid5 -sparegoal 1 db_grp0
mkarray -name db_array1 -drive 6:7:8:9:10:11 -level raid5 -sparegoal 1 db_grp1
mkarray -name log_array0 -drive 12:13:14:15:16:17:18:19:20:21:22 -level raid5
 -sparegoal 1 log_grp0
mkarray -name stgpool_array0 -drive 24:25:26:27:28:29:30:31:32:33:34
 -level raid6 -sparegoal 1 stgpool_grp0
mkarray -name stgpool_array1 -drive 36:37:38:39:40:41:42:43:44:45:46
 -level raid6 -sparegoal 1 stgpool_grp1
```

5. Create the storage volumes for the system. Issue the **mkvdisk** command for each volume, specifying the volume sizes in MB. For example:

```
mkvdisk -mdiskgrp db_grp0 -size 347904 -name db_00 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 347904 -name db_01 -iogrp 0
mkvdisk -mdiskgrp db_grp1 -size 347904 -name db_02 -iogrp 0
mkvdisk -mdiskgrp db_grp1 -size 347904 -name db_03 -iogrp 0

mkvdisk -mdiskgrp log_grp0 -size 148736 -name alog -iogrp 0

mkvdisk -mdiskgrp log_grp0 -size 1244928 -name archlog -iogrp 0

mkvdisk -mdiskgrp stgpool_grp0 -size 2097152 -name backup_0 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2097152 -name backup_1 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_00 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_01 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_02 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_03 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_04 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_05 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_06 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_07 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_08 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_09 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_10 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_11 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_12 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_13 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_14 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_15 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_16 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_17 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 2350336 -name filepool_18 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 2350336 -name filepool_19 -iogrp 0
```

6. Assign hot spares by using the **chdrive** command. You need one spare for the serial-attached Small Computer System Interface (SAS) and two spares for nearline SAS (NL-SAS) for a total of three spares. Do not specify disks that you already included in an MDisk array.

   Tip: To determine which disks are part of an MDisk array, review the **mkarray** commands that you issued previously.

   For example, if drives 23, 35, and 47 are available after you create the MDisk arrays, issue the following commands to assign them as spares:

   ```
   chdrive -use spare 23
   chdrive -use spare 35
   chdrive -use spare 47
   ```

7. Create a logical host object by using the **mkhost** command. Specify the Fibre Channel WWPNs from your operating system and specify the name of your host. To obtain the WWPNs from your system, follow the instructions in "Step 1: Set up and configure hardware" on page 26.

   For example, to create a host that is named *hostone* with a list that contains FC WWPNs *10000090FA3D8F12* and *10000090FA49009E*, issue the following command:

   ```
   mkhost -name hostone -fcwwpn 10000090FA3D8F12:10000090FA49009E -iogrp 0
    -type=generic -force
   ```

8. Map the volumes that you created in Step 5 on page 68 to the new host. Issue the **mkvdiskhostmap** command for each volume. For example, issue the following commands where *hostname* is the name of your host:

   ```
   mkvdiskhostmap -host hostname -scsi 0 db_00
   mkvdiskhostmap -host hostname -scsi 1 db_01
   mkvdiskhostmap -host hostname -scsi 2 db_02
   mkvdiskhostmap -host hostname -scsi 3 db_03

   mkvdiskhostmap -host hostname -scsi 4 alog

   mkvdiskhostmap -host hostname -scsi 5 archlog

   mkvdiskhostmap -host hostname -scsi 6 backup_0
   mkvdiskhostmap -host hostname -scsi 7 backup_1

   mkvdiskhostmap -host hostname -scsi 8 filepool_00
   mkvdiskhostmap -host hostname -scsi 9 filepool_01
   mkvdiskhostmap -host hostname -scsi 10 filepool_02
   mkvdiskhostmap -host hostname -scsi 11 filepool_03
   mkvdiskhostmap -host hostname -scsi 12 filepool_04
   mkvdiskhostmap -host hostname -scsi 13 filepool_05
   mkvdiskhostmap -host hostname -scsi 14 filepool_06
   mkvdiskhostmap -host hostname -scsi 15 filepool_07
   mkvdiskhostmap -host hostname -scsi 16 filepool_08
   mkvdiskhostmap -host hostname -scsi 17 filepool_09
   mkvdiskhostmap -host hostname -scsi 18 filepool_10
   mkvdiskhostmap -host hostname -scsi 19 filepool_11
   mkvdiskhostmap -host hostname -scsi 20 filepool_12
   mkvdiskhostmap -host hostname -scsi 21 filepool_13
   mkvdiskhostmap -host hostname -scsi 22 filepool_14
   mkvdiskhostmap -host hostname -scsi 23 filepool_15
   mkvdiskhostmap -host hostname -scsi 24 filepool_16
   mkvdiskhostmap -host hostname -scsi 25 filepool_17
   mkvdiskhostmap -host hostname -scsi 26 filepool_18
   mkvdiskhostmap -host hostname -scsi 27 filepool_19
   ```

Medium Storwize system

1. Connect to and log in to the disk system by issuing the **ssh** command. For example:

```
ssh superuser@your5000hostname
```

2. List drive IDs for each type of disk so that you can create the MDisk arrays in Step 4 on page 71. Issue the **lsdrive** command. The output can vary, based on slot placement for the different disks. The output is similar to the following example:

```
IBM_Storwize:tapv5a:superuser>lsdrive
id  status  use       tech_type        capacity  ... enclosure_id slot_id ...
0   online  candidate sas_hdd          1.1TB         2            15
1   online  candidate sas_nearline_hdd 5.5TB         4            12
2   online  candidate sas_hdd          1.1TB         2            16
24  online  candidate sas_ssd          372.1GB       2            23
25  online  candidate sas_ssd          372.1GB       2            24
26  online  candidate sas_ssd          372.1GB       2            22
27  online  candidate sas_ssd          372.1GB       2            21
28  online  candidate sas_ssd          372.1GB       2            20
30  online  candidate sas_ssd          372.1GB       2            19
31  online  candidate sas_ssd          372.1GB       2            18
33  online  candidate sas_ssd          372.1GB       2            17
34  online  candidate sas_hdd          1.1TB         2            12
35  online  candidate sas_hdd          1.1TB         2            2
36  online  candidate sas_hdd          1.1TB         2            4
37  online  candidate sas_hdd          1.1TB         2            14
38  online  candidate sas_hdd          1.1TB         2            5
39  online  candidate sas_hdd          1.1TB         2            9
40  online  candidate sas_hdd          1.1TB         2            1
41  online  candidate sas_hdd          1.1TB         2            8
42  online  candidate sas_hdd          1.1TB         2            13
43  online  candidate sas_hdd          1.1TB         2            11
44  online  candidate sas_hdd          1.1TB         2            10
45  online  candidate sas_hdd          1.1TB         2            6
46  online  candidate sas_hdd          1.1TB         2            7
67  online  candidate sas_hdd          1.1TB         2            3
73  online  candidate sas_nearline_hdd 5.5TB         4            11
74  online  candidate sas_nearline_hdd 5.5TB         4            1
75  online  candidate sas_nearline_hdd 5.5TB         4            10
76  online  candidate sas_nearline_hdd 5.5TB         4            3
77  online  candidate sas_nearline_hdd 5.5TB         4            6
78  online  candidate sas_nearline_hdd 5.5TB         4            9
79  online  candidate sas_nearline_hdd 5.5TB         4            4
80  online  candidate sas_nearline_hdd 5.5TB         4            5
81  online  candidate sas_nearline_hdd 5.5TB         4            8
82  online  candidate sas_nearline_hdd 5.5TB         4            2
83  online  candidate sas_nearline_hdd 5.5TB         4            7
84  online  candidate sas_nearline_hdd 5.5TB         5            12
85  online  candidate sas_nearline_hdd 5.5TB         5            2
86  online  candidate sas_nearline_hdd 5.5TB         5            1
87  online  candidate sas_nearline_hdd 5.5TB         5            10
88  online  candidate sas_nearline_hdd 5.5TB         5            4
89  online  candidate sas_nearline_hdd 5.5TB         5            8
90  online  candidate sas_nearline_hdd 5.5TB         5            7
91  online  candidate sas_nearline_hdd 5.5TB         5            9
92  online  candidate sas_nearline_hdd 5.5TB         5            5
93  online  candidate sas_nearline_hdd 5.5TB         5            11
94  online  candidate sas_nearline_hdd 5.5TB         5            6
95  online  candidate sas_nearline_hdd 5.5TB         5            3
96  online  candidate sas_nearline_hdd 5.5TB         6            1
97  online  candidate sas_nearline_hdd 5.5TB         6            2
98  online  candidate sas_nearline_hdd 5.5TB         6            9
99  online  candidate sas_nearline_hdd 5.5TB         6            6
100 online  candidate sas_nearline_hdd 5.5TB         6            11
101 online  candidate sas_nearline_hdd 5.5TB         6            4
102 online  candidate sas_nearline_hdd 5.5TB         6            12
103 online  candidate sas_nearline_hdd 5.5TB         6            8
104 online  candidate sas_nearline_hdd 5.5TB         6            10
105 online  candidate sas_nearline_hdd 5.5TB         7            12
106 online  candidate sas_nearline_hdd 5.5TB         7            3
107 online  candidate sas_nearline_hdd 5.5TB         7            2
108 online  candidate sas_nearline_hdd 5.5TB         7            6
109 online  candidate sas_nearline_hdd 5.5TB         7            9
110 online  candidate sas_nearline_hdd 5.5TB         7            4
111 online  candidate sas_nearline_hdd 5.5TB         7            5
112 online  candidate sas_nearline_hdd 5.5TB         7            11
```

```
113 online  candidate sas_nearline_hdd 5.5TB         7            10
114 online  candidate sas_nearline_hdd 5.5TB         6            3
115 online  candidate sas_nearline_hdd 5.5TB         6            7
116 online  candidate sas_nearline_hdd 5.5TB         6            5
117 online  candidate sas_nearline_hdd 5.5TB         7            7
118 online  candidate sas_nearline_hdd 5.5TB         7            1
119 online  candidate sas_nearline_hdd 5.5TB         7            8
```

3. Create the MDisk groups for the Tivoli Storage Manager database and storage pool. Issue the **mkmdiskgroup** command for each pool, specifying 1024 for the extent size:

```
mkmdiskgrp -name db_grp0 -ext 1024
mkmdiskgrp -name arch_bkup_grp0 -ext 1024
mkmdiskgrp -name arch_bkup_grp1 -ext 1024
mkmdiskgrp -name stgpool_grp0 -ext 1024
mkmdiskgrp -name stgpool_grp1 -ext 1024
mkmdiskgrp -name stgpool_grp2 -ext 1024
mkmdiskgrp -name stgpool_grp3 -ext 1024
```

4. Create MDisk arrays by using **mkarray** commands. Specify the commands to complete the following actions:
   - Add the MDisk arrays to the data pools that you created in the previous step.
   - Identify the drives to include in the array by creating drive lists and separating each drive ID by a colon.

   Tip: Use the output from the **lsdrive** command to create the drive lists.

   For example:

```
mkarray -name db_array0 -drive 24:25:26:27:28:30:31 -level raid5
-sparegoal 1 db_grp0
mkarray -name arch_bkup_array0 -drive 0:2:34:35:36:37:38:39 -level raid5
-sparegoal 1 arch_bkup_grp0
mkarray -name arch_bkup_array1 -drive 40:41:42:43:44:45:46 -level raid5
-sparegoal 1 arch_bkup_grp1
mkarray -name stgpool_array0 -drive 1:73:74:75:76:77:78:79:80:81:82:83
-level raid6 -sparegoal 1 stgpool_grp0
mkarray -name stgpool_array1 -drive 84:85:86:87:88:89:90:91:92:93:94:95
-level raid6 -sparegoal 1stgpool_grp1
mkarray -name stgpool_array2 -drive 96:97:98:99:100:101:102:103:104:114:115
-level raid6 -sparegoal 1 stgpool_grp2
mkarray -name stgpool_array3 -drive 105:106:107:108:109:110:111:112:113:117:118
-level raid6 -sparegoal 1 stgpool_grp3
```

5. Create the storage volumes for the system. Issue the **mkvdisk** command for each volume, specifying the volume sizes in MB. For example:

```
mkvdisk -mdiskgrp db_grp0 -size 532480 -name db_00 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 532480 -name db_01 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 532480 -name db_02 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 532480 -name db_03 -iogrp 0

mkvdisk -mdiskgrp db_grp0 -size 150528 -name alog -iogrp 0

mkvdisk -mdiskgrp arch_bkup_grp0 -size 1572864 -name archlog_00 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp1 -size 1572864 -name archlog_01 -iogrp 0

mkvdisk -mdiskgrp arch_bkup_grp0 -size 3214909 -name backup_00 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp0 -size 3214909 -name backup_01 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp1 -size 2642411 -name backup_02 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp1 -size 2642411 -name backup_03 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp0 -size 11384761 -name filepool_00 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 11384761 -name filepool_01 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 11384761 -name filepool_02 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 11384761 -name filepool_03 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp0 -size 11384761 -name filepool_04 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp1 -size 11384761 -name filepool_05 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 11384761 -name filepool_06 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 11384761 -name filepool_07 -iogrp 0
```

```
mkvdisk -mdiskgrp stgpool_grp1 -size 11384761 -name filepool_08 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp1 -size 11384761 -name filepool_09 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp2 -size 10241024 -name filepool_10 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp2 -size 10241024 -name filepool_11 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp2 -size 10241024 -name filepool_12 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp2 -size 10241024 -name filepool_13 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp2 -size 10241024 -name filepool_14 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp3 -size 10241024 -name filepool_15 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp3 -size 10241024 -name filepool_16 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp3 -size 10241024 -name filepool_17 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp3 -size 10241024 -name filepool_18 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp3 -size 10241024 -name filepool_19 -iogrp 0
```

6. Assign hot spares by using the **chdrive** command. You need one spare for SSD, one spare for SAS, and two spares for NL-SAS for a total of four spares. Do not specify disks that you already included in an MDisk array.

   Tip: To determine which disks are part of an MDisk array, review the **mkarray** commands that you issued previously.

   For example, if drives 33, 67, 116, and 119 are available after you create the MDisk arrays, issue the following commands to assign them as spares:

   ```
   chdrive -use spare 33
   chdrive -use spare 67
   chdrive -use spare 116
   chdrive -use spare 119
   ```

7. Create a logical host object by using the **mkhost** command. Specify the Fibre Channel WWPNs from your operating system and specify the name of your host. To obtain the WWPNs from your system, follow the instructions in "Step 1: Set up and configure hardware" on page 26.

   For example, to create a host that is named *hostone* with a list that contains FC WWPNs *10000090FA3D8F12* and *10000090FA49009E*, issue the following command:

   ```
   mkhost -name hostone -fcwwpn 10000090FA3D8F12:10000090FA49009E -iogrp 0
    -type=generic -force
   ```

8. Map the volumes that you created in Step 5 on page 71 to the new host. Issue the **mkvdiskhostmap** command for each volume. For example, issue the following commands where *hostname* is the name of your host:

   ```
   mkvdiskhostmap -host hostname -scsi 0 db_00
   mkvdiskhostmap -host hostname -scsi 1 db_01
   mkvdiskhostmap -host hostname -scsi 2 db_02
   mkvdiskhostmap -host hostname -scsi 3 db_03

