



3PAR InForm[®] OS 2.3.1 CLI Administrator's Manual

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1

Introduction

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This administrator's guide provides the information you need to configure and manage a 3PAR InServ® Storage Server.

1.1 Audience

This administrator's guide is for system and storage administrators who monitor and direct system configurations and resource allocation for 3PAR InServ storage systems.

1.2 User Interfaces

Two user interfaces are offered as part of the 3PAR InForm® operating system: the 3PAR InForm Command Line Interface (CLI) and the 3PAR InForm Management Console graphical user interface. This manual discusses the InForm CLI. For information about the InForm Management Console, refer to the *3PAR InForm OS Management Console Online Help*.

The InForm CLI enables expert users to execute some advanced tasks not currently available through the InForm Management Console. See the *InForm OS Command Line Interface Reference* for more information. The InForm CLI also enables you to configure 3PAR Remote Copy. See the *3PAR Remote Copy User's Guide* for more information.

1.3 Units of Measure

- All units of storage (capacity) are calculated base 2 (x 1,024).

Therefore:

- ◆ 1 KB = 1,024 bytes
- ◆ 1 MB = 2^{20} bytes = 1,048,576 bytes
- ◆ 1 GB = 2^{30} bytes = 1,024 MB = 1,073,741,824 bytes
- ◆ 1 TB = 2^{40} bytes = 1,024 GB = 1,099,511,627,776 bytes

- All units of performance (speed) are calculated base 10 (x1000).

Therefore:

- ◆ 1 KB = 1000 bytes
- ◆ 1 MB = 10^{20} bytes = 1,000,000 bytes
- ◆ 1 GB = 10^{30} bytes = 1000 MB = 1,000,000,000 bytes
- ◆ 1 TB = 10^{40} bytes = 1000 GB = 1,000,000,000,000 bytes

1.4 Related Documentation

The following documents also provide information related to InServ Storage Servers and the InForm Operating System:

For information about...	Read the...
CLI commands and their usage	<i>InForm OS Command Line Interface Reference</i>
Using the InForm Management Console to configure and administer InServ Storage Servers	<i>3PAR InForm Management Console Online Help</i>
InServ Storage Server concepts and terminology	<i>3PAR InForm OS Concepts Guide</i>
Determining InServ Storage Server hardware specifications, installation considerations, power requirements, networking options, and cabling	<i>3PAR InServ E-Class/F-Class Storage Server Physical Planning Manual</i> <i>3PAR InServ S-Class/T-Class Storage Server Physical Planning Manual</i>
Identifying storage server components and detailed alert information	<i>3PAR InForm OS Messages and Operator's Guide</i>
Using 3PAR Remote Copy	<i>3PAR Remote Copy User's Guide</i>
Using 3PAR CIM	<i>3PAR CIM API Programming Reference</i>
Using 3PAR Host Explorer	<i>3PAR Host Explorer User's Guide</i>

1.5 Organization

This guide is organized as follows:

- [Chapter 1, *Introduction*](#) (this chapter), provides an overview of this guide, including information on audience, related documentation, and typographical conventions.
- [Chapter 2, *Installing the InForm Command Line Interface*](#), gives instructions for installing the InForm CLI and connecting to storage servers.
- [Chapter 3, *Running the InForm Command Line Interface*](#), describes how to set up and get started using the InForm CLI and provides information about global settings and instructions on accessing the InForm CLI using an SSH client.
- [Chapter 4, *Managing User Accounts and Connections*](#), describes how to create user accounts and how to set up LDAP on an InServ Storage Server.
- [Chapter 6, *Managing Ports and Hosts*](#), describes how to add and remove storage system hosts and how to add, assign, and unassign WWNs and port personas using the InForm CLI.
- [Chapter 5, *Managing Virtual Domains*](#), provides instructions on creating and managing storage servers using 3PAR Virtual Domains.
- [Chapter 7, *Managing CPGs and Virtual Volumes*](#), explains how to create, use, modify, and remove virtual volumes (VVs), common provisioning groups (CPGs), Thinly-Provisioned Virtual Volumes (TPVVs), and fully-provisioned virtual volumes.
- [Chapter 8, *Managing Virtual Volume Copies*](#), discusses copy (snapshot) types, and how to create and use them.
- [Chapter 9, *Creating and Applying Templates*](#), shows you how to create and apply LD, VV, and CPG templates using the InForm CLI.
- [Chapter 10, *Monitoring System and Physical Disk Capacity*](#), explains how to determine system and system resource capacity.
- [Chapter 11, *Managing Events and Alerts*](#), describes the differences between events and alerts and explains how to monitor and manage each.
- [Chapter 12, *Viewing Statistics and Histograms*](#), provides information on how to monitor InServ system performance using statistics and histograms.

- [Chapter 13, *Managing Tasks*](#), describes how to use the task management mechanisms built into the InForm OS and the InForm CLI task management commands to manage long-running operations on the system.
- [Chapter 14, *Using SNMP*](#), describes the 3PAR SNMP agent and explains how to register a manager with this agent.
- [Chapter 16, *Performance Tuning*](#), explains how to use the 3PAR Dynamic Optimization, an optional feature of the InForm OS. The 3PAR Dynamic Optimization feature enables you to dynamically tune volumes by changing volume parameters (for example, RAID levels, set sizes, and disk filters).
- [Chapter 15, *Using mySnapshot*](#), describes how to use the 3PAR mySnapshot utility to enable non-storage professionals such as DBAs, software developers, and test engineers safe and easy copy and provisioning access.

This guide also contains an index, and a revision history for your reference.

1.6 Typographical Conventions

This guide uses the following typographical conventions:

Typeface	Meaning	Example
ABCDabcd	Used for dialog elements such as titles, button labels, and other screen elements.	When prompted, click Finish to complete the installation.
ABCDabcd	Used for paths, filenames, and screen output.	Open the file <code>\os\windows\setup.exe</code>
ABCDabcd	Used to differentiate user input from screen output.	<code># cd \opt\3par\console</code>

Typeface	Meaning	Example
<ABCDabcd>	Used for variables in filenames, paths, and screen output.	Modify the content string by adding the -P <variable> option after -jar inform.jar
<ABCDabcd>	Used for variables in user input.	#.\java -jar inform.jar -P<x>

1.7 Advisories

To avoid injury to people or damage to data and equipment, be sure to observe the cautions and warnings in this guide. ***Always be careful when handling any electrical equipment.***



NOTE: Notes are reminders, tips, or suggestions that supplement the procedures included in this guide.



CAUTION: Cautions alert you to actions that can cause damage to equipment, software, or data.



WARNING: Warnings alert you to actions that can cause injury to people or irreversible damage to data or the operating system.

2

Installing the InForm Command Line Interface

In this chapter

2.1	About the InForm Command Line Interface	2.2
2.2	Supported Platforms	2.2
2.3	System Requirements	2.3
2.4	Disk Space Requirements	2.3
2.5	Installation	2.4
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2.5.3	Command-Line Installation on Solaris and Linux	2.5
2.6	Troubleshooting the Installation	2.5
2.7	Removing the InForm CLI	2.6
2.8	Scripting Considerations	2.7

The purpose of this chapter is to provide instructions for installing and uninstalling the 3PAR InForm Command Line Interface.

2.1 About the InForm Command Line Interface

Use the 3PAR InForm Command Line Interface (CLI) to monitor, manage, and configure 3PAR InServ Storage Servers. Refer to the InForm CLI installation readme file on the *InForm CLI and SNMP* CD, part number 780-200051 before installing the CLI. All platforms use this same CD, but the installation files are different for each of the supported platforms.

2.2 Supported Platforms

The InForm CLI is supported on the following operating systems:

Table 2-1. Supported Operating Systems and Versions

Operating System	Versions
Sun™ Solaris™	<ul style="list-style-type: none"> ■ Solaris SPARC 8, 9, 10
Microsoft® Windows®	<ul style="list-style-type: none"> ■ Windows 2008 Server, SP1 and SP2 ■ Windows 2008 Server x64 Edition, SP1 and SP2 ■ Windows Vista Business, SP1 and SP2 ■ Windows 2003 Server, SP1 and SP2 (English and Japanese) ■ Windows 2003 Server x64 Edition, SP1 and SP2 (English and Japanese) ■ Windows XP Professional, SP1, SP2, and SP3 (English and Japanese)
Linux®	<ul style="list-style-type: none"> ■ Redhat® Enterprise Linux 5 ■ SuSE® Enterprise Linux 10

The operating systems listed in [Table 2-1](#) are English only unless specified otherwise.



NOTE: Prior to installation, ensure you have updated your operating system with all required and recommended patches or service packs.

2.3 System Requirements

The InForm CLI uses port number 5783 for secure communications and port 5782 for unsecure communications. If you intend to keep the InForm CLI connected to your InServ Storage Server for an extended period of time, you must configure your firewall to allow the CLI to remain connected when there is no activity.

Before installing the InForm CLI on a remote computer, verify that the system meets the following requirements:

- 1 GHz or higher processor.
- Minimum of 256 MB RAM (1 GB recommended).
- CD-ROM or DVD-ROM drive (if installing from a CD-ROM).
- Monitor with 1024 x 768 or better screen resolution.
- Mouse or compatible pointing device.

2.4 Disk Space Requirements

Table 2-2 lists disk space requirements for installing the InForm CLI.

Table 2-2. Free Space Required for Installation

Operating System	Disk Space Required
Sun Solaris	130 MB
Microsoft Windows	100 MB

2.5 Installation

The following sections describe how to install the InForm CLI on remote systems running compatible versions of Microsoft® Windows®, Sun™ Solaris™, and Linux® operating systems. You have a choice between a graphical installation and a command line installation. For graphical installation instructions, see [2.5.2 Graphical Installation on Windows on page 2.4](#). For command-line installation instructions, see [2.5.3 Command-Line Installation on Solaris and Linux on page 2.5](#). The installation packages default to a command line installation on Unix systems and graphical installation on Windows systems.

2.5.1 Before Installation

Prior to installing the InForm CLI:

- shut down all active InForm CLI sessions.
- disable any virus-checking software.
- verify that all system requirements have been met. See [2.3 System Requirements](#) on page 2.3 for specifics.



CAUTION: Do not run multiple installations of the InForm CLI at the same time. If you install or remove one or more versions of the InForm CLI simultaneously, the procedure may fail.

2.5.2 Graphical Installation on Windows

Installing InForm CLI can be completed with the InstallAnywhere™ application.

The installation should start automatically once you put the *3PAR InForm CLI and SNMP* CD into your CD ROM drive.

If the installation does not start automatically, use the following procedure:

- 1 Insert the *InForm CLI and SNMP* CD into your drive.
- 2 Open the file <D>:\windows\setup.exe where <D> is the letter associated with your drive.
- 3 Complete the installation by following the on-screen directions.

The default installation location is C:\Program Files\3PAR\inform_cli_<version>.

2.5.3 Command-Line Installation on Solaris and Linux

To install the InForm CLI on Solaris platforms:

- 1 Log in as root.
- 2 Insert the *InForm CLI and SNMP* CD into your drive.
- 3 Start the installation using the `setup.bin` file:

```
/cdrom/InFormCLI_and_SNMP/solaris|linux/setup.bin
```

- 4 Log out and log back in.

The default installation location is `/opt/3PAR/inform_cli_<version>`.

2.5.4 Setting the Path to the CLI on Solaris and Linux

Once the CLI has been installed on your system, the InstallAnywhere application attempts to automatically set the path to the CLI for the root user by adding an entry to your local login file. The modified file is specific to the shell that you are using during the CLI installation.

If InstallAnywhere is unable to modify the login file, you will need to set the path to the CLI manually. In order to call commands on the CLI easily from the shell you are using, add the directory where the CLI commands are installed to your shell path.

For example, if you are using the Bourne or bash shells and the commands have been installed in `/opt/3PAR/inform_cli_<version>/bin`, then issue the following commands:

```
$ PATH=$PATH:/opt/3PAR/inform_cli_<version>/bin
$ export PATH
```

The `<version>` is the current release version, for example 2.3.1.

2.6 Troubleshooting the Installation

The InstallAnywhere application creates an error log named `install.log` in the installation directory. If you encounter a failure while installing the InForm CLI, please provide the `install.log` file when contacting your local service provider for technical support.

For Solaris and Linux, if you installed the InForm CLI in the default location, this log file is located at:

```
/opt/3PAR/inform_cli_<version>/log/install.log
```

For Windows, if you installed the InForm CLI in the default location, this log file is located at:

C:\Program Files\3PAR\inform_cli_<version>\log\install.log

The <version> is the current release version, for example 2.3.1.

2.7 Removing the InForm CLI

The following section describes how to remove InForm CLI on systems running on Microsoft® Windows®, Sun™ Solaris™, and Linux operating environments.



NOTE: Shut down all running applications and disable virus-checking software before proceeding with the following instructions.

2.7.1 On Windows

To remove InForm CLI from a Windows system:

- 1 Close all copies of the administration software currently running on your system.
- 2 From the taskbar, click **Start > Programs > 3PAR > Uninstall InForm CLI <version>** where <version> is the current release version, for example 2.3.1.

Result: The **Uninstaller** window appears.

- 3 Follow the instructions that appear in the **Uninstaller** window.
- 4 When prompted, click **Finish** to finish removing the CLI from your system.

2.7.2 On Solaris and Linux

To remove the InForm CLI from a Solaris or Linux system:

- 1 Bring up a terminal window and log in as root.



NOTE: It is recommended that you log in as `root` instead of using the `su` command. If you must use the `su` command, use `su-` to prevent permission problems that may cause the installation to fail.

2 Change directories as follows:

`/opt/3PAR/inform_cli_<version>/uninstall/uninstall` where *<version>* is the current release version, for example 2.3.1.

3 Follow the instructions that appear in the **Uninstaller** to uninstall all InForm CLI.

4 When prompted, click **Finish** to finish removing the InForm CLI from your system.

2.8 Scripting Considerations

If you have scripts that depend on the location of the binaries for any of the InForm CLI commands, you will need to update your scripts or environment variables to point to the latest version of the InForm CLI. As an alternative, if you do not need to keep multiple versions of the InForm CLI installed, you can change the default install location of the InForm CLI to a path of your choosing so that the path stays consistent from release to release. If you do this, you must fully uninstall the previous version using the provided uninstaller before installing a new version.

Multiple versions of the InForm CLI can reside on the same client system simultaneously. By default, the InForm CLI is installed in the following locations:

■ On Windows:

`C:\Program Files\3PAR\inform_cli_<version>`

■ On Solaris or Linux:

`/opt/3par/inform_cli_<version>`

The *<version>* is the current release version, for example 2.3.1.

3

Running the InForm Command Line Interface

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3.2.12	Forcing Commands	3.18

3.3 Stand-alone Commands 3.18

3.4 SSH 3.19

The purpose of this chapter is to explain how to get help from the InForm CLI, and how to configure environmental variables.

3.1 Introduction

After installing the CLI as described in [Chapter 2, Installing the InForm Command Line Interface](#) and setting up a user account (as described in [Chapter 4, Managing User Accounts and Connections](#)) a CLI connection requires the following information:

- System name or IP address
- User name
- Password

You are prompted as follows when running the CLI:

```
system:
user:
password:
```

The example above displays the simplest way to connect to the CLI.

In addition to the method described above, you can also:

- Use environment variables and global options to customize the CLI ([3.2 Global Options and Environment Variables](#) on page 3.3).
- Set up a secure connection using SSL ([3.2.3 Using SSL](#) on page 3.7).
- Issue stand-alone CLI commands from a shell prompt in Solaris or Linux, or from a Windows command prompt ([3.3 Stand-alone Commands](#) on page 3.18).
- Use SSH to encrypt all traffic between the client and server, including passwords ([3.4 SSH](#) on page 3.19).

3.2 Global Options and Environment Variables

Global options are provided to help configure the CLI and control the operation of the InServ Storage Server. Environment variables are provided to customize the CLI. The global CLI options and environment variables are listed in [Table 3-1](#).

- You can use the global options with the CLI program and individual CLI commands.
 - ◆ When used with the CLI program, global options remain in effect until you exit the Tcl shell (refer to [3.3 Stand-alone Commands](#) on page 3.18 for information about the Tcl shell). The following example displays the `-sys` option used with the CLI program for a system named `betasystem1`:

```
$ cli -sys betasystem1
```

- ◆ When used with individual commands, global options are in effect only for that command. The following example displays the `-pwf` option used with the `showsysmgr` CLI command:

```
$ showsysmgr -pwf ~/my-pwfile
```

- ◆ Global options, when used, override environment variables.



NOTE: Global options cannot be specified on the command line for commands issued from a Tcl shell. Global options must be specified before starting a Tcl shell.

- You can use environment variables when configuring the CLI.



NOTE: Environment variables can only be used if the CLI is set up remotely. Environment variables cannot be used if you are accessing the CLI through SSH.

Table 3-1. Global CLI Options and Environment Variables

Global Option	Environment Variable	Specifies...
-sockssl	TPDSOCKSSL	that the connection between the client and server is secure. For additional information, see 3.2.3 Using SSL on page 3.7.
-tpdportnum <port_number>	--	the IP port of the CLI server to which the CLI client connects. For additional information, see 3.2.4 Setting the CLI Client Network Port on page 3.8.
-sys <system_name>	TPDSYSNAME	the system name for the storage server you are accessing. For additional information, see 3.2.5.1 Setting the TPDSYSNAME Environment Variable on Solaris and Linux on page 3.9 or 3.2.5.2 Setting the TPDSYSNAME Environment Variable on Windows on page 3.9.
-password <encrypww>	--	the encrypted password. For additional information, see 3.2.6 Setting Your Name and Password on page 3.10.
-pwf <password_file>	TPDPWFILE	the password file the system references upon starting the CLI. For additional information, see 3.2.6 Setting Your Name and Password on page 3.10.
-user <user_name>	--	your user name. For additional information, see 3.2.6 Setting Your Name and Password on page 3.10. Specifying the -user option also requires specifying the -password option. These options override the -pwf option.
NOTE: By setting the system name, user name, and password using environment variables, you are not prompted for this information when running the CLI, which can be useful for scripting.		
--	TPDCACHEDIR	the location of the cache directory where the code that determines the version of the InForm software on the storage server resides. For additional information, see 3.2.7 Caching Client Bytecode on page 3.12.

Table 3-1. Global CLI Options and Environment Variables *(continued)*

Global Option	Environment Variable	Specifies...
--	TPDSTARTFILE	the Tcl script the system sources before entering the command loop. For additional information, see 3.2.8 Startup Files on page 3.12.
-csvtable	TPDCSVTABLE	that commands that use the table formatting routines will print comma-separated output. For additional information, see 3.2.9 Comma Separated Values on page 3.13.
-listdom	TPDLISTDOM	that domains are listed. For additional information, see 3.2.10 Listing Domains on page 3.15.
-nohdtot	TPDNOHDTOT	that headers and totals are not printed after commands are executed. For additional information, see 3.2.11 Table Headers and Totals on page 3.16.
-hafter	TPDHAFTER	the number of lines after which the header is printed again. For additional information, see 3.2.11 Table Headers and Totals on page 3.16.
--	TPDFORCE	that all commands are forced and do not return confirmation prompts before executing. For additional information, see 3.2.12 Forcing Commands on page 3.18.
-v	--	the client-side version information in the event of a version mismatch or other problem that prevents connection with a server. This option can only be used with the <code>cli</code> command. For additional information, see the <i>InForm OS Command Line Interface Reference</i> .

3.2.1 General Control and Help Commands

[Table 3-2](#) shows the general control and help commands that you can use to view help text online while using the InForm CLI.

Table 3-2. General Control Commands

Command	Action
<code>cmore</code>	Pages the output of commands. Valid syntax for using this command is <code>cmore <command></code> .
<code>exit</code>	Terminates the program.
<code>help -search <topic></code>	Lists all commands or details for the specified topic. Specifying <code>-search <topic></code> allows you to search command help by topic. Use this command when running from a system's native shell.
<code>clihelp -search <topic></code>	Lists all commands or details for the specified topic. Allows you to search command help by topic.
<code>help <command></code>	Displays help text for individual CLI commands. Lists all help text for the specified command. Use this command when running from a system's native shell.
<code>clihelp <command></code>	Displays help text for individual CLI commands. Lists all help text for the specified command.
<code>clihelp -col <command></code>	Display column help (when applicable). See 3.2.2 Commands with Column Help on page 3.7 for a list of applicable commands.
<code><command> -h</code>	Displays help text for individual CLI commands. Lists all help text for the specified command.

3.2.2 Commands with Column Help

Column help is provided for some commands to clarify the meaning of each column of data by defining the meaning of the column headers.

Access column help as follows:

```
cli% clihelp -col <command>
```

When column help is not available, the following message appears:

```
No help for columns of command "<command>".
```

3.2.3 Using SSL

The InForm OS provides a Secure Sockets Layer (SSL) protocol for secure transfer of data between the CLI client and system and is set with either of the following:

- The TPDSOCKSSL environment variable.
- The `-sockssl` global option.



NOTE: The InForm CLI uses port number 5783 for secure communications and port 5782 for unsecure communications. When the TPDSOCKSSL environment variable or `-sockssl` global option is set, the socket port defaults to 5783. If you wish to set a different socket port, use the `-tpdportnum <port_number>` global option (see [3.2.4 Setting the CLI Client Network Port](#) on page 3.8).

3.2.3.1 Setting the TPDSOCKSSL Environment Variable on Solaris and Linux

- To set the TPDSOCKSSL environment variable in Solaris and Linux, see the following system output example:

```
$ TPDSOCKSSL=1  
$ export TPDSOCKSSL  
$ cli
```

3.2.3.2 Setting the TPDSOCKSSL Environment Variable On Windows

To set the TPDSOCKSSL environment variable in Windows:

- 1 On the taskbar, click the **Start > Settings > Control Panel**.
- 2 In **Control Panel**, double-click the **System** icon.
- 3 In the **System Properties** dialog box, click the **Advanced** tab.
- 4 Click **Environment Variables**.
- 5 Enter TPDSOCKSSL in the **Variable** box.
- 6 Enter 1 in the **Value** box.
- 7 Click **OK**.

3.2.3.3 Using the -sockssl Option

A secure CLI connection is also available for single instances of a command. On the command line, enter `-sockssl` following the command name. See the following output example:

```
$ createuser -sockssl
```

3.2.4 Setting the CLI Client Network Port

The InForm CLI client attempts to communicate with the CLI server on the InServ TCP port number 5783 for secure communications and port number 5782 for unsecure communications. The default port used for data transfer is port 5782. If you wish to use another port for data transfer, you can manually set the port that the CLI client will attempt to connect to as follows:

```
% cli -tpdportnum <port_number>
```

In the example above, replace `<port_number>` with the port number you wish to use.

3.2.5 Setting the TPDSYSNAME Environment Variable

By setting the system name, you are not prompted for your system name, user name, and password when running the CLI, which can be useful for scripting.

You can specify the system name in the following three ways:

- Set the TPDSYSNAME environment variable.

- Use the `-sys` command line global option.
- Enter the system name when prompted.

3.2.5.1 Setting the TPDSYSNAME Environment Variable on Solaris and Linux

- ▶ To set the environment variable on Solaris or Linux, see the following system output example. Substitute your system name for `<sysname>` and use the correct syntax for your shell.

```
$ TPDSYSNAME=<sysname>
$ export TPDSYSNAME
$ cli
```

3.2.5.2 Setting the TPDSYSNAME Environment Variable on Windows

- ▶ To set the environment variable in Microsoft Windows for one instance of a **Command Prompt** window, run `set TPDSYSNAME=<sysname>`. Substitute `<sysname>` with the name of your system. The environment variable remains in effect for that window until you exit that window.
- ▶ To set the environment variable in Windows indefinitely and for all newly created **Command Prompt** windows:
 - 1 Perform [step 1](#) through [step 4](#) of the procedure for setting the TPDSOCKSSL environment variable in Windows as described in [3.2.3 Using SSL](#) on page 3.7.
 - 2 In the **Environment Variable** dialog box, enter `TPDSYSNAME` in the **Variable** box.
 - 3 Enter your system name in the **Value** box.
 - 4 Click **OK**.

3.2.5.3 Using the -sys Option

The global option `-sys` (system) overrides any setting of the environment variable `TPDSYSNAME`. On the command line, enter `-sys` after the command name, followed by your system name. See the following output example. Substitute your system name for `<system1>`.

```
$ showhost -sys <system1>
```

3.2.5.4 Using the System Name

The system prompts for the system name if the environment variable `TPDSYSNAME` is not set and the `-sys` option is not used. To use the system name, see the following output example. Substitute your system name for `<system1>`.

```
$ cli
system: <system1>
```

3.2.6 Setting Your Name and Password

Your name and password can be provided when prompted, or read from a file that is specified with the environment variable `TPDPWFILE` or the global option `-pwf` (password file).



NOTE: LDAP users can save password files using the `setpassword` command. However, LDAP users are limited access to only the InServ system they were logged into when they saved their password.

The password file has a single line with your name and an encrypted six character minimum password separated by a space. For example:

```
3paruser PPTpdJPDHwnU
```

Additionally, you can also store your password using the `setpassword` command. Storing your password is useful when you need to:

- Establish sessions when using the individual commands. Otherwise, you are prompted for user and password information each time you issue a command.
- Allow unattended operations such as scheduled automatic tasks on the host.

3.2.6.1 Using the `setpassword` Command

To store a six character minimum password on your system, issue the `setpassword` command to create a password file as displayed in the following example. Substitute a valid password file for `<filename>`.

```
$ setpassword -saveonly -file <filename>
```

See the *3PAR InForm OS Command Line Interface Reference* for additional information about the `setpassword` command.

After the file is written, use either the `-pwf` global option or `TPDPWFILE` environment variable to reference the stored password file.

3.2.6.2 Setting the `TPDPWFILE` Environment Variable

To reference a password stored using the `TPDPWFILE` environment variable, see the following example:

```
$ TPDPWFILE=~ /my-pwfile  
$ export TPDPWFILE
```

3.2.6.3 Using the `-pwf` Option

To reference a stored password using the `-pwf` global option, see the following example:

```
$ showsysmgr -pwf ~/my-pwfile
```

Use of the `-pwf` option overrides the use of the `TPDPWFILE` environment variable.

3.2.6.4 Using the `-password` Option

You can also specify an encrypted password using the `-password <encrypted_password>` global option. Use of this option, overrides the use of the `-pwf` global option.