   mkvdiskhostmap -host hostname -scsi 4 alog

   mkvdiskhostmap -host hostname -scsi 5 archlog_00
   mkvdiskhostmap -host hostname -scsi 6 archlog_01

   mkvdiskhostmap -host hostname -scsi 7 backup_00
   mkvdiskhostmap -host hostname -scsi 8 backup_01
   mkvdiskhostmap -host hostname -scsi 9 backup_02
   mkvdiskhostmap -host hostname -scsi 10 backup_03

   mkvdiskhostmap -host hostname -scsi 11 filepool_00
   mkvdiskhostmap -host hostname -scsi 12 filepool_01
   mkvdiskhostmap -host hostname -scsi 13 filepool_02
   mkvdiskhostmap -host hostname -scsi 14 filepool_03
   mkvdiskhostmap -host hostname -scsi 15 filepool_04
   mkvdiskhostmap -host hostname -scsi 16 filepool_05
   mkvdiskhostmap -host hostname -scsi 17 filepool_06
   mkvdiskhostmap -host hostname -scsi 18 filepool_07
   mkvdiskhostmap -host hostname -scsi 19 filepool_08
   ```

```
mkvdiskhostmap -host hostname -scsi 20 filepool_09
mkvdiskhostmap -host hostname -scsi 21 filepool_10
mkvdiskhostmap -host hostname -scsi 22 filepool_11
mkvdiskhostmap -host hostname -scsi 23 filepool_12
mkvdiskhostmap -host hostname -scsi 24 filepool_13
mkvdiskhostmap -host hostname -scsi 25 filepool_14
mkvdiskhostmap -host hostname -scsi 26 filepool_15
mkvdiskhostmap -host hostname -scsi 27 filepool_16
mkvdiskhostmap -host hostname -scsi 28 filepool_17
mkvdiskhostmap -host hostname -scsi 29 filepool_18
mkvdiskhostmap -host hostname -scsi 30 filepool_19
```

Large Storwize system

1. Connect to and log in to the disk system by issuing the **ssh** command. For example:

   ```
   ssh superuser@your7000hostname
   ```

2. Increase the memory that is available for the RAIDs to 75 MB by issuing the **chiogrp** command:

   ```
   chiogrp -feature raid -size 75
   ```

3. List drive IDs for each type of disk so that you can create the MDisk arrays in Step 5. Issue the **lsdrive** command. The output can vary, based on slot placement for the different disks. The output is similar to what is returned for small and medium systems.

4. Create the MDisk groups for the Tivoli Storage Manager database and storage pool. Issue the **mkmdiskgroup** command for each pool, specifying 1024 for the extent size:

   ```
   mkmdiskgrp -name db_grp0 -ext 1024
   mkmdiskgrp -name arch_bkup_grp0 -ext 1024
   mkmdiskgrp -name arch_bkup_grp1 -ext 1024
   mkmdiskgrp -name stgpool_grp00 -ext 1024
   mkmdiskgrp -name stgpool_grp01 -ext 1024
   mkmdiskgrp -name stgpool_grp02 -ext 1024
   mkmdiskgrp -name stgpool_grp03 -ext 1024
   mkmdiskgrp -name stgpool_grp04 -ext 1024
   mkmdiskgrp -name stgpool_grp05 -ext 1024
   mkmdiskgrp -name stgpool_grp06 -ext 1024
   mkmdiskgrp -name stgpool_grp07 -ext 1024
   mkmdiskgrp -name stgpool_grp08 -ext 1024
   mkmdiskgrp -name stgpool_grp09 -ext 1024
   mkmdiskgrp -name stgpool_grp10 -ext 1024
   mkmdiskgrp -name stgpool_grp11 -ext 1024
   mkmdiskgrp -name stgpool_grp12 -ext 1024
   mkmdiskgrp -name stgpool_grp13 -ext 1024
   mkmdiskgrp -name stgpool_grp14 -ext 1024
   mkmdiskgrp -name stgpool_grp15 -ext 1024
   mkmdiskgrp -name stgpool_grp16 -ext 1024
   mkmdiskgrp -name stgpool_grp17 -ext 1024
   mkmdiskgrp -name stgpool_grp18 -ext 1024
   ```

5. Create MDisk arrays by using **mkarray** commands. Specify the commands to complete the following actions:

   - Add the MDisk arrays to the data pools that you created in the previous step.
   - Identify the drives to include in the array by creating drive lists and separating each drive ID by a colon. Five of the 19 storage pool arrays use 11 drives instead of 12 to make spares available.

     Tip: Use the output from the **lsdrive** command to create the drive lists.

   For example:

```
mkarray -name db_array0 -drive 0:1:2:3:4:5:6 -level raid5
-sparegoal 1 db_grp0
mkarray -name arch_bkkup_array0 -drive 8:9:10:11:12:13:14:15 -level raid5
 -sparegoal 1 arch_bkup_grp0
mkarray -name arch_bkkup_array1 -drive 16:17:18:19:20:21:22 -level raid5
 -sparegoal 1 arch_bkup_grp1
mkarray -name stgpool_array00 -drive 24:25:26:27:28:29:30:31:32:33:34:35
 -level raid6 -sparegoal 1 stgpool_grp00
mkarray -name stgpool_array01 -drive 36:37:38:39:40:41:42:43:44:45:46
 -level raid6 -sparegoal 1 stgpool_grp01
mkarray -name stgpool_array02 -drive 48:49:50:51:52:53:54:55:56:57:58:59
 -level raid6 -sparegoal 1 stgpool_grp02
mkarray -name stgpool_array03 -drive 60:61:62:63:64:65:66:67:68:69:70
 -level raid6 -sparegoal 1 stgpool_grp03
mkarray -name stgpool_array04 -drive 72:73:74:75:76:77:78:79:80:81:82:83
 -level raid6 -sparegoal 1 stgpool_grp04
mkarray -name stgpool_array05 -drive 84:85:86:87:88:89:90:91:92:93:94
 -level raid6 -sparegoal 1 stgpool_grp05
mkarray -name stgpool_array06 -drive 96:97:98:99:100:101:102:103:104:105:106:107
 -level raid6 -sparegoal 1 stgpool_grp06
mkarray -name stgpool_array07 -drive 108:109:110:111:112:113:114:115:116:117:118
 -level raid6 -sparegoal 1 stgpool_grp07
mkarray -name stgpool_array08 -drive 120:121:122:123:124:125:126:127:128:129:130:131
 -level raid6 -sparegoal 1 stgpool_grp08
mkarray -name stgpool_array09 -drive 132:133:134:135:136:137:138:139:140:141:142
 -level raid6 -sparegoal 1 stgpool_grp09
mkarray -name stgpool_array10 -drive 144:145:146:147:148:149:150:151:152:153:154:155
 -level raid6 -sparegoal 1 stgpool_grp10
mkarray -name stgpool_array11 -drive 156:157:158:159:160:161:162:163:164:165:166:167
 -level raid6 -sparegoal 1 stgpool_grp11
mkarray -name stgpool_array12 -drive 168:169:170:171:172:173:174:175:176:177:178:179
 -level raid6 -sparegoal 1 stgpool_grp12
mkarray -name stgpool_array13 -drive 180:181:182:183:184:185:186:187:188:189:190:191
 -level raid6 -sparegoal 1 stgpool_grp13
mkarray -name stgpool_array14 -drive 192:193:194:195:196:197:198:199:200:201:202:203
 -level raid6 -sparegoal 1 stgpool_grp14
mkarray -name stgpool_array15 -drive 204:205:206:207:208:209:210:211:212:213:214:215
 -level raid6 -sparegoal 1 stgpool_grp15
mkarray -name stgpool_array16 -drive 216:217:218:219:220:221:222:223:224:225:226:227
 -level raid6 -sparegoal 1 stgpool_grp16
mkarray -name stgpool_array17 -drive 228:229:230:231:232:233:234:235:236:237:238:239
 -level raid6 -sparegoal 1 stgpool_grp17
mkarray -name stgpool_array18 -drive 240:241:242:243:244:245:246:247:248:249:250:251
 -level raid6 -sparegoal 1 stgpool_grp18
```

6. Create the storage volumes for the system. Issue the **mkvdisk** command to create each volume in an MDisk group. The unit of size that is specified varies for different types. Compression with automatic expansion is enabled for the database, archive log, and database backup volumes.

   For example:

```
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_00 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_01 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_02 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_03 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_04 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_05 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_06 -iogrp 0
mkvdisk -mdiskgrp db_grp0 -size 533504 -unit mb -name db_07 -iogrp 0

mkvdisk -mdiskgrp db_grp0 -size 307200 -unit mb -name alog -iogrp 0

mkvdisk -mdiskgrp arch_bkup_grp0 -size 2097152 -unit mb -name archlog_00 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp1 -size 2097152 -unit mb -name archlog_01 -iogrp 0

mkvdisk -mdiskgrp arch_bkup_grp0 -size 4928307 -unit mb -name backup_00 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp0 -size 4928307 -unit mb -name backup_01 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp1 -size 3984588 -unit mb -name backup_02 -iogrp 0
mkvdisk -mdiskgrp arch_bkup_grp1 -size 3984588 -unit mb -name backup_03 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp00 -size 13897 -unit gb -name filepool_00 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp00 -size 13897 -unit gb -name filepool_01 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp00 -size 13897 -unit gb -name filepool_02 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp00 -size 13897 -unit gb -name filepool_03 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp01 -size 12501 -unit gb -name filepool_04 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp01 -size 12501 -unit gb -name filepool_05 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp01 -size 12501 -unit gb -name filepool_06 -iogrp 0
```