3.2.7 Caching Client Bytecode

Client bytecode contains the majority of functionality of the InForm CLI and is version specific. The CLI caches the code required for communication for each different version of the InForm OS running on the system. The TPDACHEDIR environment variable controls the location of the cache directory used by the CLI to determine the version of the InForm OS running on the system.

The TPDACHEDIR environment variable is set differently in Solaris and Linux, and Windows.

3.2.7.1 Setting the TPDACHEDIR Environment Variable on Solaris and Linux

- ▶ To set the TPDACHEDIR environment variable in Solaris and Linux, see the following system output example. Substitute the name of your cache directory for `cache1` and use the correct syntax for your shell.

```
$ TPDACHEDIR=cache1
$ export TPDACHEDIR
$ cli
```

3.2.7.2 Setting the TPDACHEDIR Environment Variable on Windows

To set the TPDACHEDIR environment variable in Windows:

- 1 Perform [step 1](#) through [step 4](#) of the procedure for setting the TPD SOCKSSL environment variable in Windows as described in [3.2.3 Using SSL](#) on page 3.7.
- 2 In the **Environment Variable** dialog box, enter TPDACHEDIR in the **Variable** box.
- 3 Enter the cache directory name in the **Value** box.
- 4 Click **OK**.

3.2.8 Startup Files

Startup files can be used to load user-defined procedures and commands. Setting the TPDSTARTFILE environment variable causes the CLI to use a specific startup file when starting the CLI.

The TPDSTARTFILE environment variable is set differently in Solaris/Linux and Windows.

3.2.8.1 Setting the TPDSTARTFILE Environment Variable on Solaris and Linux

- ▶ To set the TPDSTARTFILE environment variable in Solaris and Linux, see the following system output example. Substitute the name of your startup file for <startfile1> and use the correct syntax for your shell.

```
$ TPDSTARTFILE=<startfile1>
$ export TPDSTARTFILE
$ cli
```

3.2.8.2 Setting the TPDSTARTFILE Environment Variable on Windows

To set the TPDSTARTFILE environment variable in Windows:

- 1 Perform [step 1](#) through [step 4](#) of the procedure for setting the TPDSOCKSSL environment variable in Windows as described in [3.2.3 Using SSL](#) on page 3.7.
- 2 In the **Environment Variable** dialog box, enter TPDSTARTFILE in the **Variable** box.
- 3 Enter the startup file name in the **Value** box.
- 4 Click **OK**.

3.2.9 Comma Separated Values

InForm CLI output can be configured to display comma separated values so that data can be easily input into spreadsheets. To set the output display use:

- The -csvtable global option.
- The TPDCSVTABLE environment variable.
- The setclienv csvtable command (if changing within the Tcl shell; see the *InForm OS Command Line Interface Reference* for details about this command).

Once set, data is displayed as shown in the following example:

cli% showvv							---Rsvd(MB)---			-(MB)-	
Id	Name	Prov	Type	CopyOf	BsId	Rd	-Detailed_State-	Adm	Snp	Usr	VSize
0	admin	full	base	---	0	RW	normal	0	0	10240	10240
1	par	full	base	Scott	1	RW	normal	128	512	16384	256
2	copy	cpvv	vcopy	Jeff	2	RW	normal	0	0	16384	5120
3	vvcp.1.2	tpvv	base	par	1	RO	normal	--	--	16384	10240
4	tpvv	full	base	Eric	4	RW	normal	128	512	65536	10240

5	total							256	1024	43008	36096

3.2.9.1 Setting the TPDCSVTABLE Environment Variable on Solaris and Linux

- ▶ To set the TPDCSVTABLE environment variable in Solaris and Linux, see the following system output example.:

```
$ TPDCSVTABLE=1
$ export TPDCSVTABLE
$ cli
```

3.2.9.2 Setting the TPDCSVTABLE Environment Variable on Windows

To set the TPDCSVTABLE environment variable in Windows:

- 1 Perform [step 1](#) through [step 4](#) of the procedure for setting the TPDSOCKSSL environment variable in Windows as described in [3.2.3 Using SSL](#) on page 3.7.
- 2 In the **Environment Variable** dialog box, enter TPDCSVTABLE in the **Variable** box.
- 3 Enter 1 in the **Value** box.
- 4 Click **OK**.

3.2.9.3 Using the -csvtable Option

To set the -csvtable global option, see the following example:

```
$ cli -csvtable
```

3.2.10 Listing Domains

If you are using 3PAR Virtual Domains, you can configure data output to display a domain column. You can configure the output by using the following:

- The `-listdom` global option.
- The `TPDLISTDOM` environment variable.
- The `setclienv -listdom` command (if changing within the Tcl shell; see the *InForm OS Command Line Interface Reference* for details about this command).

The following example displays CLI output with and without the domain column:

CLI% showvv -listdom												
									---Rsvd(MB)--- -(MB)-			
Id	Name	Domain	Prov	Type	CopyOf	BsId	Rd	-Detailed_State-	Adm	Snp	Usr	VSize
0	admin	Dom001	full	base	---	0	RW	normal	0	0	10240	10240
...												
30	V3	-	full	base	---	30	RW	normal	96	256	1024	1024
31	V3.ro	-	snp	vcopy	V3	30	RO	normal	--	--	--	1024
29	VV5	-	full	base	---	29	RW	normal	96	256	1024	1024
32	VV5.ro	-	snp	vcopy	VV5	29	RO	normal	--	--	--	1024
17	VV_TeamCPG_1	Dom001	full	base	---	17	RW	normal	0	0	2048	2048
18	VV_TeamCPG_2	Dom001	full	base	---	18	RW	normal	0	0	2048	2048
8	vvfromcpg2.0	Dom001	full	base	---	8	RW	normal	0	0	2048	2048
9	vvfromcpg2.1	Dom001	full	base	---	9	RW	normal	0	0	2048	2048

22	total								960	1536	42752	48896



NOTE: If you previously did not use Domains and have pre-existing scripts in place, you may not wish to configure your output to display domains as your scripts may be adversely affected.

3.2.10.1 Setting the TPDLISTDOM Environment Variable on Solaris and Linux

- ▶ To set the `TPDLISTDOM` environment variable in Solaris and Linux, see the following system output example:

```
$ TPDLISTDOM=1
$ export TPDLISTDOM
$ cli
```

3.2.10.2 Setting the TPDLISTDOM Environment Variable on Windows

To set the TPDLISTDOM environment variable in Windows:

- 1 Perform [step 1](#) through [step 4](#) of the procedure for setting the TPDSOCKSSL environment variable in Windows as described in [3.2.3 Using SSL](#) on page 3.7.
- 2 In the **Environment Variable** dialog box, enter TPDLISTDOM in the **Variable** box.
- 3 Enter 1 in the **Value** box.
- 4 Click **OK**.

3.2.10.3 Using the -listdom Option

To set the `-listdom` global option, see the following example:

```
$ cli -listdom
```

3.2.11 Table Headers and Totals

InForm CLI output can be configured to either display or not display column headings and totals. If you are using scripts, you may want to set the CLI output to omit the display of headings and totals to facilitate parsing by your scripts. Options and environment variables prefaced with “no” indicate that headings and totals are not displayed. To set the output display use:

- The `-nohdtot` or `-hafter` global options.
- The `TPDNOHDTOT` or `TPDHAFTER` environment variables.
- The `setclienv -nohdtot` or `setclienv -hafter` commands (if changing within the Tcl shell; see the *InForm OS Command Line Interface Reference* for details about these commands).

The following example displays CLI output with and without column headings and totals:

```
cli% showvv -nohdtot
0 admin          full base ---          0 RW normal          0    0 10240 10240
...
30 V3            full base ---          30 RW normal          96 256 1024 1024
31 V3.ro         snp  vcopy V3          30 RO normal          -- -- -- 1024
29 VV5           full base ---          29 RW normal          96 256 1024 1024
32 VV5.ro        snp  vcopy VV5          29 RO normal          -- -- -- 1024
17 VV_TechPubs_1 full base ---          17 RW normal          0  0 2048 2048
18 VV_TechPubs_2 full base ---          18 RW normal          0  0 2048 2048
 8 vvfromcpg2.0  full base ---          8  RW normal          0  0 2048 2048
 9 vvfromcpg2.1  full base ---          9  RW normal          0  0 2048 2048
```

3.2.11.1 Setting the Environment Variable on Solaris and Linux

- ▶ To set the TPDNOHDTOT or TPDHAFTER environment variable in Solaris and Linux, see the following system output example:

```
$ TPDNOHDTOT=1
$ export TPDNOHDTOT
$ cli
```

Substitute TPDHAFTER for TPDNOHDTOT in the example above as necessary.

3.2.11.2 Setting the Environment Variable on Windows

To set the TPDNOHDTOT or TPDHAFTER environment variable in Windows:

- 1 Perform [step 1](#) through [step 4](#) of the procedure for setting the TPDSOCKSSL environment variable in Windows as described in [3.2.3 Using SSL](#) on page 3.7.
- 2 In the **Environment Variable** dialog box, enter TPDNOHDTOT or TPDHAFTER in the **Variable** box.
- 3 Enter 1 in the **Value** box.
- 4 Click **OK**.

3.2.11.3 Using the -nohdtot Option

To set the -nohdtot or -hafter global option, see the following example:

```
$ cli -nohdtot
```

Substitute -hafter for -nohdtot in the example above as necessary.

3.2.12 Forcing Commands

A number of CLI commands return confirmation prompts before executing the command operations. For these commands, an `-f` option is provided allowing you to bypass the confirmation and force the execution of the command. The `TPDFORCE` environment variable automatically provides the functionality of the `-f` option and alleviates the need of having to specify the `-f` option when issuing commands that would otherwise require a confirmation.

The `TPDFORCE` environment variable is set differently in Solaris or Linux, and Windows.

3.2.12.1 Setting the TPDFORCE Environment Variable on Solaris and Linux

- ▶ To set the `TPDFORCE` environment variable in Solaris and Linux, see the following system output example:

```
$ TPDFORCE=1
$ export TPDFORCE
$ cli
```

3.2.12.2 Setting the TPDFORCE Environment Variable on Windows

To set the `TPDFORCE` environment variable in Windows:

- 1 Perform [step 1](#) through [step 4](#) of the procedure for setting the `TPDSOCKSSL` environment variable in Windows as described in [3.2.3 Using SSL](#) on page 3.7.
- 2 Enter `TPDFORCE` in the **Variable** box.
- 3 Enter `1` in the **Value** box.
- 4 Click **OK**.

3.3 Stand-alone Commands

There are two ways to issue CLI commands from a shell prompt in Solaris and Linux, or from a Windows command prompt:

- CLI commands can be executed like typical UNIX and MS-DOS commands.
 - ◆ If the CLI commands are run as individual commands, you are prompted for your username and password for each command. This can be avoided by setting your system to read your username and password from a file. See [3.2.6 Setting Your Name and Password](#) on page 3.10 for more information.

- ◆ If you are running the CLI commands as individual commands, you can put each command in a script or pipe them to other commands. You can use the shell of your choice for scripting or initiating interactive sessions that provide history and line editing capabilities.
- Enter `cli` at your DOS or Solaris and Linux prompt to run the `cli` script. Running this script places you into an interactive Tcl shell where all CLI commands are available.
- ◆ The Tcl shell connects to the system and remains connected until you exit from the shell. While the Tcl shell is connected, you are not prompted for your username and password for each command you issue.
- ◆ The Tcl shell provides access to the Tcl language that allows you to write Tcl procedures or source Tcl scripts that build on top of CLI commands.



NOTE: Help is available to display information about CLI commands. If you started the CLI with the `cli` command, you can obtain help by typing either `help` or `clihelp`. When you run individual CLI commands from a system's native shell, use `clihelp`.

3.4 SSH

The InServ storage system is provided with Secure Shell (SSH) protocol version 2 that enables great flexibility in accessing the InForm CLI and provides an alternative to installing the remote CLI client. SSH uses public-private key encryption algorithms to encrypt all traffic between the client and server, including passwords.

SSH client applications are typically provided with the following operating systems:

- AIX
- HP-UX
- Linux
- Sun™ Solaris™

For Microsoft® Windows® users, an SSH client is available at <http://www.openssh.org>.

3.4.1 Benefits of Using SSH

SSH provides the following benefits:

- No InForm CLI installation. CLI clients are not required to access and use the CLI (assuming SSH client is installed).
- No version matching. The InForm CLI and InForm OS versions do not need to match because the CLI does not need to be installed remotely.
- Strong encryption. All information exchanged between client machines and InServ systems are encrypted.
- Data integrity. Integrity checking is executed to verify that data has not been altered during transmission from sender to receiver.
- Server authentication. The InServ system can be authenticated using the public key authentication scheme. The system's public key can be stored on client machines allowing the SSH client to compare the key presented by the InServ system to the key copied on the client machine.

3.4.2 CLI User Name Restrictions Using SSH

There are several CLI user names that are reserved for use by 3PAR®. Reserved names are as follows:

- root
- daemon
- bin
- console
- nobody
- sshd
- telnetd
- sys
- sync
- man
- proxy

- `list`

3.4.2.1 New Users

When creating a new user, specify a new user name that is different from those listed previously.

3.4.2.2 Existing Users

- ▶ To delete a user, issue the `removeuser` command.

```
cli% removeuser pw1
User removed
```

In the previous example, a user with the reserved user name of `pw1` is removed.

- ▶ To create a new user, issue the `createuser` command.

```
cli% createuser ROOT1 all edit
```

In the previous example, new user `ROOT1` is created.



NOTE: See the *3PAR InForm OS Command Line Interface Reference* for complete information about these commands.

3.4.3 Accessing the CLI Using SSH



NOTE: The following screen examples display output for UNIX systems. Windows screens are identical, with DOS prompts replacing UNIX prompts.



NOTE: A total of 16 connections is allowed at one time.

To access the CLI for the first time using SSH:

- 1 From any host that has SSH client, enter the following example:

```
$ ssh 3paradm@<InServ-host-name>
```

In the previous example, 3paradm is the first default user with super level privilege and <InServ-host-name> is the InServ system's host name.

- 2 If this is the first login from the client host (e.g the host does not already have InServ public key for identity), expect the following message:

```
The authenticity of host <InServ-host-name> can't be established.  
  
RSA key fingerprint is 68:a6:c9:60:a1:cb:...  
  
Are you sure you want to continue connecting (yes/no): yes
```

When prompted to continue, enter yes.

This is normal SSH behavior because the client host does not have the InServ system's public key. If InServ system's public key has been stored on the client host before this connection, this message will not be displayed. After you have set the key, on subsequent connections this message will not be displayed.



NOTE: The validity of the key fingerprint presented at this point can be verified by using the public keys provided as part of the InForm Administration Tools. These keys can be installed with the administration tools or can be obtained directly from the InForm Administration Tools CD. Consult your SSH client documentation for instructions on creating a key fingerprint from the public key.

- 3 When prompted for a password, enter the default password, 3pardata.
- 4 After the password is entered, you will see the CLI prompt.

```
<InServ-host-name> cli %
```

In the previous example, InServ-host-name is the InServ system's cluster name or host name.

You are now in the CLI shell and can issue any CLI command as documented in this manual.

- 5 If you need to create CLI additional users, issue the `createuser` command.

```
<InServ-host-name> cli % createuser -c testpw user2 all edit
```

In the previous example, new user `user2` with password `testpw` is created.

- 6 Terminate the CLI session by typing `exit` at the prompt.

```
<InServ-host-name> cli % exit
```

Newly created CLI users can access the CLI by following the instructions as explained earlier, substituting their own user name, system name, and password when prompted.

3.4.4 CLI Scripting Through SSH

You can use SSH key authentication to issue CLI commands in scripts. No password is required, however you will need to generate a public/private key pair.

- The public key must be stored on the InServ system using the `setsshkey` command to enable log in without a password.
- The private key must be kept in a file accessible by scripts that use CLI commands.

The key pair is generated by using the `ssh-keygen` utility (typically included in an SSH client software package and available on UNIX and Windows platforms).



NOTE: The following screen examples display output for UNIX systems. Windows screens are identical, with DOS prompts replacing UNIX prompts.

The following steps describe setting up CLI scripting through SSH:

- 1 Create a CLI user and password using the `createuser` command.

```
$ssh user1@system1
3paradm's password: *****
system1 cli% createuser -c testpw3 user3 all browse
User created
```

In the previous example, user `user1` logs into InServ system `system1` and creates user `user3` with the password `testpw3`.

- 2 Create a key pair using the `ssh-keygen` utility. Both `rsa` and `dsa` key formats are supported by the InServ system and recommended key length is 1024.



NOTE: For additional information about the `ssh-keygen` utility and `rsa` and `dsa` key formats, consult your SSH client documentation.

To create a key pair using `rsa` format:.

```
$ ssh-keygen -b 1024 -t rsa
```

To create a key pair using `dsa` format:

```
$ ssh-keygen -b 1024 -t dsa
Generating public/private dsa key pair.
Enter file in which to save the key (/home/usr/user3/.ssh/id_dsa):
Created directory '/home/usr/user3/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/usr/user3/.ssh/id_dsa.
Your public key has been saved in /home/usr/user3/.ssh/id_dsa.pub.
The key fingerprint is:
3f:a0:b5:6a:4d:dd:45:76:37:fb:a3:3e:52:44:55:32 user3@3pardata.com
```

The `ssh-keygen` utility generates two files: `id_rsa.pub` and `id_rsa.pub` (or `id_dsa.pub` and `id_dsa.pub`).

- ◆ Generate the key with or without a pass phrase.
- ◆ When the key is generated with a pass phrase, your private key is stored encrypted in the file.



NOTE: The pass phrase must be entered and decrypted before running a script. Running the `ssh-agent` and `ssh-add` commands decrypt the key (see [step 6 on page 3.26](#)).

- ◆ When a pass phrase is not specified, the key is stored unencrypted in the file.

- ◆ Ensure that only the owner has access and read/write permission on the private key file, otherwise the SSH client refuses the key file.

3 Log onto an InServ system from any system with the SSH client installed.

```
$ssh user3@system1
user3@system1's password: testpw3
```

4 Issue the setsshkey command.

```
system1 cli% setsshkey
setsshkey

Please enter the SSH public key below. When finished, press enter twice.
The key is usually long. It's better to copy it from inside an editor and
paste it here. (Please make sure there is no extra blanks.)

ssh-rsa AF5afPdciUTJ0PYzB6msRxFrCuDSqDwPshqWS5tGCFSoSZdE= user3's pubic key

SSH public key successfully set!
```

5 Write your script. See the following example:

```
#!/bin/sh
# Assume that the user name "user3" exists on system1
# The private key file "id_rsa" is accessible.
SSH="ssh -i id_rsa -l user3 system1 "
#
# Execute the command passed in as command line argument $1
${SSH} $1
```

- 6 If you specified a pass phrase when creating the key pair, run `ssh-agent` and `ssh-add` to decrypt the key before running your script (`<script_name>` in the following example).

```
$ ssh-agent  
  
echo Agent pid 24216  
  
$ ssh-add  
  
Enter passphrase for /home/usr/user3/.ssh/id_dsa: *****  
  
Identity added: /home/usr/user3/.ssh/id_dsa (/home/usr/user3/.ssh/id_dsa)  
  
$ <script_name>
```

4

Managing User Accounts and Connections

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The purpose of this chapter is to explain how to create and manage user accounts.

4.1 User Accounts

A user account is required to access an InServ Storage Server. The first user account must be set up on the node itself. A user class is assigned to each user that wishes to access an InServ storage system. At the most basic level, a user created on the system and who accesses the system using the InForm CLI is considered a *local user*.

Four user classes are provided to allow varying levels of accessibility in the system and are described in [Table 4-1](#).

Table 4-1. User Classes

User Class	Accessibility
Browse	Allows read-only accessibility.
Edit	Allows access to most commands, such as for creating and editing virtual volumes.
Super	Allows access to all CLI commands.
Service	Allows access to limited commands required to service the storage server; allows limited access to user information and user group resources.



NOTE: If the first user created does not have sufficient privileges to create additional users, operations are limited to what the first user can do. Therefore, it is recommended that the first user be created with super user privileges by specifying `super` for your user class when issuing the `createuser` command. See the *3PAR InForm OS Command Line Interface Reference* for additional information about the `createuser` command.

If you are using 3PAR Virtual Domains for access control, you will also need to assign users privileges over domains that you have set up in your system. See [Chapter 5, Managing Virtual Domains](#) for instructions on creating domains. These users are referred to as *domain users*. The combination of privilege level and assigned domain determines the domain user's level of accessibility within the system. For information about Domains and domain user privileges, see the *InForm OS Concepts Guide*.

4.1.1 Default User Accounts

During the InServ Storage Server's moment of birth operation, the following InForm CLI user account IDs are created:

- **3paradm** is a user ID with Super level CLI user privileges. This user ID is not used by 3PAR personnel and you can modify or delete this user ID. Use the `3paradm` user ID to create new CLI users. You should change the password of this user.
- **3parcim** is a user ID with Browse level CLI user privileges. This user ID is reserved for use by the InForm administration tools. The `3parcim` user ID and password must not be modified or deleted.
- **3parbrowse** is a user ID with Browse level CLI user privileges. No 3PAR personnel or service providers have access to this user ID. The password is randomly created and is unknown to anyone. This user ID is not used by 3PAR personnel and you can modify or delete this user ID.
- **3paredit** is a user ID with Edit level CLI user privileges. No 3PAR personnel or service providers have access to this user ID. The password is randomly created and is unknown to anyone. This user ID is not used by 3PAR personnel and you can modify or delete this user ID.

- **3parsvc** is a user ID with Super level CLI user privileges. This Super user ID is used by the InServ Service Processor to monitor the InServ Storage Server. If the 3parsvc user ID is removed or modified, the service processor will be unable to communicate with the storage server. If the service processor is unable to communicate with the storage server, the ability to monitor and service the InServ Storage Server is severely restricted. The the 3parsvc user ID and password must not be modified or deleted.
- **3parservice** is a user ID with Super level CLI user privileges. This Super user ID is used by 3PAR personnel and authorized service providers to use interactive CLI commands to perform service and diagnostic functions on the InServ Storage Server. If the 3parservice user ID is removed or modified, service personnel will be unable to communicate with the storage server through the service processor. If the service personnel are unable to communicate with the storage server through the service processor, the ability to monitor and service the InServ Storage Server is severely restricted. The the 3parservice user ID and password must not be modified or deleted.

4.1.2 Creating a User

- ▶ To create a new user, issue the `createuser -c|-e <password> <user_name> <domain_name> <user_class>` command, where:
 - ◆ `-c|-e <password>` is either a clear-text (`-c`) or encrypted (`-e`) password. A clear-text password must be between 6 and 8 characters in length. An encrypted password must be less than or equal to 31 characters in length. Encrypted passwords are generated by the system. You can only enter previously generated encrypted passwords. If no password is specified using `-c` or `-e`, then you are prompted to enter a clear-text password.
 - ◆ `<user_name>` is the name of the newly created user.



NOTE: By default, users in systems not using Domains fall into the `all` domain. For additional details about the `all` domain, see the *InForm OS Concepts Guide*.

- ◆ `<domain_name>` is the name of the domain to which the newly created user will belong. If you are not using Domains, specify `all`. If you are using Domains, specify the name of an existing domain in your system.
- ◆ `<user_class>` is specified as `super`, `browse`, or `edit` and establishes the new user's level of accessibility within the specified domain.

When you create a user, you can optionally use `all` in place of a `domain_name` to specify privileges over the entire system. In this case, the created user can be assigned a privilege level of Browse, Edit, Super, or Service.

For additional information about user privilege levels and domains, see the *InForm OS Concepts Guide*.

4.1.3 Viewing Users

- ▶ To view a list of users, their user classes, and domain associations (if you are using Domains), issue the `showuser` command. Under the `Domain` column, user's with privileges over the entire system are denoted with `all`. Otherwise, the domain name to which a user has specific privileges is displayed. Refer to the *InForm OS Command Line Interface Reference* for details about this command.
- ◆ If you are using Domains, users with Super level privilege can view all system users across all domains. If you belong to a specific domain, you can only view users within that particular domain.
- ◆ If you are not using Domains, the output of the `showuser` command still displays a `Domain` column. By default, users in systems not using Domains fall into the `no domain`. For additional details about the `no domain`, see the *InForm OS Concepts Guide*.

4.1.4 Viewing User Connections

- ▶ To view users currently connected to your system, including their IP addresses and their connection information, issue the `showuserconn` command. Refer to the *InForm OS Command Line Interface Reference* for details about this command.

If you are using Domains, prior to issuing the `showuserconn` command, you must first set the `TPDLISTDOM` environment variable or the `-listdom` global option to display domain information. If you are working in a Tcl shell, issue the `setclienv listdom 1` command to set your system output to display domain information. See [3.2.10 Listing Domains](#) on page 3.15 for further information.

If the `setclienv listdom 1` command is issued when viewing system objects, a `Domain` column is displayed. Objects not belonging to any domain (`no domain`) are displayed with a dash (-) under the `Domain` column. Otherwise, the domain to which the object belongs appears under the `Domain` column.

4.1.5 Removing User Connections

- ▶ To terminate a user's connection to the system, issue the `removeuserconn <ID> <user_name> <IP_address>` command, where:
 - ◆ `<ID>` is the user's numeric ID.
 - ◆ `<user_name>` is the user's assigned name.
 - ◆ `<IP_address>` is the user's IP address.

Refer to the *InForm OS Command Line Interface Reference* for details about this command.

4.1.6 Removing a User

- ▶ To remove a user from the system, issue the `removeuser <user_name>` command, where `<user_name>` is the name of the user being removed.

4.2 Users and Domains

If you are using Domains your existing users can be modified in the following ways:

- Users can be added to a domain.
- Users can be removed from a domain.
- Users can be set to work in a default domain.
- Users can be set to work in a current domain.

4.2.1 Adding a User to a Domain

- ▶ To add a user to an existing domain, issue the `setuser -adddomain <domain_name>:<user_class> <user_name>` command, where:
 - ◆ `<domain_name>` is the name of the domain to which you are adding the specified user.
 - ◆ `<user_class>` is specified as `super`, `browse`, or `edit` and defines the specified user's level of accessibility within the specified domain.
 - ◆ `<user_name>` is the name of the user being added to the specified domain.

4.2.2 Removing a User From a Domain

- ▶ To remove a user from a domain, issue the `setuser -rmdomain <domain_name> <user_name>` command, where:
 - ◆ `<domain_name>` is the name of the domain from which the specified user is being removed.
 - ◆ `<user_name>` is the name of the user being removed from the specified domain. You can specify `all` in place of a specific domain name to remove the user from all domains.

4.2.3 Setting a User's Default Domain

A user's default domain is the domain *that* user will access upon each working CLI session.



NOTE: Prior to setting a specific domain as a user's default, the user must previously have been assigned accessibility within that domain.

- ▶ To set a user's default domain, issue the `setuser -defaultdomain <domain_name> <user_name>` command, where:
 - ◆ `<domain_name>` is the name of the domain which is being set as the default.
 - ◆ `<user_name>` is the name of the user whom you are assigning a default domain.

For information about default domains, see the *InForm OS Concepts Guide*. For detailed information about the `setuser` command, refer to the *InForm OS Command Line Interface Reference*.

4.2.4 Removing a User's Default Domain

- ▶ To remove a user's default domain, issue the `setuser -defaultdomain -unset <user_name>` command, where `<user_name>` is the name of the user for whom you are removing a default domain.

4.2.5 Setting a User's Current Domain

The current domain refers to the domain in which a user is working during a particular, single CLI session.

- ▶ To set a user's current domain, issue the `setclienv currentdomain <domain_name>` command, where `<domain_name>` is the domain you wish to set as the working domain for the current CLI session.

4.2.6 Removing a User's Current Domain



NOTE: When issuing the `setclienv currentdomain -unset` command, you are not returned to your default domain.

To remove a user's current domain, issue the `setclienv currentdomain -unset` command.

4.3 LDAP Connection

The InForm OS provides an LDAP client that can be configured to use an LDAP server for authentication and authorization of InServ Storage Server users. Currently, the only supported LDAP server implementation is Active Directory.

An *LDAP user* is similar to a local user, however an LDAP user is authenticated and authorized using information from an LDAP server. Additionally, LDAP users' privileges within the system are tied to the groups to which the users belong.

Authentication is the process of using data from the LDAP server to verify a user's name and the supplied password. Authorization is the process of using data from the LDAP server to determine the user's group membership and privileges in the InServ system.

By default, LDAP users cannot store an SSH public key using the InForm CLI `setsshkey` command. Instead, LDAP users can use the `setsshkey` command by using the `allow-ssh-key` parameter with the `setauthparam` command. Assigned privileges, domains, and access to the InServ system continues as when the `setsshkey` command was issued, regardless of any changes to the user's data in the LDAP server. For more information about using LDAP with InServ Storage Servers, see the *InForm OS Concepts Guide*.

4.3.1 Active Directory LDAP Configuration with SASL Binding

To configure your InServ Storage Server to use Active Directory with SASL binding, the following process must be performed (detailed instructions follow):

- Configure connection parameters using the following commands:
 - ◆ `setauthparam ldap-server <IP_address>`
 - ◆ `setauthparam ldap-server-hn <DNS_HostName>`
 - ◆ `setauthparam kerberos-realm <LDAP_ServiceName>`
- Configure binding (authentication) parameters using the following commands:
 - ◆ `setauthparam binding sasl`
 - ◆ `setauthparam sasl-mechanism <SASL_type>`
- Configure account location parameters using the following commands:
 - ◆ `setauthparam accounts-dn <dn_path>`
 - ◆ `setauthparam account-obj user`
 - ◆ `setauthparam account-name-attr sAMAccount`
 - ◆ `setauthparam memberof-attr memberOf`
- Configure group-to-privilege mapping parameters using the following commands:
 - ◆ `setauthparam <privilege_map> <group>`
- Test the authentication/authorization for an Active Directory user account:
 - ◆ `checkpassword <user_name>`

Each step in the process above is discussed in the following sections. Each section is followed by an example showing the implementation of the instructions described.



NOTE: The examples used to illustrate the procedures described for Active Directory LDAP configuration with SASL binding specifically use GSSAPI as the SASL binding mechanism.

As you will see, a single user is used to determine group hierarchies and path structures used in the system, which are then used to complete the LDAP configuration.

4.3.1.1 Configuring Connection Parameters

To configure connection parameters:

- 1 If not already known, obtain the LDAP server's host name and Kerberos server information by running the `ldapsearch` command or using `ldp.exe` (available as part of the downloadable Windows Support Tools from Microsoft). You must know the LDAP server's IP address.



NOTE: If you do not have access to the `ldapsearch` command, use the `ldp.exe` command shown below.

- ◆ Issue the `ldapsearch` command and record the displayed `dnsHostName` (the value used for the `ldap-server-hn` parameter) and `ldapServiceName` (the value used for the `kerberos-realm` parameter) attributes for later use.
- ◆ Run `ldp.exe` as follows:
 - 1) Click **Start** > **Run**.
 - 2) In the **Open** box, enter `ldp` and click **OK**.
 - 3) The **Ldp** window opens.
 - 4) In the **Ldp** window, click **Connection** > **Connect**.
 - 5) In the **Server** box, enter the Active Directory server's IP address and click **OK**.

The root DSE attributes and values are displayed in the right-side pane.



NOTE: In `ldp.exe`, the Kerberos realm is the portion of the `ldapServiceName` value that follows the "at" (@) sign and terminates before the semi-colon (;).

In `ldapsearch` output, the Kerberos realm is the portion of the `ldapServiceName` value that follows the "at" (@) sign.

- 6) Record the displayed `dnsHostName` (the value used for the `ldap-server-hn` parameter) and `ldapServiceName` (the value used for the `kerberos-realm` parameter) attributes for later use.

- 2 Set the address to which the LDAP server will connect by issuing the `setauthparam ldap-server <IP_address>` command, where `<IP_address>` is your LDAP server's IP address.
- 3 Set the LDAP server's host name by issuing the `setauthparam ldap-server-hn <DNS_HostName>` command, where `<DNS_HostName>` is the value displayed by either using the `ldapsearch` command or `ldp.exe` in [step 1 on page 4.10](#).
- 4 Set the Kerberos realm by issuing the `setauthparam kerberos-realm <LDAP_ServiceName>` command, where `<LDAP_ServiceName>` is the value displayed by either using the `ldapsearch` command or `ldp.exe` in [step 1 on page 4.10](#).



NOTE: The value displayed for the default naming context is used later in [4.3.1.3 Configuring Account Location Parameters](#) on page 4.12.

Example:

```
% ldapsearch -LLL -x -H ldap://192.168.10.13 -b "" -s base dnsHostName
ldapServiceName defaultNamingContext
dn:
dnsHostName: domaincontroller.3par.com
ldapServiceName: 3par.com:domaincontroller$@NTDOM1.3PAR.COM
defaultNamingContext: DC=3par,DC=com
```

The example above corresponds to [step 1 on page 4.10](#) and displays the following:

- The LDAP server's IP address is 192.168.10.13.
- The `DNS_HostName` is `domaincontroller.3par.com`.
- The `LDAP_ServiceName` is `NTDOM1.3PAR.COM`.
- The `defaultNamingContext` is `DC=3par,DC=com`.

```
InServ1 cli% setauthparam -f ldap-server 192.168.10.13
InServ1 cli% setauthparam -f ldap-server-hn domaincontroller.3par.com
InServ1 cli% setauthparam -f kerberos-realm NTDOM1.3PAR.COM
```

The example above corresponds to [step 2 on page 4.11](#) through [step 4 on page 4.11](#).

4.3.1.2 Configuring Binding Parameters

After you have configured the connection parameters to your LDAP server, you must configure the binding (authentication) parameters for users.

- 1 Issue the `setauthparam binding sasl` command.
- 2 Issue the `setauthparam sasl-mechanism <SASL_type>` command, where `<type>` is specified as `PLAIN`, `DIGEST-MD5`, or `GSSAPI`.

For information on binding types, see Chapter 4, *LDAP*, in the *InForm OS Concepts Guide*

Example:

```
InServ1 cli% setauthparam -f binding sasl
InServ1 cli% setauthparam -f sasl-mechanism GSSAPI
```

In the example above, GSSAPI SASL binding is used for authentication.

4.3.1.3 Configuring Account Location Parameters

To configure the account location parameters:

- 1 If you are unsure of the user's account information, select a known user's full name (to be entered as the `cn` value) and run the `ldapsearch` command using the `defaultNamingContext` value previously displayed in [4.3.1.1 Configuring Connection Parameters](#) on page 4.10. Make a note of the group information displayed in the command's output.
- 2 Issue the `setauthparam accounts-dn <dn_path>` command.
- 3 Issue the `setauthparam account-obj user` command.
- 4 Issue the `setauthparam account-name-attr sAMAccount` command.
- 5 Issue the `setauthparam memberof-attr memberOf` command.



NOTE: You must know the user's password in order to successfully use the `checkpassword` command.

- 6 Issue the `checkpassword` command to obtain information about the user's group membership(s) from the LDAP server.

Example:

```
% ldapsearch -LLL -x -H ldap://192.168.10.13 -D 'NTDOM1\joeadmin' -W -b
DC=3par,DC=com -s sub '(cn=3PARuser)' dn
Enter LDAP Password:
dn: CN=3PAR User,OU=Engineering,OU=Users,DC=3par,DC=com
```

The example above corresponds to [step 1 on page 4.12](#), and displays the following:

- joadmin is the user name of the NT Windows domain (NTDOM1) administrator searching for group information for user 3PARuser (cn=3PAR User).
- dn: CN=3PAR User,OU=Engineering,OU=Users,DC=3par,DC=com displays user locations in the LDAP server Directory Information Tree (DIT).

```
InServ1 cli% setauthparam -f accounts-dn OU=Users,DC=3par,DC=com
InServ1 cli% setauthparam -f account-obj user
InServ1 cli% setauthparam -f account-name-attr sAMAccountName
InServ1 cli% setauthparam -f memberof-attr memberOf
```

The example above corresponds to [step 2 on page 4.12](#) through [step 5 on page 4.12](#).

- The Users group within the 3par group is set as the basis for any user search when authenticating with the LDAP server.
- The values user, sAMAccountName, and memberOf for the account-obj, account-name-attr, and memberof-attr parameters are typical of Active Directory configurations.

```

InServ1 cli% checkpassword 3PARuser
password:
+ attempting authentication and authorization using system-local data
+ authentication denied: unknown username
+ attempting authentication and authorization using LDAP
+ using Kerberos configuration file:
    [domain_realm]
        domaincontroller.3par.com = NTDOM1.3PAR.COM
    [realms]
        NTDOM1.3PAR.COM = {
            kdc = 192.168.10.13
        }
+ temporarily setting name-to-address mapping: domaincontroller.3par.com ->
192.168.10.13
+ attempting to obtain credentials for 3PARuser@NTDOM1.3PAR.COM
+ connecting to LDAP server using URI: ldap://192.168.10.13
+ binding to user 3PARuser with SASL mechanism GSSAPI
+ searching LDAP using:
    search base:   OU=Users,DC=3par,DC=com
    filter:        (&(objectClass=user)(sAMAccountName=3PARuser))
    for attribute: memberOf
+ search result DN: CN=3PARuser,OU=Engineering,OU=Users,DC=3par,DC=com
+ search result:   memberOf: CN=Software,CN=Users,DC=3par,DC=com
+ search result:   memberOf: CN=Eng,CN=Users,DC=3par,DC=com
+ search result:   memberOf: CN=Golfers,CN=Users,DC=3par,DC=com
+ authorization denied: no user groups match mapping rules
user 3PARuser is not authenticated or not authorized

```

- The example above corresponds to [step 6 on page 4.12](#), and shows that 3PARuser is a member of the following hierarchy of groups:
 - ◆ Engineering
 - ◆ Software
 - ◆ Eng
 - ◆ Golfers
- In this example, 3PARuser is not yet authenticated or authorized because 3PARuser's group-to-privilege mapping has not been configured.

4.3.1.4 Configuring Group-To-Privilege Mapping Parameters

Once you have configured the group location parameters, you must now decide what privilege you wish to assign the users for a given group. To configure group-to-privilege mapping:

- 1 Issue the `setauthparam <privilege_map> <group>` command, where:
 - ◆ `<privilege_map>` is one of:
 - ◆ `super-map` - provides super level privileges within the specified group.
 - ◆ `service-map` - provides service level privileges within the specified group.
 - ◆ `edit-map` - provides edit level privileges within the specified group.
 - ◆ `browse-map` - provides browse level privileges within the specified group.
 - ◆ `<group>` is the group to which the user has membership, as displayed with the `checkpassword` command. You can specify multiple groups. For Active Directory, the group is displayed as a string of information as shown in the following example:

`CN=Software,CN=Users,DC=ACME,DC=com`
- 2 Repeat [step 1](#) above if you wish to assign users a different privilege level for another group to which that user has membership.
- 3 Issue the `checkpassword` command to verify that the users have the privilege(s) you assigned for the desired group(s). Use a member of a specific group to verify the privilege.

Example:

```
InServ1 cli% setauthparam -f edit-map CN=Software,CN=Users,DC=3par,DC=com
InServ1 cli% setauthparam -f browse-map CN=Eng,CN=Users,DC=3par,DC=com
```

In the example above:

- Users belonging to the `Software` group are configured to have edit privileges within the system.
- Users belonging the `Eng` group are configured to have browse privileges within the system.

```
InServ1 cli% checkpassword 3PARuser
...
+ search result:      memberOf: CN=Software,CN=Users,DC=3par,DC=com
+ search result:      memberOf: CN=Eng,CN=Users,DC=3par,DC=com
+ search result:      memberOf: CN=Golfers,CN=Users,DC=3par,DC=com
+ mapping rule: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ rule match: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ mapping rule: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
+ rule match: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
user 3PARuser is authenticated and authorized
```

In the example above:

- 3PARuser is a member of the `Software` group and is assigned edit level privileges within the system.
- Although 3PARuser is also a member of the `Eng` group, the edit privilege associated with the `Software` group supersedes the browse privilege associated with the `Eng` group.
- The mapping rules set for 3PARuser are applied to all members of the `Software` group and `Eng` groups; all `Software` group members have edit privileges within the system and all `Eng` group members have browse privileges within the system.

4.3.2 Active Directory LDAP Configuration with Simple Binding Over SSL

To configure Active Directory with simple binding over SSL, follow these procedures using the specified commands (detailed instructions follow):

- Configure connection parameters using the following commands:
 - ◆ `setauthparam ldap-server <IP_address>`
 - ◆ `setauthparam ldap-server-hn <DNS_HostName>`
- Configure binding (authentication) parameters using the following commands:
 - ◆ `setauthparam binding simple`
 - ◆ `setauthparam user-atter <DN_attribute>`
- (Optional) Set the CA certificate using the following command:
 - ◆ `setauthparam ldap-ssl-cacert <certificate>`
- Configure account location parameters using the following commands:
 - ◆ `setauthparam accounts-dn <DN_path>`
 - ◆ `setauthparam account-obj user`
 - ◆ `setauthparam account-name-attr sAMAccount`
 - ◆ `setauthparam memberof-attr memberOf`
 - ◆ `checkpassword <user_name>`
- Configure group-to-privilege mapping parameters using the following commands:
 - ◆ `setauthparam <privilege_map> <group>`
 - ◆ `checkpassword <user_name>`

Each step in the process above is discussed in the following sections. Each section is followed by an example showing the implementation of the instructions described.

4.3.2.1 Configuring Connection Parameters

To configure connection parameters:

- 1 If not already known, obtain the LDAP server's host name by running the `ldapsearch` command or using `ldp.exe` (available as part of the downloadable Windows Support Tools from Microsoft). You must know the LDAP server's IP address.



NOTE: If you do not have access to the `ldapsearch` command, use the `ldp.exe` command.

- ◆ Issue the `ldapsearch` command and record the displayed `dnsHostName` (the value used for the `ldap-server-hn` parameter; this is only necessary when setting CA certificates).
- ◆ Run `ldp.exe` as follows:
 - 1) Click **Start** > **Run**.
 - 2) In the **Open** box, enter `ldp` and click **OK**.
 - 3) The **Ldp** window opens.
 - 4) In the **Ldp** window, click **Connection** > **Connect**.
 - 5) In the **Server** box, enter the Active Directory server's IP address and click **OK**.

The root DSE attributes and values are displayed in the right-side pane.

- 6) Record the displayed `dnsHostName` (the value used for the `ldap-server-hn` parameter; only necessary if setting CA certificates).
- 2 Set the address to which the LDAP server will connect by issuing the `setauthparam ldap-server <IP_address>` command, where `<IP_address>` is your LDAP server's IP address.
- 3 Set the LDAP server's host name by issuing the `setauthparam ldap-server-hn <DNS_HostName>` command, where `<DNS_HostName>` is the value displayed by either using the `ldapsearch` command or `ldp.exe` in [step 1 on page 4.18](#).



NOTE: The value displayed for the `defaultNamingContext` is used later in [4.3.1.3 Configuring Account Location Parameters](#) on page 4.12.

Example:

```
% ldapsearch -LLL -x -H ldap://192.168.10.13 -b "" -s base dnsHostName
ldapServiceName defaultNamingContext
dn:
dnsHostName: domaincontroller.3par.com
ldapServiceName: 3par.com:domaincontroller$@NTDOM1.3PAR.COM
defaultNamingContext: DC=3par,DC=com
```

The example above corresponds to [step 1 on page 4.18](#) and displays the following:

- The LDAP server's IP address is 192.168.10.13.
- The DNS_HostName is domaincontroller.3par.com.
- The defaultNamingContext is DC=3par,DC=com.

```
InServ1 cli% setauthparam -f ldap-server 192.168.10.13
InServ1 cli% setauthparam -f ldap-server-hn domaincontroller.3par.com
```

The example above corresponds to [step 2 on page 4.18](#) through [step 3 on page 4.18](#).

4.3.2.2 Configuring Binding Parameters

After you have configured the connection parameters to your LDAP server, you must configure the binding (authentication) parameters for users.

- 1 Issue the `setauthparam binding simple` command.
- 2 Issue the `setauthparam user-attr <DN_attribute>` command to set the attribute used to form a DN to the Windows domain.

Example:

```
InServ1 cli% setauthparam -f binding simple
```

```
setauthparam -f user-attr NTDOM1\\
```

In the example above, the Windows domain is NTDOM1.

4.3.2.3 Configuring the CA Certificate

To configure the CA certificate:

- 1 Obtain the location of the CA certificate from the Active Directory server's administrator.



NOTE: If the certificate ends in the file extension `.crt`, it will need to be converted to a form compatible with the `setauthparam` command.

- 2 If necessary, convert the certificate to `.cer` file format. On a Windows system:
 - a Double-click the certificate.
 - b Select the **Details** tab.
 - c Click **Copy to File...**
 - d Click **Next**.
 - e Select **Base-64 encoded x.5098** format.
 - f Click **Next**.
 - g Click **Browse...** and select a filename for the certificate (ending in the `.cer` file extension) and a folder in which the certificate will be stored.
 - h Click **Next > Finish**.

Or, use the `openssl x509` program.

- 3 Set the certificate using the `setauthparam ldap-ssl-cacert <certificate>` command, where `<certificate>` is the name of the certificate you previously located or converted.

Example:

```
openssl x509 -inform DER -in ca.crt -outform PEM -out ca.cer
```

In the example above, the `openssl x509` command is used to convert the CA certificate from `ca.crt` format to `ca.cer` format, which can then be used with the `setauthparam` command.

```
setauthparam -f ldap-ssl-cacert ca.cer
```

In the example above, the `setauthparam` command is issued to set the CA certificate to the `ca.cer` file.

4.3.2.4 Configuring Account Location Parameters

To configure the account location parameters:

- 1 If you are unsure of the user's account information, select a known user's full name (to be entered as the `cn` value) and run the `ldapsearch` command using the `defaultNamingContext` value previously displayed in [4.3.2.1 Configuring Connection Parameters](#) on page 4.18. Make a note of the group information displayed in the command's output.
- 2 Issue the `setauthparam accounts-dn <DN_path>` command.
- 3 Issue the `setauthparam account-obj user` command.
- 4 Issue the `setauthparam account-name-attr sAMAccount` command.
- 5 Issue the `setauthparam memberof-attr memberOf` command.



NOTE: You must know the user's password in order to successfully use the `checkpassword` command.

- 6 Issue the `checkpassword` command to obtain information about the user's group membership(s) from the LDAP server.

Example:

```
% ldapsearch -LLL -x -H ldap://192.168.10.13 -D 'NTDOM1\joeadmin' -W -b
DC=3par,DC=com -s sub '(cn=3PARuser)' dn
Enter LDAP Password:
dn: CN=3PAR User,OU=Engineering,OU=Users,DC=3par,DC=com
```

The example above corresponds to [step 1 on page 4.21](#), and displays the following:

- `joadmin` is the user name of the NT Windows domain (NTDOM1) administrator searching for group information for user `3PARuser` (`cn=3PARuser`).

- `dn: CN=3PAR User,OU=Engineering,OU=Users,DC=3par,DC=com` displays user locations in the LDAP server directory information tree (DIT).

```
InServ1 cli% setauthparam -f accounts-dn OU=Users,DC=3par,DC=com
InServ1 cli% setauthparam -f account-obj user
InServ1 cli% setauthparam -f account-name-attr sAMAccountName
InServ1 cli% setauthparam -f memberof-attr memberOf
```

The example above corresponds to [step 2 on page 4.21](#) through [step 5 on page 4.21](#). The following can be surmised based on the group information gathered from running the `ldapsearch` command:

- The Users group within the 3par group is set as the basis for any user search when authenticating with the LDAP server.
- The values `user`, `sAMAccountName`, and `memberOf` for the `account-obj`, `account-name-attr`, and `memberof-attr` parameters are typical of Active Directory configurations.

```

InServ1 cli% checkpassword 3PARuser
password:
+ attempting authentication and authorization using system-local data
+ authentication denied: unknown username
+ attempting authentication and authorization using LDAP
+ using Kerberos configuration file:
    [domain_realm]
        domaincontroller.3par.com = NTDOM1.3PAR.COM
    [realms]
        NTDOM1.3PAR.COM = {
            kdc = 192.168.10.13
        }
+ temporarily setting name-to-address mapping: domaincontroller.3par.com ->
192.168.10.13
+ attempting to obtain credentials for 3PARuser@NTDOM1.3PAR.COM
+ connecting to LDAP server using URI: ldap://192.168.10.13
+ binding to user 3PARuser with SASL mechanism GSSAPI
+ searching LDAP using:
    search base:   OU=Users,DC=3par,DC=com
    filter:        (&(objectClass=user)(sAMAccountName=3PARuser))
    for attribute: memberOf
+ search result DN: CN=3PARuser,OU=Engineering,OU=Users,DC=3par,DC=com
+ search result:   memberOf: CN=Software,CN=Users,DC=3par,DC=com
+ search result:   memberOf: CN=Eng,CN=Users,DC=3par,DC=com
+ search result:   memberOf: CN=Golfers,CN=Users,DC=3par,DC=com
+ authorization denied: no user groups match mapping rules
user 3PARuser is not authenticated or not authorized

```

- The example above corresponds to [step 6 on page 4.21](#), and displays that 3PARuser is a member of the following hierarchy of groups:
 - ◆ Engineering
 - ◆ Software
 - ◆ Eng
 - ◆ Golfers
- In this example, 3PARuser is not yet authenticated or authorized because 3PARuser's group-to-privilege mapping has not been configured.

4.3.2.5 Configuring Group-To-Privilege Mapping Parameters

Once you have configured the group location parameters, you must now decide what privilege you wish to assign the users for a given group. To configure group-to-privilege mapping:

- 1 Issue the `setauthparam <privilege_map> <group>` command, where:
 - ◆ `<privilege_map>` is one of:
 - ◆ `super-map` - provides super level privileges within the specified group.
 - ◆ `service-map` - provides service level privileges within the specified group.
 - ◆ `edit-map` - provides edit level privileges within the specified group.
 - ◆ `browse-map` - provides browse level privileges within the specified group.
 - ◆ `<group>` is the group to which the user has membership, as displayed with the `checkpassword` command. You can specify multiple groups. For Active Directory, the group is displayed as a string of information as shown in the following example:

`CN=Software,CN=Users,DC=ACME,DC=com`
- 2 Repeat [step 1](#) above if you wish to assign users a different privilege level for another group to which that user has membership.
- 3 Issue the `checkpassword` command to verify that the users have the privilege(s) you assigned for the desired group(s). Use a member of a specific group to verify the privilege.

Example:

```
InSrv1 cli% setauthparam -f edit-map CN=Software,CN=Users,DC=3par,DC=com
InSrv1 cli% setauthparam -f browse-map CN=Eng,CN=Users,DC=3par,DC=com
```

In the example above:

- Users belonging to the `Software` group are configured to have edit privileges within the system.
- Users belonging the `Eng` group are configured to have browse privileges within the system.

```
InServ1 cli% checkpassword 3PARuser
...
+ search result:    memberOf: CN=Software,CN=Users,DC=3par,DC=com
+ search result:    memberOf: CN=Eng,CN=Users,DC=3par,DC=com
+ search result:    memberOf: CN=Golfers,CN=Users,DC=3par,DC=com
+ mapping rule: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ rule match: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ mapping rule: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
+ rule match: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
user 3PARuser is authenticated and authorized
```

In the example above:

- 3PARuser is found to be a member of the `Software` group and is assigned `edit` level privileges within the system.
- Although 3PARuser is also a member of the `Eng` group, the `edit` privilege associated with the `Software` group supersedes the `browse` privilege associated with the `Eng` group.
- The mapping rules set for 3PARuser are applied to all members of the `Software` group and `Eng` group; all `Software` group members have `edit` privileges within the system and all `Eng` group members have `browse` privileges within the system.

4.3.3 OpenLDAP Configuration with Simple Binding Over SSL

To configure your InServ Storage Server to use OpenLDAP with simple binding over SSL, the following process must be performed (detailed instructions follow):

- Configure connection parameters using the following command:
 - ◆ `setauthparam ldap-server <IP_address>`
 - ◆ `setauthparam ldap-ssl 1`
- Configure binding (authentication) parameters using the following commands:
 - ◆ `setauthparam binding <binding_type>`
 - ◆ `setauthparam user-dn-base <value>`
 - ◆ `setauthparam user-attr <attribute>`
- Configure group location parameters using the following commands:
 - ◆ `setauthparam groups-dn <value>`
 - ◆ `setauthparam group-object <group_object_class>`
 - ◆ `setauthparam group-name-attr <attribute>`
 - ◆ `setauthparam member-attr <member_attribute>`
- Configure group-to-privilege mapping parameters using the following commands:
 - ◆ `setauthparam <privilege_map> <group>`
 - ◆ `checkpassword <user_name>`

Different schemas can be used for user and group information with OpenLDAP. The instructions and example that follow describe configuration of the InServ Storage Server using Posix users and groups.