```
mkvdisk -mdiskgrp stgpool_grp01 -size 12501 -unit gb -name filepool_07 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp02 -size 13897 -unit gb -name filepool_08 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp02 -size 13897 -unit gb -name filepool_09 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp02 -size 13897 -unit gb -name filepool_10 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp02 -size 13897 -unit gb -name filepool_11 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp03 -size 12501 -unit gb -name filepool_12 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp03 -size 12501 -unit gb -name filepool_13 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp03 -size 12501 -unit gb -name filepool_14 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp03 -size 12501 -unit gb -name filepool_15 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp04 -size 13897 -unit gb -name filepool_16 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp04 -size 13897 -unit gb -name filepool_17 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp04 -size 13897 -unit gb -name filepool_18 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp04 -size 13897 -unit gb -name filepool_19 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp05 -size 12501 -unit gb -name filepool_20 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp05 -size 12501 -unit gb -name filepool_21 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp05 -size 12501 -unit gb -name filepool_22 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp05 -size 12501 -unit gb -name filepool_23 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp06 -size 13897 -unit gb -name filepool_24 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp06 -size 13897 -unit gb -name filepool_25 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp06 -size 13897 -unit gb -name filepool_26 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp06 -size 13897 -unit gb -name filepool_27 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp07 -size 12501 -unit gb -name filepool_28 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp07 -size 12501 -unit gb -name filepool_29 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp07 -size 12501 -unit gb -name filepool_30 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp07 -size 12501 -unit gb -name filepool_31 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp08 -size 13897 -unit gb -name filepool_32 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp08 -size 13897 -unit gb -name filepool_33 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp08 -size 13897 -unit gb -name filepool_34 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp08 -size 13897 -unit gb -name filepool_35 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp09 -size 12501 -unit gb -name filepool_36 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp09 -size 12501 -unit gb -name filepool_37 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp09 -size 12501 -unit gb -name filepool_38 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp09 -size 12501 -unit gb -name filepool_39 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp10 -size 13897 -unit gb -name filepool_40
-iogrp 0
mkvdisk -mdiskgrp stgpool_grp10 -size 13897 -unit gb -name filepool_41 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp10 -size 13897 -unit gb -name filepool_42 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp10 -size 13897 -unit gb -name filepool_43 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp11 -size 13897 -unit gb -name filepool_44 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp11 -size 13897 -unit gb -name filepool_45 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp11 -size 13897 -unit gb -name filepool_46 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp11 -size 13897 -unit gb -name filepool_47 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp12 -size 13897 -unit gb -name filepool_48 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp12 -size 13897 -unit gb -name filepool_49 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp12 -size 13897 -unit gb -name filepool_50 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp12 -size 13897 -unit gb -name filepool_51 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp13 -size 13897 -unit gb -name filepool_52 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp13 -size 13897 -unit gb -name filepool_53 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp13 -size 13897 -unit gb -name filepool_54 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp13 -size 13897 -unit gb -name filepool_55 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp14 -size 13897 -unit gb -name filepool_56 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp14 -size 13897 -unit gb -name filepool_57 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp14 -size 13897 -unit gb -name filepool_58 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp14 -size 13897 -unit gb -name filepool_59 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp15 -size 13897 -unit gb -name filepool_60 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp15 -size 13897 -unit gb -name filepool_61 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp15 -size 13897 -unit gb -name filepool_62 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp15 -size 13897 -unit gb -name filepool_63 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp16 -size 13897 -unit gb -name filepool_64 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp16 -size 13897 -unit gb -name filepool_65 -iogrp 0
```

```
mkvdisk -mdiskgrp stgpool_grp16 -size 13897 -unit gb -name filepool_66 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp16 -size 13897 -unit gb -name filepool_67 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp17 -size 13897 -unit gb -name filepool_68 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp17 -size 13897 -unit gb -name filepool_69 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp17 -size 13897 -unit gb -name filepool_70 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp17 -size 13897 -unit gb -name filepool_71 -iogrp 0

mkvdisk -mdiskgrp stgpool_grp18 -size 13897 -unit gb -name filepool_72 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp18 -size 13897 -unit gb -name filepool_73 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp18 -size 13897 -unit gb -name filepool_74 -iogrp 0
mkvdisk -mdiskgrp stgpool_grp18 -size 13897 -unit gb -name filepool_75 -iogrp 0
```

7. Create a logical host object by using the **mkhost** command. Specify the Fibre Channel WWPNs from your operating system and specify the name of your host. For instructions about obtaining the WWPNs from your system, see "Step 1: Set up and configure hardware" on page 26.

   For example, to create a host that is named *hostone* with a list that contains FC WWPNs *10000090FA3D8F12* and *10000090FA49009E*, issue the following command:

   ```
   mkhost -name hostone -fcwwpn 10000090FA3D8F12:10000090FA49009E -iogrp 0
    -type=generic -force
   ```

8. Map the volumes that you created in Step 6 on page 74 to the new host. Issue the **mkvdiskhostmap** command for each volume. For example, issue the following commands where *hostname* is the name of your host:

   ```
   mkvdiskhostmap -host hostname -scsi 0 db_00
   mkvdiskhostmap -host hostname -scsi 1 db_01
   mkvdiskhostmap -host hostname -scsi 2 db_02
   mkvdiskhostmap -host hostname -scsi 3 db_03
   mkvdiskhostmap -host hostname -scsi 4 db_04
   mkvdiskhostmap -host hostname -scsi 5 db_05
   mkvdiskhostmap -host hostname -scsi 6 db_06
   mkvdiskhostmap -host hostname -scsi 7 db_07