4.3.3.1 Configuring Connection Parameters

- 1 To configure connection parameters, issue the `setauthparam ldap-server <IP_address>` command, where `<IP_address>` is the OpenLDAP server's IP address.
- 2 Issue the `setauthparam ldap-ssl 1` command.

Example:

```
InServ1 cli% setauthparam -f ldap-server 192.168.10.13
InServ1 cli% setauthparam -f ldap-ssl 1
```

In the example above:

- The OpenLDAP server's IP address is 192.168.10.13.
- SSL security is activated using the 1 parameter.

4.3.3.2 Configuring Binding Parameters

After you have configured the connection parameters to your LDAP server, you must configure the binding (authentication) parameters for users.

To configure binding parameters:

- 1 Issue the `setauthparam binding <binding_type>` command.
- 2 Issue the `setauthparam user-dn-base <value>` command, where `<value>` is the base of the subtree where user information is kept in the OpenLDAP server's directory information tree (DIT).
- 3 Issue the `setauthparam user-attr <attribute>` command, where `<attribute>` is the name of the attribute holding the user's username.

Example:

```
InServ1 cli% setauthparam -f binding simple
```

In the example above, simple binding is specified as the binding mechanism.

```
InServ1 cli% setauthparam -f user-dn-base ou=people,dc=ldaptest,dc=3par,dc=com
```

In the example above, the base of the user entries in the OpenLDAP server DIT is `ou=people,dc=ldaptest,dc=3par,dc=com`.

```
InServ1 cli% setauthparam -f user-attr uid
```

In the example above, `uid` is the attribute with the value of the user's user name of the `posixAccount` object class.

4.3.3.3 Configuring Group Location Parameters

To configure group location parameters, perform the following:

- 1 Issue the `setauthparam groups-dn <value>` command, where `<value>` is the basis of the search for objects holding group information in the subtree of the DIT.
- 2 Issue the `setauthparam group-object <group_object_class>` command.
- 3 Issue the `setauthparam group-name-attr <attribute>` command, where `<attribute>` is the group object's attribute that holds the group name.
- 4 Issue the `setauthparam member-attr <member_attribute>` command, where `<member_attribute>` is attribute that holds the names of the users in the group.

Example:

```
InServ1 cli% setauthparam -f groups-dn ou=groups,dc=ldaptest,dc=3par,dc=com
```

In the example above, `ou=groups,dc=ldaptest,dc=3par,dc=com` is the search base for objects holding group information in the DIT subtree.

```
InServ1 cli% setauthparam -f group-obj posixGroup
InServ1 cli% setauthparam -f group-name-attr cn
InServ1 cli% setauthparam -f member-attr memberUid
```

In the example above:

- `posixGroup` is the group object class.
- `cn` is the attribute of the `posixGroup`, which has a value of the group's name.
- `memberUid` is the attribute with the value of the user's username.

4.3.3.4 Configuring Group-To-Privilege Mapping Parameters

- 1 Issue the `setauthparam <privilege_map> <group>` command, where:
 - ◆ `<privilege_map>` is one of:
 - ◆ `super-map` - provides super level privileges within the specified group.
 - ◆ `service-map` - provides service level privileges within the specified group.
 - ◆ `edit-map` - provides edit level privileges within the specified group.
 - ◆ `browse-map` - provides browse level privileges within the specified group.
 - ◆ `<group>` is the group to which the user has membership, as displayed with the `checkpassword` command. You can specify multiple groups.
- 2 Repeat [step 1](#) above if you wish to assign users a different privilege level for another group to which that user has membership.
- 3 Issue the `checkpassword` command to verify that the users have the privilege(s) you assigned for the desired group(s). Use a member of a specific group to verify the privilege.

Example:

```
InServ1 cli% setauthparam -f super-map software
InServ1 cli% setauthparam -f edit-map engineering
InServ1 cli% setauthparam -f browse-map hardware
```

In the example above:

- Users belonging to the software group are configured to have super privileges within the system.
- Users belonging to the engineering group are configured to have edit privileges within the system.
- Users belonging to the hardware group are configured to have browse privileges within the system.

```
InServ1 cli% checkpassword 3paruser
password:
+ attempting authentication and authorization using system-local data
+ authentication denied: unknown username
+ attempting authentication and authorization using LDAP
+ connecting to LDAP server using URI: ldaps://192.168.10.13
+ simple bind to LDAP user 3paruser for DN
uid=3paruser,ou=people,dc=ldaptest,dc=3par,dc=com
+ searching LDAP using:
    search base:      ou=people,dc=ldaptest,dc=3par,dc=com
    filter:           (&(objectClass=posixAccount)(uid=3paruser))
    for attributes:   gidNumber
+ search result DN:  uid=3paruser,ou=people,dc=ldaptest,dc=3par,dc=com
+ search result:     gidNumber: 2345
+ searching LDAP using:
    search base:      ou=groups,dc=ldaptest,dc=3par,dc=com
    filter:           (&(objectClass=posixGroup)(|(gidNumber=2345)(memberUid=3paruser)))
    for attributes:   cn
+ search result DN:  cn=software,ou=groups,dc=ldaptest,dc=3par,dc=com
+ search result:     cn: software
+ search result DN:  cn=engineering,ou=groups,dc=ldaptest,dc=3par,dc=com
+ search result:     cn: engineering
+ search result DN:  cn=hardware,ou=groups,dc=ldaptest,dc=3par,dc=com
+ search result:     cn: hardware
+ mapping rule: super mapped to by software
+ rule match: super mapped to by software
+ mapping rule: edit mapped to by engineering
+ rule match: edit mapped to by engineering
+ mapping rule: browse mapped to by hardware
+ rule match: browse mapped to by hardware
user 3paruser is authenticated and authorized
```

In the example above:

- User 3PARuser is found to be a member of the software group and is assigned super level privileges within the system.
- Although 3PARuser is also a member of the engineering and hardware groups, the super privilege associated with the Software group supersedes the edit and browse privileges associated with the engineering and software groups.
- The mapping rules set for 3PARuser are applied to all members of the software, engineering, and hardware groups; all software group members have super privileges within the system, all engineering group members have edit privileges within the system, and all hardware group members have browse privileges within the system.

4.4 LDAP Connection on Systems Using Domains

LDAP is also available for systems using 3PAR Virtual Domains for access control. The configuration process is nearly identical to configuring LDAP on non-Domain systems, with the only difference being an additional authorization step to map a user's group to a domain. For information about LDAP and Domains, see Chapter 4, *LDAP*, in the *InForm OS Concepts Guide*.

To configure your InServ Storage Server to use an Active Directory LDAP server using SASL binding, the following process must be performed (detailed instructions follow):

- Configure connection parameters using the following commands:
 - ◆ `setauthparam ldap-server <IP_address>`
 - ◆ `setauthparam ldap-server-hn <DNS_HostName>`
 - ◆ `setauthparam kerberos-realm <LDAP_ServiceName>`
- Configure binding (authentication) parameters using the following commands:
 - ◆ `setauthparam binding sasl`
 - ◆ `setauthparam sasl-mechanism <SASL_type>`
- Configure account location parameters using the following commands:
 - ◆ `setauthparam accounts-dn <DN_path>`
 - ◆ `setauthparam account-obj user`
 - ◆ `setauthparam account-name-attr sAMAccount`

- ◆ `setauthparam memberof-attr memberOf`
- ◆ `checkpassword <user_name>`
- Configure group-to-privilege mapping parameters using the following command:
 - ◆ `setauthparam <privilege_map> <group>`
- Configure group-to-domain mapping parameters using the following commands:
 - ◆ `setauthparam group-obj group`
 - ◆ `setauthparam domain-name-attr <attribute>`, and optionally `setauthparam domain-name-prefix <prefix>`
 - ◆ `checkpassword <user_name>`

The following instructions describe how to set up an Active Directory LDAP connection on an InServ Storage Server using Domains:

- 1 Follow the directions as described in the following sections:
 - a [4.3.1.1 Configuring Connection Parameters](#) on page 4.10
 - b [4.3.1.2 Configuring Binding Parameters](#) on page 4.12
 - c [4.3.1.3 Configuring Account Location Parameters](#) on page 4.12
 - d [4.3.1.4 Configuring Group-To-Privilege Mapping Parameters](#) on page 4.15; however, do not issue the `checkpassword` command.
- 2 Configure the group-to-domain mapping parameters, as follows:
 - ◆ Issue the `setauthparam domain-name-attr <attribute>` command, where `<attribute>` is the name of an attribute that holds the potential domain name. A common parameter to specify as the `<attribute>` is `name`.
 - ◆ (Optional.) Issue the `setauthparam domain-name-prefix <prefix>` command, where `<prefix>` is the start point of the domain name search within the information returned from the `domain-name-attr <attribute>` parameter described above. An example parameter to specify as the `<prefix>` is `InServDomain=`.
- 3 Issue the `checkpassword` command to verify that the users have the privilege(s) you assigned for the desired group(s) and the group-to-domain mapping is correct. Use a member of a specific group to verify the privilege.

Example using only the domain-name-attr parameter:

```
InServ cli% setauthparam domain-name-attr name
```

The example above corresponds to the first bullet in [step 2 on page 4.32](#). As shown, name is the attribute used as the basis of the domain name search.

```
InServ1 cli% checkpassword 3PARuser
...
+ search result:      memberOf: CN=Software,CN=Users,DC=3par,DC=com
+ search result:      memberOf: CN=Eng,CN=Users,DC=3par,DC=com
+ search result:      memberOf: CN=Golfers,CN=Users,DC=3par,DC=com
+ mapping rule: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ rule match: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ mapping rule: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
+ rule match: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
+ searching LDAP using:
      search base:      CN=Software Group,CN=Users,DC=3par,DC=com
      filter:           (objectClass=group)
      for attributes: name
+ search result DN:   CN=Software Group,CN=Users,DC=3par,DC=com
+ search result:      name: Software Group
+ group "CN=Software Group,CN=Users,DC=3par,DC=com" has potential domain
Software_Group (transformed from "Software Group")
+ searching LDAP using:
      search base:      CN=Eng,CN=Users,DC=hq,DC=3par,DC=com
      filter:           (objectClass=group)
      for attributes: name
+ search result DN:   CN=Eng,CN=Users,DC=hq,DC=3par,DC=com
+ search result:      name: Engineering
+ group "CN=Eng,CN=Users,DC=hq,DC=3par,DC=com" has potential domain Engineering
+ domain match: Engineering mapped to browse
+ domain match: Software_Group mapped to edit
user 3PARuser is authenticated and authorized
```

The example above corresponds to [step 3 on page 4.32](#) and displays the following:

- 3PARuser is found to be a member of the Software group with edit level privileges. The Software group is mapped to the Software_Group domain. 3PARuser is assigned edit level privileges within the Software domain.

- 3PARuser is also found to be a member of the Eng group with browse level privileges. The Eng group is mapped to the Engineering domain. 3PARuser is assigned browse level privilege within the Eng domain.

Example using the domain-name-prefix parameter:

```
InServ cli% setauthparam domain-name-attr description
InServ cli% setauthparam domain-name-prefix InServDomain=
```

The example above corresponds to the second bullet in [step 2 on page 4.32](#). As shown, InServDomain= is the start point of the domain name search within the information returned from the domain-name-attr description parameter described above. The text following InServDomain= is treated as the potential domain name.

```

InServ1 cli% checkpassword 3paruser
...
+ temporarily setting name-to-address mapping: domaincontroller.3par.com ->
192.168.10.13
+ attempting to obtain credentials for 3paruser@NTDOM1.3PAR.COM
+ connecting to LDAP server using URI: ldap://192.168.10.13
+ binding to user 3paruser with SASL mechanism GSSAPI
+ searching LDAP using:
    search base:      OU=Users,DC=3par,DC=COM
    filter:           (&(objectClass=user)(sAMAccountName=3paruser))
    for attributes: memberOf
+ search result DN: CN=3PAR User,OU=Eng,OU=Users,DC=3par,DC=COM
+ search result:      memberOf: CN=Software,CN=Users,DC=3par,DC=com
+ search result:      memberOf: CN=Eng,CN=Users,DC=3par,DC=com
+ mapping rule: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ rule match: edit mapped to by CN=Software,CN=Users,DC=3par,DC=com
+ mapping rule: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
+ rule match: browse mapped to by CN=Eng,CN=Users,DC=3par,DC=com
+ searching LDAP using:
    search base:      CN=Software,CN=Users,DC=3par,DC=com
    filter:           (objectClass=group)
    for attributes: description
+ search result DN: CN=Software,CN=Users,DC=3par,DC=com
+ search result:      description: Software
+ group "CN=Software,CN=Users,DC=3par,DC=com" has potential domain Software
+ searching LDAP using:
    search base:      CN=Eng,CN=Users,DC=3par,DC=com
    filter:           (objectClass=group)
    for attributes: description
+ search result DN: CN=Eng,CN=Users,DC=3par,DC=com
+ search result:      description: Engineering Group, InServDomain=engineering-group-
dom
+ group "CN=Eng,CN=Users,DC=3par,DC=com" has potential domain engineering-group-dom
(transformed from "Engineering Group, InServDomain=engineering-group-dom")
+ domain match: Engineering mapped to browse
+ domain match: Software mapped to edit
user 3paruser is authenticated and authorized

```

The example above corresponds to [step 3 on page 4.32](#) and displays the following:

- 3PARuser is found to be a member of the Software group with edit level privileges. The Software group is mapped to the Software domain. 3PARuser is assigned edit level privileges within the Software domain.

- 3PARuser is also found to be a member of the Eng group with browse level privileges. The Engineering group is mapped to the Engineering domain. 3PARuser is assigned browse level privilege within the Engineering domain.

5

Managing Virtual Domains

In this chapter

5.1 Overview	5.2
5.3 Creating a Domain	5.3
5.4 Viewing Domains	5.3
5.5 Modifying a Domain	5.4
5.6 Removing a Domain	5.5
5.7 Managing Domain Objects	5.5
5.8 Managing Virtual Domain Autonomic Groups	5.6

The purpose of this chapter is to explain how to create and manage 3PAR Virtual Domains.



NOTE: 3PAR Virtual Domains requires a 3PAR Virtual Domains license. Contact your local service provider for details.

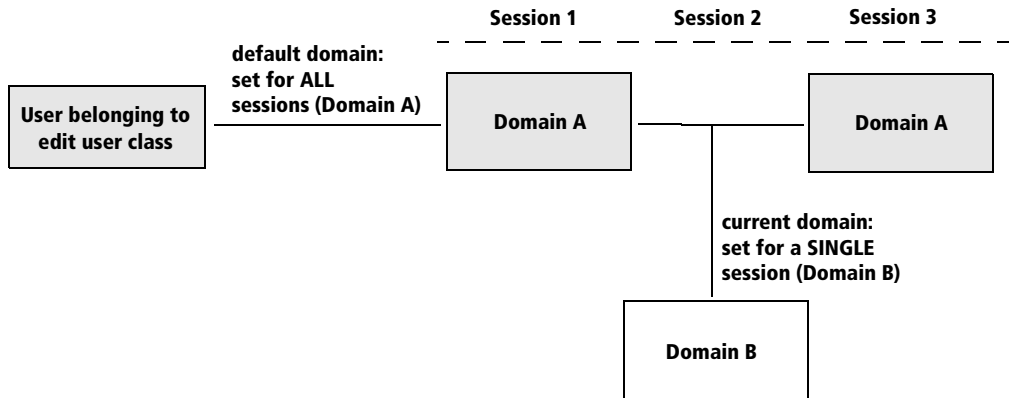
5.1 Overview

3PAR Virtual Domains (Domains) allows an administrator to create multiple domains, or spaces, within an InServ Storage Server, where each domain is dedicated to a specific application. In effect, using Domains restricts users to a subset of the volumes and hosts in a system and prevents users from exporting virtual volumes to hosts outside of the users' assigned domains. For more information about Domains, see the *InForm OS Concepts Guide*. This chapter provides instructions on creating domains and describes the administration tasks associated with maintaining domains.

5.2 Default Domains

An InForm CLI user's default domain is the domain the user accesses at the start of each CLI session. For example, if you have `edit` privileges to Domains A and B and your default domain has been set to Domain A, each time you start a new CLI session you will view and work with only objects in Domain A (Figure 5-1). The user's default domain can be set and reset at any time by the administrator.

In the following example, the default domain (Domain A) can be reassigned to Domain B for the current working session using the `setclienv currentdomain <name>` command. When the `currentdomain <name>` is set, you are able to view and work on objects in Domain B for a single CLI session. When that session is over, your next session is started in your default domain (Domain A) (Figure 5-1). Thus, a *current* domain refers to the domain in which you are working during a particular, single CLI session.



SINGLE assigned domain's (either default or current) objects viewable and operable.

Figure 5-1. Assigned Default and Current Domains

5.3 Creating a Domain

- ▶ To create a domain, issue the `createdomain <domain_name>` command, where `<domain_name>` is the name you wish to assign the domain. The `<domain_name>` can be a maximum of 31 characters in length.
- ▶ If you wish to add an informational note to a domain during its creation, issue the `createdomain -comment <comment> <domain_name>` command, where `<comment>` is the text of the note you wish to add about the domain being created. The comment length is restricted to 511 characters.

You can create up to 1024 domains within a single InServ system.

For additional information about Domains, refer to the *InForm OS Concepts Guide*.

5.4 Viewing Domains

From time to time, you may wish to view the domains in your system. Additionally, when managing your domain objects as described in [5.7 Managing Domain Objects](#) on page 5.5, you may need to view the objects' domain associations.

- To view the domains in your system, issue the `showdomain -d` command. Refer to the *InForm OS Command Line Interface Reference* for details about this command.



NOTE: To set your system output to display domain information, you must first set the TPDLISTDOM environment variable, the `-listdom` global option, or if you are working in a Tcl shell, issue the `setclienv listdom 1` command. See [3.2.10 Listing Domains](#) on page 3.15 for further information.

- To view a system object's domain association, issue the `showhost`, `showvv`, or `showcpg` commands.

5.5 Modifying a Domain

For any existing domain, you can change the domain's name or add comments to that domain using the `setdomain` command. Refer to the *InForm OS Command Line Interface Reference* for details about the command.

5.5.1 Changing a Domain Name

- ▶ To change a domain's name, issue the `setdomain -name <name> <domain_name>` command, where:
 - ◆ `<name>` is the new name you wish to assign the domain.
 - ◆ `<domain_name>` is the name of the domain you are re-naming.

Once changed, users and comments previously belonging to the old domain name are displayed as belonging to the new domain name. All previous associations, objects, and settings (default settings, etc.) are also transferred.

5.5.2 Adding Comments to a Domain

- ▶ If a comment was not added to a domain during its creation and you wish to add a note to that domain, issue the `setdomain -comment <comment> <domain_name>` command, where:
 - ◆ `<comment>` is the comment you are adding to the specified domain.
 - ◆ `<domain_name>` is the name of the domain to which you are adding a comment.

The comment length is restricted to 511 characters.

5.6 Removing a Domain

Prior to removing a domain, any users belonging to that domain must be removed ([4.2.2 Removing a User From a Domain](#) on page 4.7) and assigned to another domain ([4.2.1 Adding a User to a Domain](#) on page 4.6), or must be removed completely ([4.1.6 Removing a User](#) on page 4.6). Any objects belonging to the domain must be removed from the domain, or moved to another domain before removing the domain. Domain objects include virtual volumes, CPGs, and hosts.

- To remove a domain, issue the `removedomain <domain_name>` command, where `<domain_name>` is the domain you wish to delete.

5.7 Managing Domain Objects

Domain objects can be moved from one domain to another, or have their domain associations entirely removed. In doing so, all objects related either directly or indirectly to the domain object being managed are also moved or removed. These relationships include, but are not limited to, VLUNs between hosts and VVs, VVs which are drawing from CPGs and multiple VVs sharing the same LD. In order to move or remove a domain object or domain association, you must be Super or Edit level user with access to all domains.



NOTE: Before proceeding with any domain management activities, you may wish to view the domain associations for your system objects as described in [5.4 Viewing Domains](#) on page 5.3.

5.7.1 Moving Domain Objects to Another Domain

- To move a domain object from one domain to another domain, or to move a domain object in or out of a domain, issue the `movetodomain -vv|-cpg|-host <object_name> <domain_name> | set:<set_name>` command, where:
 - ◆ `-vv|-cpg|-host` is the type of object (VV, CPG, host, respectively) you are moving.
 - ◆ `<object_name>` is the name of the VV, CPG, or host you are moving.
 - ◆ `<domain_name>` is the name of the domain to which you are moving the specified object.
 - ◆ `<set_name>` is the name of the domain set to which you are moving the specified host.

5.7.2 Removing the Domain Association from a Domain Object

- ▶ To remove the domain association from a domain object, issue the `movetodomain -vv|-cpg|-host <object_name> -unset` command, where:
 - ◆ `-vv|-cpg|-host` is the type of object (VV, CPG, host, respectively) from which you are removing the domain association.
 - ◆ `<object_name>` is the name of the VV, CPG, or host from which you are removing the domain association.

5.8 Managing Virtual Domain Autonomic Groups

Virtual domains can be combined into autonomic groups, which are sets that can be managed as one object. Virtual domain sets are part of the Autonomic Groups feature. Virtual domains can be combined into autonomic groups, which are sets that can be managed as one object. If you have a group of domains that require the same administrative procedures, it is easier to group those domains into a set and manage them together. For example, you can create a domain set and put all the hosts in a cluster into a host set. By setting the domain of the hosts in the host set to the newly created domain set, all the virtual volumes exported to one host in the cluster are accessible to all the hosts in the cluster. If one of the hosts in the cluster is a backup host, all of the virtual volumes in the domain set can access the backup host. Without domain sets there is no way for a host to access volumes from different domains at the same time. Individual domains can be members of multiple domain sets.

Hosts are the only objects that can be a member of a domain set. All other objects can only belong to a single domain. If a host that is a member of a domain set is moved with the `movetodomain` command to an individual domain, then all objects associated with the host must be members of the destination domain or the command will fail. Moving a host to a domain set does not change the domain of any objects associated with the host. If a volume is exported to a host that is a member of a domain set is selected directly or indirectly by the `movetodomain` command, the move does not propagate to the host or any of the volumes exported to the host if the domain set includes the destination domain of the volume.

Virtual domains added to a set inherit the privileges of that set. Any action that requires browse privileges for a host requires the user to have browse privileges in any domain in the domain set. Any action that requires edit privileges for the host requires the user to have edit privileges in all domains in the domain group.

A virtual domain in a virtual domain set cannot be removed from the system until it has been removed from the virtual domain set, or until the virtual domain set is removed from the

system. Removing a virtual domain set does not remove the virtual domains in that set. Changing the name of a virtual domain in a set does not change the privileges of the virtual domain or remove it from the virtual domain set.

5.8.1 Creating Virtual Domain Sets

- ▶ To create a domain set, issue the `createdomainset <set_name> <domain_names>` command, where:

- ◆ `<set_name>` is the name of the domain set being created.
- ◆ `<domain_names>` are the names of the domains included in the domain set.

For a complete list of options available for the `createdomainset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

5.8.2 Adding Virtual Domains to Virtual Domain Sets

- ▶ To add a domain to an existing domain set, issue the `createdomainset -add <set_name> <domain_names>` command, where:

- ◆ `<set_name>` is the name of the domain set that will include the added domains.
- ◆ `<domain_names>` are the names of the domains being added to the domain set.

For a complete list of options available for the `createdomainset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

5.8.3 Modifying Virtual Domain Sets

- ▶ To change the name of a domain set, issue the `setdomainset <new_name> <set_name>` command, where:

- ◆ `<new_name>` is the new name of the domain set.
- ◆ `<set_name>` is the name of the domain set being modified.

For a complete list of options available for the `setdomainset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

5.8.4 Removing Virtual Domain Sets

- ▶ To remove a domain set from the system, or to remove domains from a set, issue the `removedomainset <set_name> <domain_names>` command, where:
 - ◆ `<set_name>` is the name of the virtual volume set being removed or modified.
 - ◆ `<domain_names>` are the names of the domains being removed from the `<set_name>` domain set. This specifier is optional and it is not required if you are removing the entire set.

For a complete list of options available for the `removedomainset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

6

Managing Ports and Hosts

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The purpose of this chapter is to explain how to manage ports, hosts, and host personas.

6.1 Overview

The InServ Storage Server sees a host as a set of initiator port WWNs (World Wide Names) or iSCSI Names. Hosts that are physically connected to ports on the InServ Storage Server are automatically detected. The Fibre Channel port WWNs and iSCSI port iSCSI Names are displayed in the InForm CLI. You can also add new WWNs or iSCSI Names for unestablished host paths and assign them to a host before they are physically connected. These WWNs or iSCSI Names do not need to be associated with target ports on the storage server controller nodes. This allows for plug-and-play functionality that avoids the need for manual reconfiguration after connecting new hosts.

Host personas are a set of behaviors that permit hosts connected to FC or iSCSI ports on the InServ Storage Server to deviate from the default host behavior. By assigning a persona to a host, multiple host types that require distinct customized responses can share a single InServ Storage Server port. For example, hosts running Windows, Linux, and AIX operating systems can all connect to the same InServ port. This simplifies connecting hosts to the storage server and reduces management time related to complex host connections.

For more information about ports, hosts, and host personas, see the *InForm OS Concepts Guide*.



NOTE: See the 3PAR Implementation Guides for recommended practices and detailed configuration information about using your specific host devices with the InServ Storage Server.

6.2 Modifying Port Parameters

Use the InForm CLI `controlport` command to modify the Fibre Channel (FC) ports and the Gigabit Ethernet ports used for the 3PAR Remote Copy over IP (RCIP) solution. Use the `controliscsiport` command to modify the iSCSI ports on the InServ Storage Server. These commands control several aspects of the ports. Whenever you use these commands, you must use a sub-command specifying the operation you want to perform and include the port location.

The InForm CLI displays the controller node Fibre Channel, iSCSI, and Gigabit Ethernet port locations in the following format: `<Node>:<Slot>:<Port>`. For example: `2:4:1`.

- **Node:** Valid node numbers are 0-7 for each storage server, depending on the number of nodes and the storage server model.
- **Slot:** Valid slot numbers are 0-7 for S-Class and T-Class storage server nodes, and 0-5 for E-Class and F-Class storage server nodes. Slots are numbered consecutively from left to right.
- **Port:** Valid port numbers are 1-4 for each Host Bus Adapter (HBA), ports are numbered consecutively from top to bottom on most nodes.

6.2.1 FC Port Settings

The InForm CLI `controlport` command is described in detail the *InForm OS Command Line Interface Reference* and the CLI Help Pages. Use the `controlport` command to perform the following tasks.

- Set the port's mode with the `config` sub-command followed by `disk|host|rcfc` and the port location in `Node:Slot:Port` format.

To set the port's mode:

- 1) Disconnect the cable from the port on the InServ Storage Server.
 - 2) Set the port's mode. Issue the `controlport config disk|host|rcfc <node:slot:port>` command.
 - 3) Reconnect the cable to the port on the InServ Storage Server.
- Set the port's data rate in Gbps with the `rate` sub-command followed by 1, 2 or 4 and then by the port location in `Node:Slot:Port` format. Alternatively, you can use `controlport rate auto` followed by the port location in `Node:Slot:Port` format to allow the system to determine the data rate automatically. The default value for this option is `auto`.

To set the port's data rate in Gbps, issue the `controlport rate <1|2|4> <node:slot:port>` command.

- When `unique_nwwn` is enabled, the port presents a unique node name for the connection. To set the mode of an FC port, or set the unique node WWN option for the port, issue the `controlport config <connmode> [-ct <ctval>] [-unique_nwwn enable|disable] <node:slot:port>` command, where:
 - ◆ `<connmode>` is the one of the following connections: `disk|host|rcfc`.
 - ◆ `<ctval>` is either `loop` or `point`. The `loop` parameter sets the port to arbitrated loop mode, the `point` parameter sets the port to point-to-point mode.

- Set the port's Class 2 service support level with the `cl2` sub-command followed by `ack0`, `ack1`, or `disable` and then by the port location in `Node:Slot:Port` format.

To set the port's Class 2 service support level, issue the `controlport cl2 <cl2val> <node:slot:port>` command.

- Set the port's VLUN Change Notification (VCN) support generation with the `vcn` sub-command followed by either `enable` or `disable` and then by the port location in `Node:Slot:Port` format.

To set the port's VLUN Change Notification (VCN) support, issue the `controlport vcn <enable|disable> <node:slot:port>` command.



NOTE: Other options are available for the `controlport` command, including options for resetting the port's mode, modifying Remote Copy settings, and issuing an FC Loop Initialization Primitive (LIP) procedure. These options are described in detail the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

6.2.2 iSCSI Port Settings

The InForm CLI `controliscsiport` command is described in detail the *InForm OS Command Line Interface Reference* and the CLI Help Pages. Use the `controliscsiport` command to perform the following tasks:

- To set the IP address and netmask of the iSCSI port, use the `addr` sub-command followed by the IP address and netmask, then the port location in `node:slot:port (N:S:P)` format.

To set the IP address and netmask of the iSCSI port, issue the `controliscsiport addr <IP_address> <netmask> <node:slot:port>` command.

- To set the gateway address of the iSCSI port, use the `gw` sub-command followed by the gateway address, then the port location in `node:slot:port (N:S:P)` format.

To set the gateway address of the iSCSI port, issue the `controliscsiport gw <gw_address> <node:slot:port>` command.

- To set the TCP port number for the iSNS server, use the `isnsport` sub-command followed by the iSNS server port number, then the port location in `node:slot:port (N:S:P)` format.

To set the TCP port number for the iSNS server, issue the `controliscsiport isnsport <isns_port> <node:slot:port>` command.



NOTE: Other options are available for the `controliscsiport` command, including options setting the primary and secondary iSNS server IP addresses, setting the Maximum Transmission Unit (MTU) size for the iSCSI port, and using the Dynamic Host Configuration Protocol (DHCP). These options are described in detail the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

6.3 Port Target, Initiator, and Peer Modes

The InServ Storage Server controller node ports operate in different modes. Depending on the type of port, the port may operate in target, initiator, or peer mode.

Fibre Channel ports use the following firmware mode settings:

- Target mode for ports that connect to hosts and receive commands from those hosts.
- Initiator mode for ports that connect to the storage server physical disks and send commands to those disks.
- Initiator mode for Remote Copy over FC (RCFC).

iSCSI ports use the following firmware mode settings:

- Target mode for ports that connect to hosts and receive commands from those hosts.

Gigabit Ethernet ports use the following firmware mode setting:

- Peer mode for Ethernet ports, used for Remote Copy over IP (RCIP).

Use the InForm CLI `showport` command to display the current mode for all ports. Use the `controlport` command to change the mode of an FC port. These commands are described in detail the *InForm OS Command Line Interface Reference* and the CLI Help Pages.



CAUTION: Ports in the same Fibre Channel adapter should be set to the same mode.

- For dual-port LSI cards, both ports must use the same mode.
- For quad-port LSI cards, each port pair (ports 1&2 and 3&4) must use the same mode.
- For QLogic cards, it is strongly recommended that all ports in a card be set to the same mode.

6.4 Active and Inactive Hosts

An active host is a host that is connected to an InServ Storage Server port and recognized by the InForm OS. Under normal operation, an active host may have a number of volumes exported to it and therefore the host has access to those volumes.

An inactive host is a host that is known to the InForm OS but is not recognized as being connected to any InServ Storage Server port at the moment. This may be because the host is currently disconnected from the storage server port, or due to an error condition such as link failure or because the host is offline.

When a host on an InServ Storage Server port becomes inactive for any reason, the following happens:

- 1 The InForm OS recognizes that the host is missing on the port and changes the state of the host from `active` to `inactive`.
- 2 The InForm OS remembers all volumes exported to the host before it became `inactive`. It will not unexport the volumes on the port with the missing host.
- 3 If and when the host reappears on the same port, the InForm OS will change the state of the host to `active` again. At that time, the host will have access to all previously exported volumes as before.

6.5 Managing Hosts

The InServ Storage Server sees a host as a set of initiator port WWNs (World Wide Names) or iSCSI Names. The InForm administration tools allow you to create, modify, and remove Fibre Channel and iSCSI host paths and their properties. When creating a new host, you can either create a host with or without assigning WWNs or iSCSI Names. A virtual volume that is exported to a host is exported to all the WWNs that make up the host. If you need to export virtual volumes to particular host computer WWNs or iSCSI Names, you can create separate hosts on the storage server and assign each WWN or iSCSI Name to its own host. The host management commands are described in detail in the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

6.5.1 Host Management CLI Commands

Use the following CLI commands to manage hosts and host paths:

- `showhost` - display information about defined hosts and host paths in the system.
- `createhost` - create a host or add paths to host.
- `createhostset` - create a host set or add a host to an existing host set.
- `sethost` - modify properties of existing hosts.
- `sethostset` - change the name of a host set.
- `removehost` - remove a system host or paths to a host.
- `removehostset` - remove a host set from the system, or remove hosts from a set.
- `servicehost` - executes removal and replacement actions for a host.

6.6 Creating Hosts

When you create a new host, you are actually defining the characteristics of a new host path from the InServ Storage Server to the host. Defining host characteristics includes the assignment of a name to a host, and the assignment of a path to that host. Two types of host paths can be assigned: FC or iSCSI paths. You should create multiple paths to each host

In addition to assigning FC or iSCSI paths when creating a host, you can also annotate the host with descriptive information such as the host's location, IP address, operating system, model, and owner using either the `createhost` or `sethost` commands. This information is for

annotation purposes only and it does not affect the operation of the storage server. See the *InForm OS Command Line Interface Reference* or *InForm CLI Help* for further information. To create a host with an assigned host persona, see section [6.11.3 Creating a Host with an Assigned Host Persona](#).



NOTE: There should be at least two paths to each host to facilitate updates to the InServ Storage Server. Failure to create at least two host paths may result in unnecessary system down-time.



NOTE: See the 3PAR Implementation Guide for recommended practices and detailed configuration information about using your specific host devices with the InServ Storage Server.

6.6.1 Creating a Host with a Fiber Channel Path

To create a host with an FC path:

- 1 Determine the HBA's WWN by issuing the `showhost` command.
- 2 Issue the `createhost -persona <persona_number> <host_name> <WWN>` command, where:
 - ◆ `<persona_number>` is the host persona number assigned to the host.
 - ◆ `<host_name>` is the user-designated name of the host being defined.
 - ◆ `<WWN>` is the HBA's WWN.

If the Host Explorer agent is running on the host, the `createhost <host_name>` command automatically creates a host with the path information received from the Host Explorer agent.

6.6.2 Creating a Host with an iSCSI Path

To create a host with an iSCSI path:

- 1 Determine the HBA's iSCSI Name by issuing the `showport -iscsiname` command.
- 2 Issue the `createhost -iscsi -persona <persona_number> <host_name> <iSCSI_name>` command, where:
 - ◆ `<persona_number>` is the host persona number assigned to the host.

- ◆ `<host_name>` is the user-designated name of the host being defined.
- ◆ `<iSCSI_Name>` is the host iSCSI Name as determined from step 1 above.

If the Host Explorer agent is running on the host, the `createhost -iscsi <host_name>` command automatically creates a host with the path information received from the Host Explorer agent.

6.6.3 Creating a Host without Assigning a Path

In instances where the HBA's Fibre Channel WWN or iSCSI Name is unavailable, you can create a host as a placeholder until the path information becomes available. If the Host Explorer agent is not running on the host, the `createhost <host_name>` command creates a host without any path information. If the Host Explorer agent is running on the host, the `createhost <host_name>` command automatically creates a host with the path information received from the Host Explorer agent.

The host path information is required to display the device name. If the path information is not reported from the host to the InServ, then the device name appears as *Unknown*.

- Issue the `createhost <host_name>` command, where `<host_name>` is the user-designated name of the host being defined.

6.7 Modifying Hosts

You can modify the following parameters and functions of an existing host:

- Change the host's name.
- Add or remove WWNs or iSCSI Names.
- Add or remove iSCSI CHAP authentication information.
- Assign a host persona to a host, see section [6.11.4 Assigning a Host Persona to a Host](#).

The following CLI commands are described in detail in the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

6.7.1 Changing a Host Name

- ▶ To change a host name, issue the `sethost -name <new_host_name> <host_name>` command, where:
 - ◆ `<new_host_name>` is the new name you wish to assign to the existing host.
 - ◆ `<host_name>` is the original name of the host you are modifying.

6.7.2 Adding Fiber Channel Path WWNs

To add a WWN to an existing host:

- 1 Determine the HBA's WWN by issuing the `showhost` command.
- 2 Issue the `createhost -add <host_name> <WWN>` command, where:
 - ◆ `<host_name>` is the name of the host being modified.
 - ◆ `<WWN>` is the HBA's WWN.
- 3 Repeat as necessary for any additional WWNs you wish to add to the host definition.

6.7.3 Adding iSCSI Path iSCSI Names

To add an additional iSCSI Name for an existing host:

- 1 Determine the HBA's iSCSI Name by issuing the `showport -iscsiname` command.
- 2 Issue the `createhost -add -iscsi <host_name> <iSCSI_name>` command, where:
 - ◆ `<host_name>` is the name of the host being modified.
 - ◆ `<iSCSI_Name>` is the host iSCSI Name as determined from step 1 above.
- 3 Repeat as necessary for any additional iSCSI Names you wish to add to the host definition.

6.7.4 Removing Fibre Channel Path WWNs

- ▶ To remove a WWN from an existing host, issue the `removehost <host_name> <WWN>` command, where:
 - ◆ `<host_name>` is the name of the host being modified.
 - ◆ `<WWN>` is the FC path being removed.

6.7.5 Removing iSCSI Path iSCSI Names

- ▶ To remove an iSCSI Name from an existing host, issue the `removehost -iscsi <host_name> <iSCSI_name>` command, where:
 - ◆ `<host_name>` is the name of the host being modified.
 - ◆ `<iSCSI_name>` is the iSCSI path being removed.

6.7.6 Configuring iSCSI CHAP Authentication Information

A host with an iSCSI path can be modified as an initiator or target with iSCSI CHAP authentication information. You cannot set the target CHAP authentication information before setting the initiator CHAP authentication information.

- ▶ To configure a host as a CHAP initiator, issue the `sethost initchap <secret> <host_name>` command.
- ▶ To configure a host as a CHAP target, issue the `sethost targetchap <secret> <host_name>` command.

For both commands listed above, `<secret>` is the user-defined security key and `<host_name>` is the name of the host you are modifying.

During configuration, you can also optionally set the CHAP name and set the CHAP secret as a hex number. See the *InForm OS Command Line Interface Reference* for further information.

6.7.7 Removing iSCSI CHAP Authentication Information

To remove CHAP authentication information from a host with an iSCSI path, issue one of the following commands:

- `sethost removechap -target <host_name>`
- `sethost removechap <host_name>`

For both commands listed above:

- ◆ `<host_name>` is the name of the host you are modifying.
- ◆ The `-target` argument is specified for removal of target CHAP authentication only.

6.8 Moving, Removing and Disconnecting Hosts

Use the following commands display active hosts and the volumes exported to the hosts:

- `showhost`
- `showvln`

To display inactive hosts and the volumes that were exported to the hosts, use the `servicehost list` command.

The `showhost`, `showvln`, and `servicehost` CLI commands are described in detail in the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

After you move a host to a new port, you must:

- Remove the old host definitions.
- Disconnect the host from the storage server.
- Reconnect the host to the new port.

To move the host to another InServ Storage Server port, you must do the following:

- 1 Use the InForm CLI command `servicehost copy` to create an inactive host on the storage server port to which you wish to move the host. The inactive host created with this command is identical to the active host that is to be relocated to this port.

The `servicehost copy` command automatically exports all volumes that are currently exported to the active host to the new, inactive host once it is created. For more information about active and inactive hosts, [6.4 Active and Inactive Hosts](#) on page 6.6.

The VLUNs from the specified source port (`src_node:slot:port`) are copied from the host WWNs or iSCSI Names matching the specified pattern (`WWN_or_iSCSI_name_pattern`) to the specified destination port (`dest_node:slot:port`). If necessary, the port is reset to target mode.

- ▶ To create an inactive host on the storage server port to which you wish to move the host, issue the `servicehost copy <src_node:slot:port> <WWN_or_iSCSI_name_pattern> <dest_node:slot:port>` command, where:
 - ◆ `<src_node:slot:port>` is the current port location.
 - ◆ `<WWN_or_iSCSI_name_pattern>` specifies that the indicated WWN or iSCSI Name is treated as a glob-style pattern.

- ◆ `<dest_node:slot:port>` is the destination port location.

2 Remove the host definition(s) from the old port or ports.

Removing the host definitions does not remove the old host paths. To remove the host paths, see [6.9 Removing Host Paths](#) on page 6.13. To remove host definitions and all VLUNs associated with the old host port, issue the

```
servicehost remove [<node:slot:port> [<WWN_or_iSCSI_name> ... ]]
```

command, where:

- ◆ `<node:slot:port>` is the old port location.
- ◆ `<WWN>` is the WWN path or paths to the host to be removed.
- ◆ `<iscsi_name>` is the iSCSI path or paths to the host to be removed.

3 Disconnect the host from the storage server and then reconnect it to the new port.

The storage server discovers the host on the new port automatically by matching the WWNs or iSCSI Names of the inactive host you created in [step 1](#) to the WWNs or iSCSI Names of the host. The InForm OS automatically changes the state of the host from inactive to active. The host has immediate access to all volumes exported to the host.

6.9 Removing Host Paths

Host paths can be removed from the InServ Storage Server before or after VLUNs are exported to the hosts. The `removehost` command removes a storage server host path to an FC or iSCSI host. If one or more paths are specified the command removes only the specified paths, otherwise the entire host definition is removed. If VLUNs have been exported to the host, issue the `removehost -rvl <host_name>` command. For information about exporting VLUNs, see [7.19 Unexporting Virtual Volumes](#) on page 7.23. The `removehost` CLI command is described in detail in the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

- To completely remove a host definition from your system, issue the `removehost <host_name> [<WWN>... | <iscsi_name> ...]` command, where:
 - ◆ `<host_name>` is the host definition to be removed.
 - ◆ `<WWN>...` is the WWN path or paths to the host to be removed.
 - ◆ `<iscsi_name>...` is the iSCSI path or paths to the host to be removed.



NOTE: Physically disconnecting a host server from the storage server port does not delete the host from the system.

6.10 Managing Host Autonomic Groups

Hosts can be combined into autonomic groups, which are sets that can be managed as one object. Host sets are part of the Autonomic Groups feature. If you have a group of hosts in a cluster and all the hosts require the same administrative procedures, it is easier to group those hosts into a set and manage them together. Individual hosts can be members of multiple host sets. Hosts added to a set inherit the privileges of that set. For example, If a virtual volume is exported to a group of hosts and a new host is added to the host set, the new host can see the virtual volume as soon as it is added to the host set. The opposite is also true. If a host is removed from a set, all the privileges of that host set are revoked for the removed host.

A host in a host set cannot be removed from the system until it has been removed from the host set, or until the host set is removed from the system. Removing a host set does not remove the hosts in that set. Changing the name of a host in a set does not change the privileges of the host or remove it from the host set.

6.10.1 Creating Host Sets

Any hosts added to the host set automatically see all VLUNs available to the host set, provided there are no conflicting LUN IDs. If the added host has an exported LUN ID in the LUN ID range of the host set, the host cannot see the LUN and must be assigned a new ID. For more information about VLUN templates, see [7.18 Exporting Virtual Volumes](#).

- ▶ To create a host set, issue the `createhostset <set_name> <host_names>` command, where:
 - ◆ `<set_name>` is the name of the host set being created.
 - ◆ `<host_names>` are the names of the hosts included in the host set.

For a complete list of options available for the `createhostset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

6.10.2 Adding Hosts to Host Sets

- ▶ To add a host to an existing host set, issue the `createhostset -add <set_name> <host_names>` command, where:
 - ◆ `<set_name>` is the name of the host set that will include the added hosts.
 - ◆ `<host_names>` are the names of the hosts being added to the host set.

For a complete list of options available for the `createhostset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

6.10.3 Modifying Host Sets

- ▶ To change the name of a host set, issue the `sethostset <new_name> <set_name>` command, where:
 - ◆ `<new_name>` is the new name of the host set.
 - ◆ `<set_name>` is the name of the host set being modified.

For a complete list of options available for the `sethostset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

6.10.4 Removing Host Sets

If a host is removed from a host set, the removed host loses all privileges of the host set and cannot access volumes exported to the host set.

- ▶ To remove a host set from the system, or to remove hosts from a set, issue the `removehostset <set_name> <host_names>` command, where:
 - ◆ `<set_name>` is the name of the host set being removed or modified.
 - ◆ `<host_names>` are the names of the hosts being removed from the `<set_name>` host set. This specifier is optional and it is not required if you are removing the entire set.

For a complete list of options available for the `removehostset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

6.11 Managing Host Personas

Host personas are a set of behaviors that permit hosts connected to FC or iSCSI ports on the InServ Storage Server to deviate from the default host behavior. By assigning a persona to a host, multiple host types that require distinct customized responses can share a single InServ Storage Server port. For example, hosts running Windows, Linux, and AIX operating systems can all connect to the same InServ port. This simplifies connecting hosts to the storage server and reduces management costs related to complex host connections.

A host persona defines the custom responses for certain SCSI commands and does not affect any of the FC port settings. Host personas are tied to the host name and identified by the host persona number. You can define the host persona for a host by setting the host persona number when the host is created with the `createhost` command, or modify it later with the `sethost` command. The host management CLI commands are described in detail in the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

Different host personas have different functions and support different host operating systems. The specific host persona is designated by the host persona number. Depending on the selected host persona number, the following additional capabilities are supported:

- UARepLun - Sends an unit attention when the LUN list changes due to adding or removing VLUNs.
- RTPG - Enables the Report Target Port Group (RTPG) command and asymmetric state change unit attention when path counts change due to adding or removing ports in the host's definition.
- VolSetAddr - Enables HPUX Volume Set Addressing (VSA).
- SoftInq - Enables inquiry data formats for hosts such as Egenera and NetApp.
- NACA - Enables Normal Auto Contingent Allegiance (NACA) bit for AIX.
- SESLun - Enables SCSI Enclosure Services (SES) LUN ID 254 for Host Explorer agent support.



NOTE: Each host connected to the InServ Storage Server must use a host persona with the SCSI Enclosure Services LUN (SESLun) enabled, or the Host Explorer agent cannot communicate with the InServ Storage Server.

Table 6-1 describes the specific functionality for each host persona number. Refer to the 3PAR InForm OS Configuration Matrix for a list of supported host operating systems.

Table 6-1. Host Persona Settings

Persona Number	Persona Name	Host Operating System	Additional Capabilities
1	Generic	Linux, Windows, and Solaris	UARepLun, SESLun
2	Generic-ALUA	Linux, Windows, and Solaris	UARepLun, RTPG SESLun
6	Generic-Legacy	Linux, Windows, and Solaris	None
7	HPUX-Legacy	HP-UX	VolSetAddr
8	AIX-Legacy	AIX	NACA
9	Egenera	Egenera, NetApp	SoftInq
10	NetApp ONTAP	Data ONTAP	SoftInq



NOTE: Only the Generic, Generic-ALUA, and Generic-Legacy personas are supported for iSCSI connections.



NOTE: The NetApp host operating system requires unique WWNs for hosts in an FC fabric.



NOTE: A host device must use either iSCSI or Fibre Channel connections. Mixed ports on a single device is not supported.

6.11.1 Viewing Host Personas

- ▶ To view a list of all host personas, issue the `showhost -listpersona` command.

6.11.2 Displaying Host Persona Settings

- ▶ To display the host persona parameters, issue the `showhost -persona <host_name>` command, where `<host_name>` is the name of the host or hosts.

6.11.3 Creating a Host with an Assigned Host Persona

- ▶ To create a host with an assigned host persona, issue the `createhost -persona <persona_val> <host_name> <WWN>` command, where:
 - ◆ `<persona_val>` is the persona number, see [Table 6-1](#) for persona value descriptions.
 - ◆ `<host_name>` is the name of the host being created.
 - ◆ `<WWN>` is the host's hexadecimal WWN.

6.11.4 Assigning a Host Persona to a Host

- ▶ To assign a host persona to an existing host, issue the `sethost -persona <persona_val> <host_name>` command, where:
 - ◆ `<persona_val>` is the persona number, see [Table 6-1](#) for persona value descriptions.
 - ◆ `<host_name>` is the name of the host being modified.

6.11.5 Converting a Legacy Host Persona to a Host Persona

A legacy host persona is a host persona that simulates the behavior of a port persona. Prior to the 3PAR InForm Operating System 2.3.1 release, port personas were used on InServ Storage Server ports. Port personas are no longer supported. If you upgraded to the 3PAR InForm Operating System 2.3.1 release from a previous release, your port personas were converted to legacy host personas during the upgrade process.

If you are converting from a legacy host persona with an operating system that supports RTPG, you should convert to new persona number 2.

- ▶ To convert a legacy host persona is a host persona, issue the `sethost -persona <persona_num> <hostname>` command, where:
 - ◆ `<persona_num>` is the number of the new host persona.

- ◆ `<host_name>` is the name of the host with the legacy host persona to be converted to the new host persona.

The `sethost` CLI command is described in detail in the *InForm OS Command Line Interface Reference* and the CLI Help Pages.

6.12 The Host Explorer Agent

The 3PAR Host Explorer agent is a program that runs on a host connected to an InServ Storage Server. The Host Explorer agent runs as a service on Windows and as a daemon on Linux and Solaris operating systems. No license is required to use the 3PAR Host Explorer agent.

The Host Explorer agent communicates with the storage server over an FC or iSCSI connection and enables the host to send detailed host configuration information to the storage server. The information gathered from the Host Explorer agent is visible for uncreated hosts and assists with host creation and diagnosing host connectivity issues.

When a host is created on the InServ Storage Server, unassigned WWNs or iSCSI names are presented to the storage server. Without the Host Explorer agents running on the attached hosts, the storage server is unable to determine which host the WWN or iSCSI names belongs to and you must manually assign each WWN or iSCSI name to a host. With Host Explorer agents running, the InServ Storage Server automatically groups WWNs or iSCSI names for the host together, assisting with creating the host.

The Host Explorer agent collects the following information and sends it to the storage server:

- Host operating system and version.
- Fibre Channel and iSCSI HBA details.
- Multipath driver and current multipath configuration.
- Cluster configuration information.

You can install the Host Explorer agent from the *3PAR Host Explorer* CD. For instructions on installing and using the Host Explorer agent, see the 3PAR InServ Host Explorer User's Guide. Refer to the 3PAR InForm OS 2.3.1 Configuration Matrix for a list of supported host operating systems.

- ▶ To display the information returned by the Host Explorer agent to the InServ Storage Server, issue the `showhost -agent` or `showhost -agent -d` command.

6.13 Hosts and Virtual Domains



NOTE: 3PAR Virtual Domains requires the use of the 3PAR Virtual Domain license. Contact your local 3PAR representative for details.

If you are using 3PAR Virtual Domains, you can create and modify domain-specific Fiber Channel or iSCSI hosts. In many instances, you follow the same process for creating and modifying hosts just as you would for hosts that do not use domains.

6.13.1 Creating a Domain-Specific Host

In order to create a domain-specific host, you must be a super or edit level user in the `all` domain. Refer to the *InForm OS Concepts Guide* and the `createhost` command in the *InForm OS Command Line Interface Reference* for details about this restriction.

- ▶ To create a domain-specific host, issue the `createhost` command as described in [6.6.1 Creating a Host with a Fiber Channel Path](#) and [6.6.2 Creating a Host with an iSCSI Path](#) with the `-domain <domain_name> | set:<set_name>` option to specify the domain or domain set in which you are creating the host.

6.13.2 Modifying a Domain-Specific Host

Perform modifications to domain-specific hosts using the `createhost` and `sethost` commands as previously discussed in [6.7 Modifying Hosts](#) on page 6.9.

Any existing domain-specific host can be modified as follows:

- By changing the host's name. See [6.7.1 Changing a Host Name](#) on page 6.10 for instructions. You must be a super or edit level user in the `all` domain or an edit level user in a `specified` domain in order to perform this operation (refer to the *InForm OS Concepts Guide* for details about this restriction).
- By adding or removing WWNs or iSCSI names. This operation is restricted to super or edit level user in the `all` domain (refer to the *InForm OS Concepts Guide* for details about this restriction). See the following for instructions:
 - ◆ [6.7.2 Adding Fiber Channel Path WWNs](#) on page 6.10.
 - ◆ [6.7.3 Adding iSCSI Path iSCSI Names](#) on page 6.10.