   mkvdiskhostmap -host hostname -scsi 8 alog

   mkvdiskhostmap -host hostname -scsi 9 archlog

   mkvdiskhostmap -host hostname -scsi 10 backup_0
   mkvdiskhostmap -host hostname -scsi 11 backup_1
   mkvdiskhostmap -host hostname -scsi 12 backup_2
   mkvdiskhostmap -host hostname -scsi 13 backup_3

   mkvdiskhostmap -host hostname -scsi 14 filepool_00
   mkvdiskhostmap -host hostname -scsi 15 filepool_01
   < ... >
   mkvdiskhostmap -host hostname -scsi 89 filepool_75
   ```

9. Assign the remaining drives as hot spares by using the **chdrive** command. You need one spare for SSD, one spare for SAS, and five spares for NL-SAS for a total of seven spares. Do not specify disks that you already included in an MDisk array.

   Tip: To determine which disks are part of an MDisk array, review the **mkarray** commands that you issued previously.

   For example, if drives 7, 23, 47, 71, 95, 119, and 143 are available after you create the MDisk arrays, issue the following commands to assign them as spares:

   ```
   chdrive -use spare 7
   chdrive -use spare 23
   chdrive -use spare 47
   ```

```
chdrive -use spare 71
chdrive -use spare 95
chdrive -use spare 119
chdrive -use spare 143
```

Appendix C. Using a response file with the blueprint configuration script

You can run the blueprint configuration script in non-interactive mode by using a response file to set your configuration choices.

Three response files are provided with the blueprint configuration script. If you plan to set up a system by using all default values, you can run the configuration script in non-interactive mode by using one of the following response files:

Small system
`responsefilesmall.txt`

Medium system
`responsefilemed.txt`

Large system
`responsefilelarge.txt`

The files are pre-filled with default configuration values for the small, medium, and large systems and do not require updates.

If you want to customize your responses for a system, use the following table with your "Planning worksheets" on page 10 to update one of the default response files. The values that are used in the response file correspond to values that you recorded in the *Your value* column of the worksheet.

Response file value	Corresponding value from the planning worksheet
serverscale	Not recorded in the planning worksheet. Enter a value of *S* for a small system, *M* for a medium system, or *L* for a large system.
db2user	DB2 instance owner ID
db2userpw	DB2 instance owner password
db2group	Primary group for the DB2 instance owner ID
db2userhomedir	Home directory for the DB2 instance owner ID. By default, this directory is created in the `/home` file system. For IBM Elastic Storage Server configurations, the preferred method is to use a directory in the shared IBM Spectrum Scale file system.
instdirmountpoint	Directory for the server instance
db2dirpaths	Directories for the database
tsmstgpaths	Directories for storage
actlogpath	Directory for the active log
archlogpath	Directory for the archive log
dbbackdirpaths	Directories for database backup
backupstarttime	Schedule start time
tsmsysadminid	Tivoli Storage Manager administrator ID
tsmsysadminidpw	Tivoli Storage Manager administrator ID password

Response file value	Corresponding value from the planning worksheet
tcpport	TCP/IP port address for communications with the Tivoli Storage Manager server. Enter the value that you specified for Step 8 on page 29.
servername	Server name
serverpassword	Server password

Appendix D. Using predefined client schedules

The blueprint configuration script creates several client schedules during server configuration. To use these schedules, you must complete configuration steps on the client system.

Table 30 lists the predefined schedules that are created on the server. The schedule names and descriptions are based on the default backup schedule start time of 10 PM. If you changed this start time during server configuration, the predefined client schedules on your system are named according to that start time. Information about updating client schedules to use with the Tivoli Storage Manager server are provided in the sections that follow the table.

For complete information about scheduling client backup operations, see your client documentation.

Table 30. Predefined client schedules

Client	Schedule name	Schedule description
Tivoli Storage Manager for Databases: Data Protection for Oracle	ORACLE_DAILYFULL_10PM	Oracle Daily FULL backup that starts at 10 PM
Tivoli Storage Manager for Databases: Data Protection for Microsoft SQL Server	SQL_DAILYFULL_10PM	Microsoft SQL Daily FULL backup that starts at 10 PM
Tivoli Storage Manager backup-archive client	FILE_INCRFOREVER_10PM	File incremental-forever backup that starts at 10 PM
Tivoli Storage Manager for Mail: Data Protection for Lotus® Domino®	DOMINO_DAILYFULL_10PM	Daily FULL backup that starts at 10 PM
Tivoli Storage Manager for Mail: Data Protection for Microsoft Exchange Server	EXCHANGE_DAILYFULL_10PM	FULL backup that starts at 10 PM
Windows Hyper-V	HYPERV_FULL_10PM	Hyper-V full backup that starts at 10 PM

Data Protection for Oracle

Data Protection for Oracle does not include a sample backup file. You can create a script or .bat command file and update the **OBJECTS** parameter for the predefined schedule by using the **UPDATE SCHEDULE** server command. Specify the full path to the command file on the client system unless you save the command file in the client installation directory. Then, you must provide only the file name.

For example, to update the ORACLE_DAILYFULL_10PM schedule that is in the DATABASE domain, issue the following command. Specify the name of the command file that you want to use in the client installation directory. In this example, the command file is named `schedcmdfile.bat`.