- ◆ [6.7.4 Removing Fibre Channel Path WWNs](#) on page 6.10.
- ◆ [6.7.5 Removing iSCSI Path iSCSI Names](#) on page 6.11.
- By adding or removing iSCSI CHAP authentication information. This operation is restricted to super or edit level user in the `all` domain (refer to the *InForm OS Concepts Guide* for details about this restriction). See the following for instructions:
 - ◆ [6.7.6 Configuring iSCSI CHAP Authentication Information](#) on page 6.11
 - ◆ [6.7.7 Removing iSCSI CHAP Authentication Information](#) on page 6.11

6.13.3 Changing a Host's Domain

This operation is restricted to super or edit level user in the `all` domain (refer to the *InForm OS Concepts Guide* for details about this restriction).

For information about changing a host's domain association, see [5.7 Managing Domain Objects](#) on page 5.5.

7

Managing CPGs and Virtual Volumes

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The purpose of this chapter is to explain how to create and modify Common Provisioning Groups (CPGs) and virtual volumes, and to explain how to export virtual volumes to hosts.

7.1 Overview

A Common Provisioning Group (CPG) creates a virtual pool of logical disks that allows up to 4,095 virtual volumes to share the CPG's resources and allocate space on demand. Virtual volumes draw their resources from CPGs, and virtual volumes are exported as Logical Unit Numbers (LUNs) to hosts. Virtual volumes are the only data layer visible to hosts. You can create physical copies or virtual copy snapshots of virtual volumes for use if the original base volume becomes unavailable. Before creating virtual volumes, you must first create CPGs to allocate space to the virtual volumes.

For detailed information about CPGs and virtual volumes, see the *3PAR InForm OS Concepts Guide*.

For instructions on how to create copies of volumes, see [Chapter 8, Managing Virtual Volume Copies](#).



NOTE: Creating Thinly-Provisioned Virtual Volumes (TPVVs) requires the 3PAR Thin Provisioning license. Creating virtual copies or *snapshots* requires the 3PAR Virtual Copy license. Contact your 3PAR representative for more information.

7.2 Common Provisioning Groups

By default, a CPG is configured to auto-grow new logical disks when the amount of available logical disk space falls below a configured threshold. CPGs are initially empty. The initial buffer pool of logical disks starts off at a fraction of the exported virtual capacity of mapped volumes and automatically grows over time as required by application writes. For detailed information about CPG growth warnings and growth limits, see the *3PAR InForm OS Concepts Guide*.



NOTE: Virtual volumes in the same CPG can share the same logical disk. In the unlikely event that the logical disk is damaged by multiple simultaneous disk failures, all the volumes associated with that logical disk will be unavailable.



NOTE: Virtual volume performance may suffer from too much interleaving within the logical disks.

7.2.1 Growth Increment Considerations for Common Provisioning Groups

The default growth increment of a CPG is fixed at 32 GB, but the minimum growth increment varies according to the number of controller nodes in the system and ranges from 8 GB for a two-node system to 32 GB for an eight-node system ([Table 7-1](#)).

Table 7-1. Default and Minimum Growth Increments

Number of nodes	Default	Minimum
2	32 GB	8 GB
4	64 GB	16 GB
6	96 GB	24 GB
8	128 GB	32 GB

There are several courses of action you can take such as adding physical disks to the system, or limiting the future growth of volumes that draw from the CPG. Your response will vary depending on several factors:

- Total available space on your system.
- Nature of the data running on the system.
- Number of CPGs in the system.
- Number of volumes associated with those CPGs.
- Anticipated growth rate of the volumes associated with the CPGs.



CAUTION: Use caution in planning CPGs. The system does not prevent you from setting growth warnings or growth limits that exceed the amount of currently available storage on a system. When volumes associated with a CPG use all space available to that CPG, any new writes to TPVVs associated with the CPG will fail and/or snapshot volumes associated with the CPG may become invalid. Invalid volumes do not handle write failures gracefully and may produce unexpected failures.



CAUTION: Do not allow volumes that draw from a CPG to exceed the CPG's growth limit. Exceeding the CPG growth limit can invalidate snapshot volumes.



NOTE: By default, the growth warning and growth limit are set to `none`, which effectively disables these safety features.



NOTE: Refer to the *InForm OS Messages and Operator's Guide* for additional information about specific alerts. Managing alerts is described in [Chapter 11, Managing Events and Alerts](#).

7.2.2 System Guidelines for Creating Common Provisioning Groups

When you use the advanced parameters for logical disk creation, use the following guidelines to ensure maximum performance and optimal reliability in the volumes supported by those logical disks:

- Chunklets in the same RAID set should be from different drive magazines or drive cages.

- Chunklets in the same row should be from different physical disks. In other words, a physical disk should not appear twice in the same row.
- Chunklets should belong to a disk that is connected through the primary path to the logical disk's owner node.
- The growth increment is limited to 40 chunklets.
- The system should use as many physical disks as possible.
- The load on all physical disks should be balanced.
- The system should use the largest possible row size.

7.3 Common Provisioning Group CLI Commands

Use the following CLI commands to manage Common Provisioning Groups (CPGs):

- `showcpg` - display CPGs in the system.
- `createcpg` - create CPGs.
- `setcpg` - modify existing CPGs
- `compactcpg` - consolidate logical disk space in CPGs into as few logical disks as possible.
- `removecpg` - remove CPGs from the system or remove specific logical disks from CPGs.

7.4 Creating a Common Provisioning Group

- ▶ To create a CPG, issue the `createcpg -aw <percent> -sdgs <size> -sdgl <size> -sdgw <size> -t <RAID_type> <CPG_name>` command, where:
 - ◆ `-aw <percent>` is the percentage of used snapshot space and administration space that will generate a warning alert. If 0 (default) is specified, alert generation is disabled.
 - ◆ `-sdgs <size>` is the amount of logical disk storage created during each autogrow operation. Refer to [Table 7-1 on page 7.4](#) for the minimum default growth sizes per number of nodes.
 - ◆ `-sdgl <size>` is the growth limit which cannot be exceeded during autogrow operations. If 0 (default) is specified, no limit is enforced.

- ◆ `-sdgw <size>` is the space limit for logical disk space before a warning alert is generated. If 0 (default) is specified, no warning limit is enforced.
- ◆ `-t <RAID_type>` is the RAID type, specified as `r0` (RAID 0), `r1` (RAID 1), `r5` (RAID 5), or `r6` (RAID MP).
- ◆ `<CPG_name>` is the name of the CPG being created.

For a complete list of options available for the `createcpg` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.5 Modifying a Common Provisioning Group

The following modifications are commonly performed on CPGs using variations of the `setcpg` command:

- Specify the percentage of administration space or snapshot space that is used before an alert is generated.
- Specify the amount of logical disk space created with each auto-grow operation.

For a complete list of options available for the `setcpg` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.5.1 Setting Snapshot Space Usage Warnings

- ▶ To set or modify the space usage warning for a CPG, issue the `setcpg -sdgw <size> <CPG_name>` command, where:
 - ◆ `-sdgw <size>` is the space limit for logical disk space before a warning alert is generated. If 0 (default) is specified, no warning limit it enforced.
 - ◆ `<CPG_name>` is the name of the CPG being created.

7.5.2 Setting a Common Provisioning Group's Autogrow Size



NOTE: Before modifying your CPG's autogrow settings see [7.2.1 Growth Increment Considerations for Common Provisioning Groups](#) on page 7.4 for guidelines.

- ▶ To set or modify a CPG's autogrow size, issue the `setcpg -sdgs <size> <CPG_name>` command, where:
 - ◆ `-sdgs <size>` is the amount of logical disk storage created during each autogrow operation. Refer to [Table 7-1 on page 7.4](#) for the minimum default growth sizes per number of nodes.
 - ◆ `<CPG_name>` is the name of the CPG being created.

7.5.3 Consolidating Common Provisioning Group Space

Compacting a CPG allows you to reclaim space from a CPG that has become less efficient in space usage from creating, deleting, and relocating volumes. Compacting consolidates logical disk space in CPGs into as few logical disks as possible.

- ▶ To consolidate CPG space, issue the `compactcpg <CPG_name> or compactcpg <pattern>` command, where:
 - ◆ `<CPG_name>` is the name of the CPG you wish to compact.
 - ◆ `<pattern>` is the pattern name to which matching CPGs are compacted.

For a complete list of options available for the `compactcpg` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.5.4 Removing a Common Provisioning Group

You cannot remove a CPG that still has virtual volumes provisioned from it.

- ▶ To remove a CPG and the logical disks that make up that CPG, issue the `removecpg <CPG_name>` command, where `<CPG_name>` is the name of the CPG being removed.

For a complete list of options available for the `removecpg` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.6 Virtual Volume Types

There are three types of virtual volumes:

- Fully-provisioned virtual volumes
- Thinly-Provisioned Virtual Volumes (TPVVs)
- Administrative Volumes

Administrative volumes are created by the system and are for system usage only.



CAUTION: It is strongly recommended that you do not tamper with the `admin` volumes.

Virtual volumes have three separate data components:

- *User space* is the area of the volume that corresponds to the logical disk regions in the CPG available to the host. The user space contains the user data and is exported as a LUN to the host.
- *Snapshot space*, also known as *copy space*, is the area of the volume that corresponds to logical disk regions in the CPG containing copies of user data that changed since a *snapshot* of the volume was created. The snapshot space contains the copy data.
- *Administration space*, also known as *admin space*, is the area of the volume that corresponds to logical disk regions in the CPG that track changes to the volume since a snapshot was created. The administration space contains pointers to copies of user data in the snapshot space. Administration space is managed by the system, not with the tools you use to manage user and snapshot space.

You can increase the size of volumes, the amount of user space, and the amount of snapshot space for volumes as the requirements increase. If the user space and snapshot space use all available space, the 3PAR Virtual Copy feature's copy-on-write operation will fail. To avoid running out of user space, use TPVVs to automatically draw more user space from a CPG. The InForm OS automatically reclaims unused snapshot from TPVVs and fully-provisioned virtual volumes and returns the space to the logical disks.

For greater administrative flexibility, you can provision the virtual volume's user space and snapshot space from the same or different CPGs. If the virtual volume's user space and

snapshot space are on a different CPGs, the user space remains available to the host if the CPG containing the snapshot space becomes full. To save time by not repeating tasks, you can create many identical virtual volume's at one time. For planning information about virtual volumes and copies of volumes, refer to the *InForm OS Concepts Guide*.



NOTE: Automatic copy space reclamation is enabled by default in the 2.3.1 release of the InForm OS. If you upgraded from a previous release, the automatic copy space reclamation is disabled. You can enable automatic copy space reclamation with the `setsys CopySpaceReclaim <value>` command. For more information, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.6.1 Fully-Provisioned Virtual Volumes

A fully-provisioned virtual volume is a volume that uses logical disks that belong to a logical disk pool known as a Common Provisioning Group (CPG). Fully-provisioned virtual volumes are the default system volume and do not require any additional licenses. Unlike Thinly-Provisioned Virtual Volumes (TPVVs), fully-provisioned virtual volumes have a set amount of user space allocated in the system for user data. They require the system to reserve the entire amount of space required by the fully-provisioned virtual volume whether or not the space is actually used. The fully-provisioned virtual volume size is fixed, and the size limit is 16 TB. You can set snapshot space allocation limits and usage warnings to help manage the growth of snapshot space. For detailed information about fully-provisioned virtual volumes, see the *3PAR InForm OS Concepts Guide*.



NOTE: Some fully-provisioned virtual volumes may be designated as a CPVV in the 3PAR InForm CLI.

7.6.2 Thinly-Provisioned Virtual Volumes

With a 3PAR Thin Provisioning license, you can also create Thinly-Provisioned Virtual Volumes (TPVVs). A TPVV uses logical disks that belong to a logical disk pool known as a Common Provisioning Group (CPG). TPVVs associated with the same CPG draw user space from that pool as needed, allocating space on demand in small increments beginning with 256 MB per controller node. As the volumes that draw space from the CPG require additional storage, the system automatically creates additional logical disks and adds them to the pool until the CPG reaches the user-defined growth limit that restricts the CPG's maximum size. The TPVV volume

size limit is 16 TB. For detailed information about TPVV growth warnings and growth limits, see the *3PAR InForm OS Concepts Guide*.

7.7 Virtual Volume CLI Commands

Use the following CLI commands to manage fully-provisioned virtual volumes and Thinly-Provisioned Virtual Volumes (TPVVs):

- `showvv` - display virtual volumes in the system.
- `createvv` - create virtual volumes.
- `setvv` - modify existing volumes.
- `growvv` - increase the size of existing virtual volumes.
- `freespace` - frees snapshot space from a virtual volume.
- `removevv` - remove virtual volumes from the system.
- `showvvset` - show information about a virtual volume set.
- `createvvset` - create a virtual volume set, or add virtual volumes to an existing set.
- `setvvset` - modify a virtual volume set.
- `removevvset` - remove a virtual volume set, or virtual volumes from an existing set.

7.8 Creating Virtual Volumes

After you create CPGs, you can create fully-provisioned virtual volumes and Thinly-Provisioned Virtual Volumes (TPVVs) that draw space from the CPGs. For greater administrative flexibility, you can provision the virtual volume's user space and snapshot space from the same or different CPGs. If the virtual volume's user space and snapshot space are on a different CPGs, the user space remains available to the host if the CPG containing the snapshot space becomes full. You can create many identical virtual volume's at one time. Expiration dates can be set for virtual volume's to save space.

For information about planning for the growth of virtual volumes, see the *3PAR InForm OS Concepts Guide*. For information about creating CPGs, see [7.2 Common Provisioning Groups](#) on page 7.4.



NOTE: Creating virtual copies or *snapshots* requires the 3PAR Virtual Copy license. Creating Thinly-Provisioned Virtual Volumes (TPVVs) requires the 3PAR Thin Provisioning license. Contact your 3PAR sales representative for more information.

7.8.1 Creating Fully-Provisioned Virtual Volumes

A fully-provisioned virtual volume has a set amount of user space that is allocated for user data. The virtual volume's snapshot space is allocated on demand.

► To create a group of fully-provisioned virtual volumes, issue the `createvv -cnt <number> -snp_cpg <CPG_name> <user_CPG> <VV_name> <VV_size g|G|t|T>` command, where:

- ◆ `<number>` is the number of virtual volumes to create with the designated properties.
- ◆ `<CPG_name>` is the name of the CPG from which the created volume will draw its snapshot space and administration space.
- ◆ `<user_CPG>` is the name of the CPG from which the created virtual volume will draw its user space.
- ◆ `<VV_name>` is the name of the virtual volume being created.
- ◆ `<VV_size g|G|t|T>` is the size of the volume in MB, GB, or TB. If `g|G|t|T` is not specified, `VV_size` is the number of MBs. For example, `50g` specifies 50 GBs.



NOTE: If the `-tpvv` option is not specified, the created volume is a fully-provisioned virtual volume.

For a complete list of options available for the `createvv` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.8.2 Creating Thinly-Provisioned Virtual Volumes

A TPVV allocates user space and snapshot space on demand. If you do not specify a CPG to be used for snapshot space with the `-snp_cpg` option, the TPVV will have no snapshot space.

- ▶ To create a TPVV, issue the `createvv -tpvv -snp_cpg <CPG_name> -usr_aw <percent> -usr_al <percent> <user_CPG> <VV_name> <VV_size g|G|t|T>` command, where:
 - ◆ `-tpvv` indicates that you are creating a Thinly-Provisioned Virtual Volume.
 - ◆ `<CPG_name>` is the name of the CPG from which the volume will draw its snapshot space and administration space.
 - ◆ `-usr_aw <percent>` is the allocation warning alert limit for the user space specified in percentage. This generates an alert when the user space of the volume exceeds a specified percentage of the volume's size.
 - ◆ `-usr_al <percent>` is the allocation limit of the user space specified in percentage. This prevents the user space from exceeding a specified percentage of the volume's size.
 - ◆ `<user_CPG>` is the name of the CPG from which the created virtual volume will draw its user space.
 - ◆ `<VV_name>` is the name of the volume being created. The name can be up to 31 characters.
 - ◆ `<VV_size g|G|t|T>` is the size of the volume in MB, GB, or TB. If `g|G|t|T` is not specified, `VV_size` is the number of MBs. For example, `50g` specifies 50 GBs.

For a complete list of options available for the `createvv` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.9 Modifying Virtual Volumes

Existing virtual volumes can be modified to use a new name, draw space from a different CPG, set allocation warnings, or to use new policies.

- ▶ To modify a volume to draw its snapshot space and administration space from a different CPG, issue the `setvv -snp_cpg <CPG_name> -usr_cpg <user_cpg> <VV_name>` command, where:
 - ◆ `<CPG_name>` is the name of the CPG from which the modified volume will draw its snapshot space and administration space.

- ◆ `<user_CPG>` is the name of the CPG from which the modified virtual volume will draw its user space.
- ◆ `<VV_name>` is the name of the virtual volume being modified.

For a complete list of options available for the `setvv` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.10 Growing Virtual Volumes

You can increase the size, or grow, an existing virtual volume's user space automatically when the volume reaches capacity.

- ▶ To automatically increase the user space available to a virtual volume when the volume reaches capacity, issue the `growvv <VV_name> <size g|G|t|T>` command, where:
 - ◆ `<VV_name>` is the name of the virtual volume you are growing.
 - ◆ `<size g|G|t|T>` is the amount of space automatically added to the user space in MB, GB, or TB. If `g|G|t|T` is not specified, `vv_size` is the number of MBs.

For a complete list of options available for the `growvv` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.11 Reducing Volume Size with 3PAR Thin Conversion

3PAR Thin Conversion is an optional feature that converts a traditional volume to a Thinly-Provisioned Virtual Volume (TPVV). Virtual volumes with large amounts of allocated but unused space are converted to TPVVs that are much smaller than the original volume. Volumes are converted by creating a physical copy of the volume. During the conversion process, allocated but unused space is discarded and the result is a TPVV that uses less space than the original volume. To convert volumes located on an InServ Storage Server, you must have an InServ F-Class or T-Class Storage Server to perform the copy operation.

The conversion process has four steps.

- 1 Assessment.
- 2 Data preparation.
- 3 Zeroing unused space.
- 4 Creating a physical copy.



NOTE: Converting fully-provisioned volumes to Thinly-Provisioned Virtual Volumes (TPVVs) with the Thin Conversion feature requires an InServ F-Class or T-Class Storage Server, a 3PAR Thin Provisioning license, and a 3PAR Thin Conversion license. Contact your 3PAR representative for more information.

7.11.1 Converting an InServ Storage Server Virtual Volume

To convert an InServ Storage Server virtual volume to a TPVV:

- 1 Refer to the *InForm OS Concepts Guide* for assessment and preparation considerations.
- 2 After determining to proceed with converting your volumes, prepare the volumes for conversion to the new TPVV by removing unnecessary data. Perform clean-up tasks on the source volume by:
 - ◆ Emptying trash cans.
 - ◆ Archiving unused files.
 - ◆ Shrinking databases.
 - ◆ Deleting temporary files.
- 3 Use a host application to write zeros to the allocated but unused volume space. InServ F-Class and T-Class Storage Servers detect and discard the zeros during the volume copy operation.
- 4 Convert the base volume to a TPVV by creating a physical copy of the volume. Create a physical copy of the base volume with the `createevvcopy` command. For more information, see [8.3.1 Creating a Physical Copy](#) on page 8.6

InServ F-Class and T-Class Storage Servers detect and discard the zeros during the volume copy operation. The `createevvcopy` command automatically enables the `zero_detect` policy on the destination TPVV. After the copy operation is completed, the `zero_detect` policy is automatically disabled.

- 5 Use the `showvv -s` command to view the size of the TPVV created in [step 4](#). The destination TPVV should use significantly less total reserved space, and have a smaller volume size than the original base volume.
- 6 Optional. After verifying the data on the converted destination TPVV, you can use the `removevv` command to remove the base volume converted in [step 4](#).

7.12 Reducing Volume Size with 3PAR Thin Persistence

3PAR Thin Persistence is an optional feature keeps InServ TPVVs small by detecting pages of zeros during data transfers, and not allocating space for the zeros in the destination TPVV. This feature works in real-time and analyzes the data before it is written to the destination TPVV. You must have an InServ F-Class or T-Class Storage Server to use Thin Persistence with TPVVs. For more information about the 3PAR Thin Persistence feature, refer to the *InForm OS Concepts Guide*.

To enable the 3PAR Thin Persistence feature on a TPVV, use the `setvv` command to enable the `zero_detect` policy on the destination TPVV. For more information, see [7.9 Modifying Virtual Volumes](#) on page 7.13.



NOTE: Thin Persistence can have some performance implications during extremely busy system conditions. 3PAR recommends the `zero_detect` policy only be enabled during Thin Persistence and Thin Conversion operations. The `zero_detect` policy should be disabled during normal operation.



NOTE: Maintaining TPVV size with the 3PAR Thin Persistence feature requires an InServ F-Class or T-Class Storage Server, a 3PAR Thin Provisioning license, a 3PAR Thin Conversion license, and a 3PAR Thin Persistence license. Contact your 3PAR representative for more information.

7.13 Managing Virtual Volume Autonomic Groups

Virtual volume sets are part of the Autonomic Groups feature. Virtual volumes can be combined into autonomic groups, which are sets that can be managed as one object. If you have a group of volumes used by a database or an other application and all the virtual volumes require the same administrative procedures, it is easier to group those volumes into a set and manage them together. Individual virtual volumes can be members of multiple virtual volume sets.

Virtual volumes added to a set inherit the privileges of that set. For example, If a group of virtual volumes is exported to a host and a new virtual volume is added to the virtual volume set, the new virtual volume is visible to the host as soon as it is added to the virtual volume set.

The opposite is also true. If a virtual volume is removed from a set, all the privileges of that virtual volume set are revoked for the removed virtual volume.

A virtual volume in a virtual volume set cannot be removed from the system until it has been removed from the virtual volume set, or until the virtual volume set is removed from the system. Removing a virtual volume set does not remove the virtual volumes in that set. Changing the name of a virtual volume in a set does not change the privileges of the virtual volume or remove it from the virtual volume set.

7.13.1 Creating Virtual Volume Sets

- ▶ To create a virtual volume set, issue the `createvvset <set_name> <VV_names>` command, where:
 - ◆ `<set_name>` is the name of the virtual volume set being created.
 - ◆ `<VV_names>` are the names of the virtual volumes included in the virtual volume set.

For a complete list of options available for the `createvvset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.13.2 Adding Virtual Volumes to Virtual Volume Sets

- ▶ To add a virtual volume to an existing virtual volume set, issue the `createvvset -add <set_name> <VV_names>` command, where:
 - ◆ `<set_name>` is the name of the virtual volume set that will include the added virtual volumes.
 - ◆ `<VV_names>` are the names of the virtual volumes being added to the virtual volume set.

For a complete list of options available for the `createvvset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.13.3 Modifying Virtual Volume Sets

- ▶ To change the name of a virtual volume set, issue the `setvvset <new_name> <set_name>` command, where:
 - ◆ `<new_name>` is the new name of the virtual volume set.
 - ◆ `<set_name>` is the name of the virtual volume set being modified.

For a complete list of options available for the `setvvset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.13.4 Removing Virtual Volume Sets

- ▶ To remove a virtual volume set from the system, or to remove virtual volumes from a set, issue the `removevvset <set_name> <VV_names>` command, where:
 - ◆ `<set_name>` is the name of the virtual volume set being removed or modified.
 - ◆ `<VV_names>` are the names of the virtual volumes being removed from the `<set_name>` virtual volume set. This specifier is optional and it is not required if you are removing the entire set.

For a complete list of options available for the `removevvset` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.14 Freeing Virtual Volume Snapshot Space

- ▶ To free unused snapshot administration and snapshot data space from a virtual volume that is not in use by the system, issue the `freespace <VV_name>` or `freespace <pattern>` command, where:
 - ◆ `<VV_name>` is the name(s) of the virtual volume(s) from which snapshot space is to be made available.
 - ◆ `<pattern>` is the name of the pattern from which snapshot space is to be made available from all volumes matching that pattern name.



NOTE: The `freespace` command cannot be used if the virtual volume has snapshots, the virtual volume is a TPVV, or the TPVV was created with InForm OS release 2.2.4 or earlier.

For a complete list of options available for the `freespace` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help. For information about tuning your system for performance, see [Performance Tuning](#) on page 16.1.

7.15 Setting Expiration Times for Virtual Volumes

You can set virtual volume expiration times with the `-exp` option of the following commands:

- `createvv`
- `setvv`
- `createsv`
- `creategroupsv`

Use the `-exp` option to set an expiration time for any volume or copy of a volume. The expired virtual volumes are not automatically removed, you must use the `removevv` command or the System Scheduler to remove the expired volumes. The expiration time can be set during the volume creation time or applied to an existing volume.

- ▶ To set the volume expiration time for any volume, issue the `setvv -exp <time>d|D|h|H <VV_name>` command, where:
 - ◆ `-exp <time>d|D|h|H` specifies the amount of time from the current time in which the volume will expire. The value for `<time>` must be a positive integer in the range of 1 hour to 43,800 hours (1,825 days). The value for `<time>` can be specified in days with `d|D` or hours with `h|H`. For example, `14d` specifies 14 days.
 - ◆ `<VV_name>` is the name of the volume set to expire.

7.16 Setting Retention Times for Virtual Volumes

3PAR Virtual Lock is an optional feature that enforces the retention period of any volume or copy of a volume. You must purchase the 3PAR Virtual Lock license to use the `-retained` option. Locking a volume prevents the volume from being deleted intentionally or unintentionally before the retention period elapses. You can use Virtual Lock to specify the retention period for any volume or copy of a volume.

Use the `showvv -retained` command to display all volumes with retention times, and the time the volume retention expires.

Rules for using volume retention times:

- The retention time can be set during the volume creation time or applied to an existing volume.

- The retention time can be increased but it cannot be decreased.
- If both of the retention time and expiration time are specified, the retention time cannot be greater than the expiration time.
- The retention time can be set in hours or days. The minimum retention time is 1 hour and the maximum retention time is 43800 hours (1,825 days or 5 years). The default is 336 hours (14 days). The `vvMaxRetentionTime` system parameter determines the maximum retention. This parameter can be set with the `setsys` command.
- The maximum retention time for a volume in a domain can be set during the domain creation time or applied to an existing domain with the `createdomain` or `setdomain` commands.
- If the volume belongs to a domain, then volume's retention time cannot exceed the domain's maximum retention time.
- A volume with retention time cannot be removed until end of retention time period.

You can use the `-retain` option to set volume retention times with the following commands:

- ◆ `createvv`
- ◆ `setvv`
- ◆ `createsv`
- ◆ `creategroupsv`
- To create a virtual volume that cannot be deleted for a specified number of hours, issue the `createvv -retain <time>d|D|h|H <CPG_name> -snp_cpg <CPG_name> <user_CPG> <VV_name> <VV_size> g|G|t|T` command, where:
 - ◆ `-retain <time>d|D|h|H` specifies the volume cannot be removed from the system for the specified number of hours or days. The value for `<time>` must be a positive integer in the range of 1 hour to 43,800 hours (1,825 days). The value for `<time>` can be specified in days with `d|D` or hours with `h|H`. For example, `14d` specifies 14 days.
 - ◆ `<CPG_name>` is the name of the CPG from which the volume will draw its snapshot space and administration space.
 - ◆ `<user_CPG>` is the name of the CPG from which the created virtual volume will draw its user space.
 - ◆ `<VV_name>` is the name of the volume being created. The name can be up to 31 characters.

- ◆ `<VV_size g|G|t|T>` is the size of the volume in MB, GB, or TB. If `g|G|t|T` is not specified, `vv_size` is the number of MBs. For example, `50g` specifies 50 GBs.

7.17 Removing Virtual Volumes

- ▶ To virtual volumes, issue the `removevv <VV_name>` or `removevv <pattern>` command, where:
 - ◆ `<VV_name>` is the name(s) of the virtual volume(s) to be removed.
 - ◆ `<pattern>` is the name of the pattern according to which virtual volumes are to be removed.

For a complete list of options available for the `removevv` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.18 Exporting Virtual Volumes

Virtual volumes are the only logical storage component visible to hosts. A virtual volume can be exported, or made accessible, to one or more hosts. The host sees the exported volume as a LUN connected to one or more ports. Once the virtual volume is exported to a host, the host can send requests to the LUN.

A volume-LUN, or VLUN, is a pairing between a virtual volume and a logical unit number (LUN), expressed as either a *VLUN template* or an *active VLUN*. For information about VLUNs, refer to the *InForm OS Concepts Guide*.

7.18.1 Creating VLUN Templates

A *VLUN template* creates an association between a virtual volume and a LUN-host, LUN-port, or LUN-host-port combination by establishing the *export rule*, or the manner in which the volume is exported. A VLUN template enables the export of a virtual volume as a VLUN to a host or hosts. Those volume exports, which are seen as LUNs by the host or hosts, are active VLUNs.

A VLUN template can be one of the following types:

- *Host sees* - allows only a specific host to see a volume.
- *Host set* - allows any host that is a member of the host set to see a volume.

- *Port presents* - allows any host on a specific port to see the volume.
- *Matched set* - allows only a specific host on a specific port to see the volume.

7.18.1.1 Creating a Host Sees or Host Set VLUN Template

- ▶ To create a host sees or host set VLUN template, issue the `createvlun <VV_name> | set : <set_name> <LUN> <host> | set : <host_set>` command, where:
 - ◆ `<VV_name>` is the name of the virtual volume being exported to the host.
 - ◆ `<set_name>` is the name of the virtual volume set being exported to the host.
 - ◆ `<LUN>` is the LUN where the virtual volume is to be exported, expressed as an integer from 0 through 16383.
 - ◆ `<host>` is the name of the host to which the virtual volume is exported. This option creates a host sees VLUN template.
 - ◆ `<host_set>` is the name of the host set to which the virtual volume is exported. This option creates a host set VLUN template.

For detailed information about the `createvlun` command, refer to the *InForm OS Command Line Interface Reference*.

7.18.1.2 Creating a Port Presents VLUN Template

- ▶ To create a port presents VLUN template, issue the `createvlun <VV_name> | set : <set_name> <LUN> <N:S:P>` command, where:
 - ◆ `<VV_name>` is the name of the virtual volume being exported to the host.
 - ◆ `<set_name>` is the name of the virtual volume set being exported to the host.
 - ◆ `<LUN>` is the LUN where the virtual volume is to be exported, expressed as an integer from 0 through 16383.
 - ◆ `<N:S:P>` is the location of the target port used to export the virtual volume.

For detailed information about the `createvlun` command, refer to the *InForm OS Command Line Interface Reference*.

7.18.1.3 Creating a Matched Set VLUN Template

- ▶ To create a matched set VLUN template, issue the `createvln` `<VV_name> | set : <set_name> <LUN> <N:S:P> <host> | set : <host_set>` command, where:

- ◆ `<VV_name>` is the name of the virtual volume being exported to the host.
- ◆ `<set_name>` is the name of the virtual volume set being exported to the host.
- ◆ `<LUN>` is the LUN that the virtual volume is to be exported, expressed as an integer from 0 through 16383.
- ◆ `<N:S:P>` is the location of the target port used to export the virtual volume.
- ◆ `<host>` is the name of the host to which the virtual volume is exported.
- ◆ `<host_set>` is the name of the host set to which the virtual volume is exported.

For detailed information about the `createvln` command, refer to the *InForm OS Command Line Interface Reference*.

7.19 Unexporting Virtual Volumes

In order to halt the export of a virtual volume, you must remove the VLUNs associated with that volume. You must remove a VLUN template in order to remove the active VLUNs associated with that template.

Removing all VLUNs for a host stops the host from accessing any volumes.

7.19.1 Removing a Host Sees or Host Set VLUN Template

- ▶ To remove a host sees VLUN template and all active VLUNs associated with it, issue the `removevln <VV_name> | set : <set_name> <LUN> <host> | set : <host_set>` command, where:
- ◆ `<VV_name>` is the name of the virtual volume being exported to the host.
 - ◆ `<set_name>` is the name of the virtual volume set being exported to the host.
 - ◆ `<LUN>` is the LUN where the virtual volume is to be exported, expressed as an integer from 0 through 16383.
 - ◆ `<host>` is the name of the host to which the virtual volume is exported. This option creates a host sees VLUN template.

- ◆ `<host_set>` is the name of the host set to which the virtual volume is exported. This option creates a host set VLUN template.

For detailed information about the `removevlun` command, refer to the *InForm OS Command Line Interface Reference*.

7.19.2 Removing a Port Presents VLUN Template

- To remove a port presents VLUN template and all active VLUNs associated with it, issue the `removevlun <VV_name> | set:<set_name> <LUN> <N:S:P>` command, where:

- ◆ `<VV_name>` is the name of the virtual volume to halt exporting to the host.
- ◆ `<set_name>` is the name of the virtual volume to halt exporting to the host.
- ◆ `<LUN>` is the LUN that was exported, expressed as an integer from 0 through 16383.
- ◆ `<N:S:P>` is the location of the target port used to export the virtual volume.

For detailed information about the `removevlun` command, refer to the *InForm OS Command Line Interface Reference*.

7.19.3 Removing a Matched Set VLUN Template

- To remove a matched set VLUN template and all active VLUNs associated with it, issue the `removevlun <VV_name> | set:<set_name> <LUN> <N:S:P> <host> | set:<host_set>` command, where:

- ◆ `<VV_name>` is the name of the virtual volume being exported to the host.
- ◆ `<set_name>` is the name of the virtual volume set being exported to the host.
- ◆ `<LUN>` is the LUN that the virtual volume is to be exported, expressed as an integer from 0 through 16383.
- ◆ `<N:S:P>` is the location of the target port used to export the virtual volume.
- ◆ `<host>` is the name of the host to which the virtual volume is exported.
- ◆ `<host_set>` is the name of the host set to which the virtual volume is exported.

For detailed information about the `removevlun` command, refer to the *InForm OS Command Line Interface Reference*.

7.20 Virtual Domains, CPGs, and Virtual Volumes

You can use the CLI to create and manage virtual volumes belonging to domains just as you would manage virtual volumes that do not use 3PAR Virtual Domains.



NOTE: 3PAR Virtual Domains requires the use of the 3PAR Virtual Domains license. Contact your 3PAR sales representative for details.

7.20.1 Creating a Common Provisioning Group in a Domain

If you are using 3PAR Virtual Domains, you can create domain-specific CPGs which are accessible by only those users with privileges to that domain. You must be a super or edit level user in the `all` domain in order to create a domain CPG. For information about CPGs and 3PAR Virtual Domains, refer to the *InForm OS Concepts Guide*.

- ▶ To create a CPG within a domain, issue the `createcpg -domain <domain_name> -aw <percent> -sdgs <size> -sdgl <size> -sdgw <size> -t <RAID_type> <CPG_name>` command, where:
 - ◆ `<domain_name>` is the domain in which you are creating the CPG.
 - ◆ `-aw <percent>` is the percentage of used snapshot space and administration space which will generate a warning alert. If 0 (default) is specified, alert generation is disabled.
 - ◆ `-sdgs <size>` is the amount of logical disk storage created during each autogrow operation. Refer to [Table 7-1 on page 7.4](#) for the minimum default growth sizes per number of nodes.
 - ◆ `-sdgl <size>` is the growth limit which cannot be exceeded during autogrow operations. If 0 (default) is specified, no limit is enforced.
 - ◆ `-sdgw <size>` is the space limit for logical disk space before a warning alert is generated. If 0 (default) is specified, no warning limit is enforced.
 - ◆ `-t <RAID_type>` is the RAID type, specified as `r0` (RAID 0), `r1` (RAID 1), `r5` (RAID 5), or `r6` (RAID MP).
 - ◆ `<CPG_name>` is the name of the CPG being created.

All arguments are identical to those specified in [7.4 Creating a Common Provisioning Group](#) on page 7.6. For a complete list of options available for the `createcpg` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.20.2 Creating Virtual Volumes in a Virtual Domain

If you are using 3PAR Virtual Domains, you can create domain-specific virtual volumes which are accessible only by those users with privileges to that domain. You must have super or edit level user privileges in the domain in which you are creating the virtual volume. Virtual volumes are created by allocating resources from CPGs within a domain. A CPG must exist in the domain in which you wish to create a virtual volume before you can create a domain-specific virtual volume.

For instructions on creating domain CPGs, see [7.20.7 Moving a Common Provisioning Group to a Domain](#) on page 7.28. For more information about 3PAR Virtual Domains, see the *3PAR InForm OS Concepts Guide*.

- ▶ To create a virtual volume within a domain, issue the `createvv <usr_CPG> <VV_name> <VV_size> g|G|t|T` command, where:
 - ◆ `<usr_CPG>` is the name of the CPG from which the created virtual volume's user space is drawn.
 - ◆ `<usr_CPG>` is the name of the domain-specific CPG from which the created virtual volume's user space is drawn. For instructions on creating domain CPGs, see [7.20.7 Moving a Common Provisioning Group to a Domain](#) on page 7.28.
 - ◆ `<VV_name>` is the name of the virtual volume being created.
 - ◆ `<VV_size> g|G|t|T` is the size of the volume in MB, GB, or TB. If `g|G|t|T` is not specified, `vv_size` is the number of MBs. For example, `50g` specifies 50 GBs.

For a complete list of options available for the `createvv` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

7.20.3 Modifying Virtual Volumes in Domains

Domain virtual volumes can be modified just as virtual volumes in systems without domains can be modified. However, some restrictions apply to domain virtual volume modification.

- If you are super or edit level user belonging to the `all` domain, all virtual volume modification options for the `setvv` command are available for use and you can modify any virtual volume in the system.

- If you are an edit level user belonging to a `specified` domain, all options for the `setvv` command are available for use for virtual volumes that belong to the same `specified` domain.

Refer to the *InForm OS Concepts Guide* and the `setvv` command in the *InForm OS Command Line Interface Reference* for additional information about this restriction.

- ▶ To modify a virtual volume in a domain, see [7.9 Modifying Virtual Volumes](#) on page 7.13.

7.20.4 Growing Virtual Volumes in Domains

Existing domain virtual volumes can be enlarged (grown) by automatically adding capacity increments that you specify. Volumes which were created by super or edit level users in the `all` domain can only be grown by super or edit level users in the `all` domain. Volumes created from CPGs by edit level users in a `specified` domain can be grown by those users.

- ▶ For instructions on growing domain virtual volumes, see [7.10 Growing Virtual Volumes](#) on page 7.14.

7.20.5 Freeing Virtual Volume Snapshot Space in Domains

The snapshot space in virtual volumes belonging to domains can be made available just as virtual volumes in systems without domains.

- ▶ For instructions on freeing virtual volume snapshot space, see [7.14 Freeing Virtual Volume Snapshot Space](#) on page 7.18.

7.20.6 Exporting Virtual Volumes in Domains

Creating VLUN templates in domains is procedurally no different from creating VLUNs templates in systems that do not use 3PAR Virtual Domains. If you are using 3PAR Virtual Domains, you can export virtual volumes in your domains. However, depending on user privilege level, inter-domain exports can be limited.

- Super and edit level users belonging to the `all` domain can export virtual volumes in any domain existing in the system.
- Edit level users belonging to a `specified` domain can only export virtual volumes to hosts belonging to that domain.

Refer to the *InForm OS Concepts Guide* and the `createvlun` command in the *InForm OS Command Line Interface Reference* for details about this restriction.

7.20.6.1 Creating VLUN Templates in the All Domain

You can create host sees, matched set, and port presents VLUN templates if you are a super or edit level user belonging to the `all` domain. For instructions on creating each type, see [7.18.1.1 Creating a Host Sees or Host Set VLUN Template](#) on page 7.22, [7.18.1.2 Creating a Port Presents VLUN Template](#) on page 7.22, and [7.18.1.3 Creating a Matched Set VLUN Template](#) on page 7.23.

7.20.6.2 Creating VLUN Templates in a Specific Domain

As stated above, edit level users belonging to a `specified` domain can export virtual volumes to hosts belonging to that domain. Only host sees and matched set VLUN templates may be created. For instructions on creating each type, see [7.18.1.1 Creating a Host Sees or Host Set VLUN Template](#) on page 7.22 and [7.18.1.3 Creating a Matched Set VLUN Template](#) on page 7.23.

7.20.7 Moving a Common Provisioning Group to a Domain

For instructions on moving CPGs from one domain to another, see [5.7 Managing Domain Objects](#) on page 5.5.

8

Managing Virtual Volume Copies

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The purpose of this chapter is to explain how to create and modify virtual copies, or snapshots, of virtual volumes.

8.1 Overview

There are two types of copies that can be created from virtual volumes: *virtual copies* and *physical copies*.

- A *virtual copy* is a snapshot of an original or base volume. A virtual copy only records the changes to the original virtual volume.
- A *physical copy* is a complete duplicate of all the data from a base volume to a destination volume.

For more information about virtual copies, see the *3PAR InForm OS Concepts Guide*.



NOTE: Creating Thinly-Provisioned Virtual Volumes (TPVVs) requires the 3PAR Thin Provisioning license. Creating virtual copies or *snapshots* requires the 3PAR Virtual Copy license.

8.2 Virtual Copies

A virtual copy is a snapshot of another virtual volume. You can make virtual copies of base volumes, physical copies, or other virtual copies. Virtual copies are created using *copy-on-write* techniques available only with the 3PAR Virtual Copy license. Unlike a physical copy which duplicates the entire base volume, a virtual copy only records the changes to the original volume. This allows an earlier state of the original volume to be recreated by starting with the current state and rolling back all of the changes that have been made since the virtual copy was created.

You can use the InForm CLI to perform the following virtual copy tasks:

- Create
- Promote
- Modify
- Remove

For additional information about virtual copies, see the *3PAR InForm OS Concepts Guide*.

8.2.1 Creating a Virtual Copy

Virtual copies can be read-only or read/write. Read-only and read/write copies must alternate. You can only make a read-only copy of a read/write volume and a read/write copy of a read-only volume. Expiration dates can be set for virtual copies to save space. The system allows you to make a maximum of 500 virtual copies of a base volume. Up to 256 virtual copies can be read/write copies. System-level maximums of total virtual copies that can be created on a system also apply. Refer to the *3PAR InForm OS Configuration Matrix* for system-level maximum limits on virtual copies. For detailed information about the rules governing virtual copies, see the *3PAR InForm OS Concepts Guide*.

- ▶ To create a virtual copy, or snapshot, of a virtual volume or a virtual volume set, issue the `createsv -ro <snapshot_name> <source_VV> | set:<set_name>` command, where:
 - ◆ `-ro` specifies that the snapshot being created is read-only.
 - ◆ `<snapshot_name>` is the name of the snapshot being created.
 - ◆ `<source_VV>` is the name of the virtual volume being copied.
 - ◆ `<set_name>` is the name of the virtual volume set being copied.

For a complete list of options available for the `createsv` command, see the *InForm OS Command Line Interface Reference* and InForm OS Command Line Interface Help.

8.2.2 Promoting a Virtual Copy

If you have created multiple copies of a base volume, the data on a virtual copy can be rolled back to the base volume or to any of the virtual copy's RW parents in the same tree by *promoting* a virtual copy. This copies the changes from the virtual copy back onto the base volume, overwriting the base volume with the copy. The virtual copy still remains on the system.

- ◆ The virtual copy and the target of the promote must not be exported.
- ◆ Only one promote operation is allowed at a time within a virtual volume family tree.
- ▶ To promote a virtual copy to back to a base volume or back to any of the virtual copy's RW parents in the same virtual volume family tree, issue the `promotesv <VC_name> | set:<set_name>` command, where:
 - ◆ `<VC_name>` is the name of the virtual copy being promoted.
 - ◆ `<set_name>` is the name of the virtual copy set being promoted.

For a complete list of options available for the `createsv` command, see the *InForm OS Command Line Interface Reference* and InForm OS Command Line Interface Help.

If you are using 3PAR Remote Copy, you can optionally promote the virtual copy if the base volume is in a Remote Copy group. See the *InForm OS Command Line Interface Reference* for detailed information about the `promotesv` command. For details about 3PAR Remote Copy, see the *3PAR Remote Copy User's Guide*.



NOTE: To halt volume export, you must delete all VLUNs associated with the volume as described in [7.19 Unexporting Virtual Volumes](#) on page 7.23. After you delete all VLUNs, you can use the volume as the destination volume for a physical copy.

8.2.3 Modifying a Virtual Copy

Any existing virtual copy can be modified to have a new name, new allocation warnings and limits, and adhere to new policies. To modify an existing VV, issue the `setvv` command. For details on all of the `setvv` command arguments and their usage, refer to the *InForm OS Command Line Interface Reference*.

8.2.4 Removing a Virtual Copy

- ▶ To remove a virtual copy, issue the `removevv <VV_name>` command, where `<VV_name>` is the snapshot you are removing.

See the *InForm OS Command Line Interface Reference* for detailed information about the `removevv` command.

8.2.5 Creating a Group of Virtual Copies

The InForm CLI also allows for the creation of consistent group snapshots of a list of virtual volumes.

- ▶ To create group snapshots, issue the `creategroupsv <copy_of_VV>` command, where `<copy_of_VV>` is the name of the virtual volume being copied.



NOTE: If you wish to copy multiple volumes, the `<copy_of_VV>` argument can be repeated multiple times on the command line for a single instance of the `creategroupsv` command.

For information on arguments which can be optionally specified with the `creategroupsv` command, refer to the *InForm OS Command Line Interface Reference*.

8.3 Physical Copies

A physical copy duplicates all the data from a base volume to a destination volume. The base volume is the original volume that is copied to the destination volume. The physical copy on the destination volume becomes available if the original base volume becomes unavailable. Unlike a virtual copy or snapshot, a physical copy maintains the performance of the base virtual volume. Creating physical copies does not require a separate license.

A physical copy can only be made from a volume with enough free space to accommodate writes to that volume during the physical copy operation. In addition, the destination volume must meet the following conditions:

- It must have snapshot space associated with.
- It must have at least as much user space as the volume being copied.
- It must not be exported to a host.

You can use the InForm CLI to perform the following physical copy tasks:

- Create
- Resynchronize
- Promote

For additional information about the rules governing physical copies, see the *3PAR InForm OS Concepts Guide*.



NOTE: If the parent and destination volume are both Thinly-Provisioned Virtual Volumes (TPVVs), only the actual used space is copied.



NOTE: The `createvvcopy` command can be issued multiple times. However, the system allows only two physical copy tasks to run concurrently. Any additional physical copy tasks are queued, pending the completion of the active physical copy tasks.

8.3.1 Creating a Physical Copy

- ▶ To create a physical copy of a virtual volume, issue the `createvvcopy -p <parent_VV> -s <destination_VV> | set:<set_name>` command, where:
 - ◆ `-p <parent_VV>` creates a snapshot of the parent volume, as identified by `<parent_VV>`, and copies the snapshot data to the destination volume.
 - ◆ `<destination_VV>` is the name of the destination volume. The destination volume must be equal or greater in size to the parent volume, must be a writeable volume, and must not be exported as a VLUN.
 - ◆ `<set_name>` is the name of the destination volume set. Each virtual volume in the destination volume set must be equal or greater in size to the parent volume, must be a writeable volume, and must not be exported as a VLUN.
 - ◆ `-s` saves the snapshot for quick resynchronization and retains the parent/copy relationship between the parent and destination volumes.

For information on arguments that can optionally be specified with the `createvvcopy` command, refer to the *InForm OS Command Line Interface Reference*.

8.3.1.1 Creating a Group of Physical Copies

The InForm CLI also allows for the creation of consistent group physical copies of a list of virtual volumes.



NOTE: The `creategroupvvcopy` command can be issued multiple times. However, the system allows only two physical copy tasks to run concurrently. Any additional physical copy tasks are queued, pending the completion of the active physical copy tasks.

- ▶ To create group physical copies, issue the `creategroupvvcopy -p -s <parent_VV>:<destination_VV>` command, where:
 - ◆ `-p <parent_VV>` creates a group of snapshots of the parent volume, as identified by `<parent_VV>`, and copies data from the snapshots to the destination volume.
 - ◆ `-s` saves the snapshot for quick resynchronization and retains the parent/copy relationship between the parent and destination volumes.

- ◆ `<destination_VV>` is the name of the destination volume. The destination volume must be equal or greater in size to the parent volume, must be a writeable base volume, and must not be exported as a VLUN.



NOTE: If you wish to copy multiple volumes, the `<parent_VV>: <destination_VV>` argument can be repeated multiple times on the command line for a single instance of the `creategroupvvcopy` command.

For information on arguments which can be optionally specified with the `creategroupvvcopy` command, refer to the *InForm OS Command Line Interface Reference*.

8.3.2 Resynchronizing a Physical Copy

At some point, you may want to *resynchronize* a physical copy with its original base volume because either virtual volume could have been modified since the copy operation was launched. When you resynchronize a physical copy, the system copies changes from one volume in the physical copy pair to the other.

- ▶ To resynchronize a physical copy, issue the `createvvcopy -r <destination_VV>` command, where `-r <destination_VV>` is the volume to be resynced with its parent volume. The snapshot is retained for quick resynching and the parent-copy relationship is also retained.

8.3.2.1 Resynchronizing a Group of Physical Copies

Just as groups of physical copies can be created for a list of virtual volumes, those physical copies can also be resynced.

- ▶ To resynchronize a group of physical copies, issue the `creategroupvvcopy -r <destination_VV>` command, where `-r <destination_VV>` is the volume to be resynced with its parent volume.

Snapshots of the parent volume must have been saved during their creation (using the `-s` option) in order to resynchronize the volumes.

8.3.3 Promoting a Physical Copy

Over time, physical copies and their base volumes can change as data is written to each. At some point the association between the two volumes may no longer be relevant. The association between a physical copy and a base volume is broken by promoting the physical copy back to the base volume.

- ▶ To promote a physical copy back to a base volume, issue the `promotevvcopy <copy_name> | set:<set_name>` command, where:
 - ◆ `<copy_name>` is the name of the physical copy being promoted.
 - ◆ `<set_name>` is the name of the physical copy set being promoted.

8.4 Snapshots and Domains



NOTE: 3PAR Virtual Domains requires the use of the 3PAR Virtual Domains license. Contact your local 3PAR representative for further details.

As with standard systems, virtual copies and physical copies can also be created in systems using 3PAR Virtual Domains. Domain snapshot creation and modification does not differ from snapshot creation and modification in systems not using Domains. Domain snapshot creation and modification is limited to super and edit level users belonging to the `all` domain and edit level users belonging to a specified domain. Snapshots inherit the domain of their parent volumes.

- Virtual copies can be:
 - ◆ Created. See [8.2.1 Creating a Virtual Copy](#) on page 8.3 for instructions.
 - ◆ Promoted. See [8.2.2 Promoting a Virtual Copy](#) on page 8.3 for instructions.
 - ◆ Modified. See [8.2.3 Modifying a Virtual Copy](#) on page 8.4 for instructions.
 - ◆ Removed. See [8.2.4 Removing a Virtual Copy](#) on page 8.4 for instructions.
- Physical copies can be:
 - ◆ Created. See [8.3.1 Creating a Physical Copy](#) on page 8.6 for instructions.
 - ◆ Resynchronized. See [8.3.2 Resynchronizing a Physical Copy](#) on page 8.7 for instructions.
 - ◆ Promoted. See [8.3.3 Promoting a Physical Copy](#) on page 8.8 for instructions.

8.4.1 Moving Snapshots

Like other domain objects, snapshots can be moved from one domain to another using the `movetodomain` command. This action is restricted to super level users in the `all` domain.



NOTE: If a snapshot is moved from one domain to another, the snapshot's base volume is also moved.

For further instructions see [5.7.1 Moving Domain Objects to Another Domain](#) on page 5.5.

9

Creating and Applying Templates

In this chapter

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9.3 Applying Templates	9.3
9.4 Modifying Templates	9.4
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The purpose of this chapter is to explain how to create and modify templates to quickly create standardized data objects.

9.1 Overview

You can use the InForm CLI to create templates that enable you to apply a set of parameters that automatically create logical disks, virtual volumes, or Common Provisioning Groups with the same or similar characteristics.

The following general rules apply to templates:

- A property can either be included in a template or not included.

Properties are virtual volume, logical disk, or common provisioning group attributes such as set size.

- A property included in a template can have a defined value or have a value that is left unspecified.

A property with a defined value has had a specific value assigned to it (for example, a set size of 2). A property with an unspecified value does not have a specific value assigned to it. When you apply a template that includes a property with one or more unspecified values, the system will either use the default value (when applicable) or calculate the optimized setting for you.