```
update schedule database oracle_dailyfull_10pm obj=schedcmdfile.bat
```

Data Protection for Microsoft for SQL Server

The sample schedule file that is included with Data Protection for Microsoft for SQL Server is named `sqlfull.cmd`. This file can be customized for use with Tivoli Storage Manager server. If you save the file to the client installation directory on the client system, you do not have to update the predefined schedule to include the full path to the file.

Backup-archive client

When you use the predefined schedule for backup-archive clients, the server processes objects as they are defined in the client options file, unless you specify a file to run a command or macro. For information about setting the `domain`, `include`, and `exclude` options for backup operations, see the online product documentation:

- Client options reference (V6.4)
- Client options reference (V7.1)

Data Protection for Domino

The sample schedule file that is included with Data Protection for Microsoft for SQL Server is named `domsel.cmd`. This file can be customized for use with Tivoli Storage Manager server. If you save the file to the client installation directory on the client system, you do not have to update the predefined schedule to include the full path to the file.

Data Protection for Microsoft Exchange Server

The sample schedule file that is included with Data Protection for Microsoft for SQL Server is named `excfull.cmd`. This file can be customized for use with Tivoli Storage Manager server. If you save the file to the client installation directory on the client system, you do not have to update the predefined schedule to include the full path to the file.

Hyper-V

No sample schedule file is provided with Hyper-V. To create a `.cmd` file that can back up multiple virtual machines, complete the following steps:

1. Update the client options file to include the following settings:

   ```
   commmethod          tcpip
   tcpport             1500
   TCPServeraddress    <Tivoli Storage Manager server name>
   nodename            <node name>
   passwordaccess      generate
   vmbackuptype        hypervfull
   ```

2. For each virtual machine that you want to back up, create a separate script file. A unique file is needed to ensure that a log is saved for each backup. For example, create a file named `hvvm1.cmd`. Include the backup command, the name of the virtual machine, the client options file, and the log file that you want to create on the first line. On the second line, include the word `exit`.

   For example:

   ```
   dsmc backup vm "tsmhyp1vm3" -optfile=dsm-hv.opt >> hv_backup_3.log
   exit
   ```

   Repeat this step for each virtual machine that you want to back up.

3. Create a backup schedule file, for example, `hv_backup.cmd`.

4. Add an entry to `hv_backup.cmd` for each virtual machine script file that you created. For example:

```
start hvvm1.cmd
choice /T 10 /C X /D X /N > NUL
start hvvm2.cmd
choice /T 10 /C X /D X /N > NUL
start hvvm3.cmd
choice /T 10 /C X /D X /N > NUL
hvvm4.cmd
```

5. Issue the **UPDATE SCHEDULE** server command to update the predefined HYPERV_FULL_10PM schedule. Specify the full path for the Hyper-V backup schedule file location in the **OBJECTS** parameter.

Tivoli Storage Manager for Virtual Environments

To create new schedules, use the Data Protection for VMware vCenter plug-in GUI.

Appendix E. Modification of blueprint configurations

If you want to customize the configurations that are detailed in this document, plan carefully.

Consider the following before you deviate from the blueprint specifications:

- If you want to extend the usable storage for your system by adding storage enclosures, you must also add storage for the Tivoli Storage Manager database. Increase the database storage by approximately 1% of the additional total amount of managed data that will be protected (size before data deduplication).
- You can use Linux operating systems other than Red Hat Enterprise Linux, but the following caveats apply:
  - The version and operating system must be supported for use with the Tivoli Storage Manager server.
  - Additional configuration steps or modifications to steps for installation and configuration might be needed.
- If you use other storage systems, performance measurements that are reported for the blueprint configurations are not guaranteed to match your customization.
- In general, no guarantees can be made for a customized environment. Test the environment to ensure that it meets your business requirements.

Appendix F. Troubleshooting

At the time of publication, the following issue was known.

Slow throughput after server installation

In some cases, following a new installation of Tivoli Storage Manager, the server might experience slow throughput. This condition can be caused by a delay in the DB2 runstats operation, which optimizes how queries are performed. An indication of this issue is that the DB2 process db2sysc is using a large amount of CPU processing as compared to the amount of processing that is used by the server.

To resolve this problem, you can start runstats processing manually. Issue the following command from the administrative command-line interface:

```
dsmadmc > runstats all
```

Appendix G. 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 Operations Center help system is enabled for accessibility. For more information, click the question mark icon on the help system menu bar.

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

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