- For all templates, you can either allow overrides of property values or not.

When you allow overrides of a property, users can modify that property's value when applying the template. When you do not allow overrides of a property, it is not possible to modify the defined value, system default, or system-calculated value for that property when applying the template.

9.2 Creating Templates

You can create three types of templates that can then be applied to create logical disks, virtual volumes, and common provisioning groups (CPGs).

- ▶ To create a template, issue the `createtemplate <obj_type> <template_name>` command, where:

- ◆ `<obj_type>` is the object type the template is used to create. Specify VV, LD, or CPG for virtual volume, logical disk, or common provisioning group, respectively.
- ◆ `<template_name>` is the name of the template being created.

The VV, LD, and CPG templates have object-specific arguments that must be specified during creation.

Additionally, depending on the type of template you are creating, you may wish to specify other arguments to further refine the template's parameters. Refer to the *InForm OS Command Line Interface Reference* for required and optional arguments specific to each template object type.

9.3 Applying Templates

Once you have created a template, you can apply that template to create logical disks, virtual volumes, or common provisioning groups (CPGs).

9.3.1 Creating Virtual Volumes and Logical Disks Using a Template

- ▶ To create a virtual volume and its underlying logical disks using a template, issue the `createvv -templ <template_name> <VV_name> <size>` command, where:
 - ◆ `<template_name>` is the name of the template being applied to the creation of the volume and logical disks.
 - ◆ `<VV_name>` is the user-designated name of the virtual volume being created.
 - ◆ `<size>` is the size of the user volume.

In addition to using a template to create volumes and logical disks, you can also apply any optional argument available for the `createvv` command. You can overwrite read/write parameters in the applied template with new options at the time of creation. However, read-only parameters in the template cannot be overwritten. Refer to the *InForm OS Command Line Interface Reference* for additional information.

9.3.2 Creating a Common Provisioning Group Using a Template

- ▶ To create a common provisioning group using a template, issue the `createcpv -templ <template_name> <CPG_name>` command, where:
 - ◆ `<template_name>` is the name of the template being applied to the creation of the CPG.
 - ◆ `<CPG_name>` is the user-designated name of the CPG being created.

In addition to applying a template to the creation of the CPG, you can also apply any optional argument available for the `createcpv` command. Read/write parameters in the applied template can be overwritten with new options at the time of creation. However, read-only parameters in the template cannot be overwritten. Refer to the *InForm OS Command Line Interface Reference* for additional information.

9.4 Modifying Templates

You can modify a template at any time by adding, replacing, or removing template parameters, regardless of whether the template has been applied to create logical disks, virtual volumes, or common provisioning groups. When you edit a template, no changes are made to objects you have created with that template.

9.4.1 Viewing Template Parameters

Before modifying a template it may be helpful to view the template's existing parameters.

- ▶ To view a template's current parameters, issue the `showtemplate <template_name>` command.

If name of the template you wish to modify is unknown, you can alternately display templates in the system filtered by object type.

- ▶ To view templates by object type, issue the `showtemplate -t <type>` command, where `<type>` can be VV (virtual volume), LD (logical disk), or CPG (common provisioning group).

9.4.2 Adding and Replacing Template Parameters

- ▶ To add parameters to an existing template or replace parameters in an existing template, issue the `settemplate <option> <template_name>` command, where:
 - ◆ `<option>` includes the parameter and, if applicable, the parameter's value that is being added or replaced in the template. For a descriptive list of valid options that can be applied to your template, see the `createtemplate` command in the *InForm OS Command Line Interface Reference*.
 - ◆ `<template_name>` is the name of the template being modified.

9.4.3 Removing Template Parameters

- ▶ To remove parameters in an existing template, issue the `settemplate -remove <option> <template_name>` command, where:
 - ◆ `<option>` is the parameter being removed from the template. The parameters are the options that you specified during the creation of the template. It is not necessary to specify the parameter's value during removal.
 - ◆ `<template_name>` is the name of the template being modified.

9.5 Removing Templates

Removing a template deletes the template from the system, but does not delete objects created with that template.

- To remove a template from the system, issue the `removetemplate <template_name>` command, where `<template_name>` is the name of the template being removed.

You can optionally remove templates matching a specific pattern by issuing the `removetemplate -pat <template_name|pattern>` command. For details about this option, refer to the *InForm OS Command Line Interface Reference*.

10

Monitoring System and Physical Disk Capacity

In this chapter

10.1	Overview	10.2
10.2	System Capacity	10.2
10.2.1	Determining Total System Capacity	10.3
10.2.2	Determining System Capacity by Physical Disk Type	10.4
10.3	Physical Disk Capacity	10.4
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10.3.2	Determining Physical Disk Capacity by Disk Type	10.6
10.3.3	Determining the Capacity of a Specific Physical Disk	10.6
10.4	Spare Chunklets	10.7
10.4.1	Viewing Spare Chunklets	10.7

The purpose of this chapter is to explain how to display physical storage capacity.

10.1 Overview

The InForm CLI provides commands to show the amount of used space and available space in an InServ Storage Server. The commands allow you to review space usage information at the system level and for each physical disk.

Use the following CLI commands to review space usage information:

- `showpd` - displays configuration information about the physical disks in the system.
- `showspare` - displays information about spare chunklets in the system.
- `showsys` - displays an overview of the system's capacity and connectivity.

10.2 System Capacity

The InForm CLI provides detailed views of the InServ system's total capacity, as well as the system's total capacity by storage device type.

10.2.1 Determining Total System Capacity

To determine system capacity, issue the `showsys -space` command. The following is an example of the data returned by issuing this command:

```
cli% showsys -space
-----System Capacity (MB)-----
Total Capacity           : 557056
  Allocated              : 359424
    Volumes              : 179200
      Base Volumes       : 27648
        User             : 27648
        Copy             : 0
        Admin            : 0
      CPGs (TPVVs & CPVVs) : 151552
        Copy             : 86016
        Used             : 1024
        Unused           : 84992
        Admin            : 65536
        Used             : 512
        Unused           : 65024
    Unmapped            : 0
  System                 : 180224
    Internal             : 110592
    Spare                : 69632
      Used               : 0
      Unused            : 69632
  Free                   : 197632
    Initialized          : 197632
    Uninitialized        : 0
    Failed               : 0
```

As shown in the example above, system capacity is displayed in MBs. The first line displays the system's total capacity, which is the sum of the allocated space (Allocated), free space (Free), and failed space (Failed).

- ◆ The allocated space includes the following:
 - ◆ all base volumes and the volumes' user, copy, and administration spaces.
 - ◆ provisioned groups and volumes and their used and unused copy and administration spaces.
 - ◆ unmapped volumes.
 - ◆ system space, which includes administration volumes, log files, and physical disk system data, as well as used and unused spare space.

- ◆ The free space includes the total free initialized and uninitialized spaces available for use.

10.2.2 Determining System Capacity by Physical Disk Type

You can display the total capacity for all physical disks of a specific type. There are three types of physical disks: Fibre Channel (FC), Near Line (NL), and Solid State Drives (SSD).

- ▶ To display the total capacity for all physical disks of a specific type in an InServ Storage Server, issue the `showsys -space -devtype FC|NL|SSD` command.



NOTE: The output of the `showsys -space -devtype FC|NL|SSD` command is displayed in the same format as the `showsys -space` command output example in [10.2.1 Determining Total System Capacity](#) on page 10.3.

10.3 Physical Disk Capacity

The InForm CLI allows you to view capacity for all physical disks in your system, capacity of physical disks by device type, as well as the capacity for a single physical disk in your system.



NOTE: The Device Speed number does not represent a rotational speed for Solid State Drives (SSD) without spinning media. It is meant as a rough estimation of the performance difference between the drive and the other drives in the system. For FC and NL drives, the number corresponds to both a performance measure and actual rotational speed. For an SSD, the number is to be treated as a relative performance benchmark that takes into account in I/O per second, bandwidth, and the access time.

10.3.1 Determining Total Physical Disk Capacity

- ▶ To view the total physical disk capacity of the system, issue the `showpd -space` command. The following is an example of the data returned by issuing this command:

```
cli% showpd -space
```

----- (MB) -----									
Id	CagePos	Type	-State-	Size	Volume	Spare	Free	Unavail	Failed
0	0:0:0	FC	normal	139520	22272	8960	108288	0	0
1	0:0:1	FC	normal	139520	13312	8704	117504	0	0
2	0:0:2	FC	normal	139520	22272	8704	108544	0	0
3	0:0:3	FC	normal	139520	13056	8704	117760	0	0
4	0:1:0	SSD	normal	47360	1024	0	46336	0	0
5	0:1:1	SSD	normal	47360	1024	0	46336	0	0
6	0:1:2	SSD	normal	47360	1024	0	46336	0	0
7	0:1:3	SSD	normal	47360	1024	0	46336	0	0
8	0:9:0	FC	normal	139520	22272	8704	108544	0	0
9	0:9:1	FC	normal	139520	13056	8704	117760	0	0
10	0:9:2	FC	normal	139520	22272	8704	108544	0	0
11	0:9:3	FC	normal	139520	12800	8704	118016	0	0
12	1:0:0	NL	normal	7150008	22528	8704	108288	0	0
13	1:0:1	NL	normal	7150008	13056	8704	117760	0	0
14	1:0:2	NL	normal	7150008	2272	8704	108544	0	0
15	1:0:3	NL	normal	7150008	3056	8704	117760	0	0
16	1:9:0	FC	normal	139520	22272	8704	108544	0	0
17	1:9:1	FC	normal	139520	13056	8704	117760	0	0
18	1:9:2	FC	degraded	139520	22016	8704	108800	0	0
19	1:9:3	FC	normal	139520	13056	8704	117760	0	0

20	total			2421760	286720	139520	1995520	0	0

As shown in the example above, physical disk capacity is displayed in MBs. The data columns are identified as follows:

- ◆ ID - The physical disk ID.
- ◆ CagePos - The position of the physical disk within the drive cage. The format varies depending on the drive cage type.
- ◆ Type - The physical disk type. There are three types of physical disks: Fibre Channel (FC), Near Line (NL), and Solid State Drives (SSD).
- ◆ State - The state of the physical disk. The following disk states can appear:
 - ◆ normal - The disk is normal.
 - ◆ degraded - The disk is not operating normally.
 - ◆ new - The disk new and needs to be admitted with the `admitpd` command before it can be used.

- ◆ failed - The disk has failed.

Use `showpd -state` to display detailed state information.

- ◆ Size - The disk's capacity.
- ◆ Volume - The volume's capacity.
- ◆ Spare - The disk's space reserved for spare chunklets.
- ◆ Free - The disk's free space.
- ◆ Unavail - Unavailable disk space.
- ◆ Failed - Space in failed chunklets.

10.3.2 Determining Physical Disk Capacity by Disk Type

You can display the capacity of all physical disks of a specific type. There are three types of physical disks: Fibre Channel (FC), Near Line (NL), and Solid State Drives (SSD).

- To display the total capacity for all physical disks of a specific type in an InServ Storage Server, issue the `showpd -space -devtype FC|NL|SSD` command.



NOTE: The output of the `showpd -space -devtype FC|NL|SSD` command is displayed in the same format as the `showpd -space` command output example in [10.3.1 Determining Total Physical Disk Capacity](#) on page 10.4.

10.3.3 Determining the Capacity of a Specific Physical Disk

Physical disk capacity can be filtered by disk ID to display a specific disk's capacity information.



NOTE: The output for the command listed below is displayed in the same format as the `showpd -space` command output example in [10.3.1 Determining Total Physical Disk Capacity](#) on page 10.4.

- To display the capacity information for a single physical disk, issue the `showpd -space <PD_ID>` command, where `<PD_ID>` is the physical disk whose capacity information is shown.

10.4 Spare Chunklets

Some chunklets are identified as spares when the storage server is first set up at installation. Data from other chunklets is moved or reconstructed onto these spare chunklets in response to a chunklet or disk failure or when a drive magazine needs to be serviced. This initial spare storage totals the amount of storage in a single drive magazine, using the largest size physical disks.

How spare chunklets work:

- When a connection is lost to a physical disk or a physical disk fails, all future writes to the disk are automatically written to a logging logical disk until the physical disk comes back online or until the time limit for logging is reached. Logging disk space is allocated when the storage server is set up.
- If the time limit for logging is reached, or if the logging logical disk becomes full, relocation of chunklets on the physical disk to other chunklets, free chunklets or allocated spares, starts automatically. Free chunklets are chunklets that are not used by the system.
- For automatic relocations, the system uses up a maximum of one disk worth of chunklets per system node.



NOTE: Local chunklets are chunklets on disks, which are used by the node that owns the logical disk for the chunklet being relocated.

- If the system uses up its free or spare chunklets for relocation, an alert is generated.
- Once the spare and free chunklets are used up, automatic relocation no longer occurs. In most cases, some data redundancy is lost. The system also generates an alert.

10.4.1 Viewing Spare Chunklets

Use the `showspare` command to display information about all spare chunklets. If a spare chunklet is in use, the `showspare` output includes the name and ID of the logical disk using it, as well as the chunklet's position on the logical disk. If the spare chunklet is not in use, it is listed as `available`, and the columns relating to the logical disk show only dashes.

The following example displays information about two spare chunklets, 0 and 1, on physical disk 23:

```
%cli showspare
PdId Chnk LdName          LdCh State      Usage      Media      Sp Cl From      To
23   0    ----          ---  normal    available  valid      Y  Y  ---      ---
23   1    sales1.0        2   normal     ld         valid      Y  Y  ---      ---
```

The fields in this output provide the following information:

- **PdId.** The physical disk on which the chunklets reside.
- **Chnk.** The position on the physical disk of the spare chunklets.
- **LdName.** The name of the logical disk that is using the spare chunklet.
- **LdCh.** The position of the chunklet on the logical disk.
- **State.** The state of the chunklet as identified by the kernel. Can be `normal`, `none` (hasn't been used by any logical disk), or `failed`.
- **Usage.** Shows whether the spare chunklet is in use by a logical disk. Values can be
 - ◆ `available`. The chunklet is available for use as a spare.
 - ◆ `ld`. The chunklet is in use by a logical disk.
 - ◆ `reldsrc`. Relocation source. The data has been moved to another chunklet.
 - ◆ `reltgt`. Relocation target. The data in the chunklet has been moved from another spare chunklet.
 - ◆ `abtreld`. Abort relocation. The system is aborting the chunklet relocation operation.
 - ◆ `cmprld`. Completing relocation. The system is in the final phase of completing the chunklet relocation.
- **Media.** The current status of the physical disk media for the chunklet. The value is `failed` if the media has encountered errors and is unavailable, or `valid` if it is available for use.
- **Sp.** The spare status of the chunklet. `Y` indicates the chunklet is used for spare, `N` indicates that it is not.
- **Cl.** The cleaning status of the chunklet. Indicates whether the chunklet is in the process of being reinitialized for use, as happens when a physical disk is added to the system, or a logical disk is removed. The value can be `Y` (cleaned), `N` (not cleaned), or `Cg` (being cleaned now).

- **From.** The initial location of the chunklet prior to relocation. The format is PD:CH, where PD is the physical disk ID and CH is the chunklet ID.
- **To.** The destination location of the chunklet during relocation in the format PD:CH.

11

Managing Events and Alerts

In this chapter

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11.3	Monitoring and Managing Alerts	11.2
11.4	Setting System Alerts	11.3
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11.6	Stopped Logical Disks and Missing Physical Disks	11.4

The purpose of this chapter is to explain how to display system alerts.

11.1 Overview

The system tracks system events internally. Some of these events require action on the part of the system administrator, so they trigger alerts that are displayed for the administrator. Events are logs created by the system which allow you to view the day-to-day health of your system. Alerts are generated by the system when a system event requires immediate operator action/attention.

11.2 Checking the Status of an InServ Storage Server

The `checkhealth` command checks the status of an InServ Storage Servers's hardware and software components, and reports any issues. You can specify which components you want the `checkhealth` command to examine or check all system components.

- Use the `checkhealth` command to view a status summary of all system components.
- Use the `checkhealth -list` command to view a list of all system components.
- ▶ To check the health of specific hardware and software components, issue the `checkhealth <component>` command, where:
 - ◆ `<component>` is the component, or list of components, you want to check.

11.3 Monitoring and Managing Alerts

Alerts are system events that require your immediate attention. An alert may be triggered by a single event, a combination of events, or by repeated occurrences of the same event. The system administrator is responsible for responding to alerts. For detailed information about alerts, see the *InForm OS Messages and Operator's Guide*.

11.3.1 Viewing Alerts

- ▶ To display system alerts, issue the `showalert` command.

You can additionally display alerts by type (fixed alerts, acknowledged alerts, etc.). Refer to the *InForm OS Command Line Interface Reference* for information about alert display options.

11.3.2 Setting an Alert State

- ▶ To mark an alert as new, fixed, or acknowledged, issue the `setalert new|fixed|ack <alert_ID>` command, where `<alert_ID>` is the alert whose status you wish to acknowledge.

11.3.3 Removing an Alert

- ▶ To remove an alert, issue the `removealert <alert_ID>` command, where `<alert_ID>` is the alert you wish to remove.

11.4 Setting System Alerts

While most system alerts are generated automatically without any need for user configuration, there are several types of alerts that you can specifically configure.

- Limits relating to Common Provisioning Groups (CPG) can be set by the user when creating a CPG and can later trigger alerts. For information on setting the growth increment limits, see [7.2 Common Provisioning Groups](#) on page 7.4. For details about CPG creation precautions, refer to the *InForm OS Concepts Guide*.
- Limits for virtual volumes capable of allocating space on demand are also user-configurable and can trigger alerts. For information about on-demand virtual volume space allocation, refer to the *InForm OS Concepts Guide*.
- The raw space alert is a global threshold that can be set for the storage system in order to alert administrators when available space on the system falls below a user-specified level. When the available space on the storage system falls below this user-specified threshold, an alert is generated.

There are also four default system thresholds which alert you when the available space on the system falls below 50%, 75%, 85%, and 95% of the total available space on the system. When the user-defined threshold is set, alerts for system thresholds below the user-defined threshold are suppressed. The following section describes how to set and change this raw space alert threshold.

11.4.1 Setting the Raw Space Threshold Alert

- ▶ To set a raw space alert for a storage system with Nearline type drives, issue the `setsys RawSpaceAlertNL <threshold>` command.
- ▶ To set a raw space alert for a storage system with Fibre Channel type drives, issue the `setsys RawSpaceAlertFC <threshold>` command.
- ▶ To set a raw space alert for a storage system with Solid State Drives (SSD), issue the `setsys RawSpaceAlertSSD <threshold>` command.

For each command above, `<threshold>` is an integer from 100 to 100,000 that represents the total available space on the system in gigabytes. A value of 0 effectively disables the raw space alert safety feature. Any alerts for system thresholds below the user-defined thresholds are suppressed.

11.5 Monitoring and Managing the Event Log

The eventlog has information about all notable occurrences on the InServ. System events include all alerts the system has generated and alerts marked as acknowledged or fixed. These system events are generated and logged in the system events log. For detailed information about the events log, see the InForm OS Concepts Guide.

11.5.1 Viewing the Event Log

- ▶ To view the events log, simply issue the `showeventlog` command.

The eventlog display can be refined to include only events occurring before or after a specified time, within a specified time period, and that match a specified pattern. For complete information on the events log's display options, see the *InForm OS Command Line Interface Reference*.

11.5.2 Removing the Event Log

- ▶ To remove all event logs with severity `Debug` from the system, issue the `removeeventlog` command.

The `removeeventlog` command removes all event logs with severity `Debug` from the system

11.6 Stopped Logical Disks and Missing Physical Disks

If physical disks in the system are unavailable when the system is powered on, the physical disk is in the **Missing** state. The system manager will not immediately start logical disks that have chunklets on these missing disks. The result is some logical disks remain in the **Stopped** state. Use the `showpd` and `showld` commands to display the state of physical and logical disks.

If the logical disk is data-complete, but a few of the physical disks are missing, the logical disks will be automatically started after waiting five minutes. If more than four physical disks are missing, the logical disks will not be started automatically. You can start a data-complete logical disk using the InForm CLI `startld` command, and the system manager will begin reconstructing the missing mirrored data. The system automatically relocates the chunklets from the missing physical disks to free space or spare space.

For a complete list of options available for the `showpd` and `showld` commands, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

11.6.1 Preserved Data

When the InServ storage system is holding data in cache but is not able to write that data to the destination disk for any reason, it saves the data to the *preserved data logical disk*. This logical disk is automatically created at the time that the storage system is installed and initially configured.

The data written to the preserved data logical disks is typically created due to a temporary loss of availability of disks, a situation that usually corrects itself once the disks become available again. When the destination logical disks become available again, the system automatically plays back the preserved data by writing it from the preserved data LDs to the destination logical disks.

If you notice that the preserved data logical disk has data saved for a long time, use the `showpd` command to see which physical disks are in an unavailable state. If any disks are in an unavailable state, it is necessary to take corrective action in order to make those disks available again. If data is persistently saved to the preserved data logical disk, contact your local service provider for technical support and services.

12

Viewing Statistics and Histograms

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The purpose of this chapter is to explain how to display detailed statistics about the InServ Storage Server.

12.1 Overview

The InForm CLI allows you to view aspects of system performance over time. You can view statistics for the performance of VLUNs, virtual volumes, ports, physical disks, data cache memory, and CPU usage using variations of the `stat` command.

In addition, the InForm CLI provides service time and I/O size histograms for system resources such as chunklets, logical and physical disks, ports, VLUNs, and virtual volumes.

12.2 Viewing Statistics

This section provides instructions on using commonly used CLI commands to access performance statistics. The commands described here are a subset of the statistics commands available. For a complete list of statistics commands, see the *InForm OS Command Line Interface Reference*.

Performance statistics are available for the following:

- physical disks
- ports
- VLUNs
- virtual volumes
- data cache memory
- CPU usage

12.2.1 Viewing Statistics for Physical Disks

- ▶ To view physical disk statistics, issue the `statpd` command.

Data output can be further refined to display only physical disk statistics from:

- ◆ a specific physical disk by either its ID or WWN.
- ◆ specific nodes.

- ◆ specific PCI slots.
- ◆ specific ports.

Additional filters can be used to refine the data output. Refer to the *InForm OS Command Line Reference* for complete details about `statpd` command options and for sample command data output.



NOTE: The Device Speed number does not represent a rotational speed for Solid State Drives (SSD) without spinning media. It is meant as a rough estimation of the performance difference between the drive and the other drives in the system. For FC and NL drives, the number corresponds to both a performance measure and actual rotational speed. For an SSD, the number is to be treated as a relative performance benchmark that takes into account in I/O per second, bandwidth, and the access time.

12.2.2 Viewing Port Statistics

- ▶ To view port statistics, issue the `statport` command.

By default, only statistics for data transfers are displayed. You can optionally display statistics for control transfers or both data and control transfers by issuing the `statport -ctl` or `statport -both` command, respectively.

Data output can be further refined to display only port statistics from:

- ◆ specific nodes.
- ◆ specific PCI slots.
- ◆ specific ports.
- ◆ host-connected (target) ports.
- ◆ disk-connected (initiator) ports.
- ◆ Fibre Channel ports (for 3PAR Remote Copy).
- ◆ Ethernet ports (for 3PAR Remote Copy).

You can use additional filters to refine the data output. Refer to the *InForm OS Command Line Reference* for complete details about `statport` command options and for sample command data output.

12.2.3 Viewing VLUN Statistics

- ▶ To view VLUN statistics, issue the `statvln` command.

The data output can be further refined to display only VLUN statistics from:

- ◆ specific domains.
- ◆ specific hosts.
- ◆ specific virtual volumes.
- ◆ specific LUNs.
- ◆ ports from specific nodes, slots, or ports.

You can use additional filters to refine the data output. Refer to the *InForm OS Command Line Reference* for complete details about `statvln` command options and for sample command data output.

12.2.4 Viewing Virtual Volume Statistics



NOTE: Virtual volumes may be accessed externally by hosts and internally by the system prefetcher. When viewing virtual volume I/O statistics, the information provided by the InForm CLI includes access by the prefetcher. To see only external I/O statistics, view the VLUN statistics for a specific virtual volume/host combination.

- ▶ To view virtual volume statistics, issue the `statvv` command.

By default, statistics for virtual volume read and write operations are displayed together. You can optionally display statistics for volume reads and writes separately by issuing the `statvv -rw` command.

You can use additional filters to refine the data output. Refer to the *InForm OS Command Line Reference* for complete details about `statvv` command options and for sample command data output.

12.2.5 Viewing Statistics for Data Cache Memory

- ▶ To view data cache memory statistics, issue the `statcmp` command.

By default, data cache memory statistics are displayed by node. You can optionally display data cache memory statistics by virtual volume by issue the `statcmp -v` command.

You can use additional filters to refine the data output. Refer to the *InForm OS Command Line Reference* for complete details about `statcmp` command options and for sample command data output.

12.2.6 Viewing Statistics for CPU Usage

- To view statistics for CPU usage from all nodes, issue the `statcpu` command.

Refer to the *InForm OS Command Line Reference* for complete details about `statcpu` command options and for sample command data output.

12.3 Viewing Histograms

This section provides instructions on using commonly used CLI commands to access histogram data on system resources. The commands described here are a subset of the histogram commands available. For a complete list of histogram commands, see the *InForm OS Command Line Interface Reference*.

Histogram data can be viewed for the following resources:

- chunklets
- logical disks
- physical disks
- ports
- VLUNs
- virtual volumes

12.3.1 Viewing Histograms for Chunklets



NOTE: The `setstatch` command must be issued to enable statistics collection on chunklets before chunklet histogram data can be viewed.

- To view histogram data for chunklets, issue the `histch` command.

Several filters are provided to refine the data output to display only data from specific chunklets and logical disks,. Additional filters are provided to customize the way the histogram data is displayed. Refer to the *InForm OS Command Line Reference* for complete details about `histch` command options and for sample command data output.

12.3.2 Viewing Histograms for Logical Disks

- ▶ To view histogram data for logical disks, issue the `histld` command.

The `histld` command provides filters to refine the data output to display only data from logical disks mapped to specific virtual volumes. Additional filters are provided to customize the way the histogram data is displayed. Refer to the *InForm OS Command Line Reference* for complete details about `histld` command options and for sample command data output.

12.3.3 Viewing Histograms for Physical Disks

- ▶ To view histogram data for physical disks, issue the `histpd` command.

Histogram data output can be further refined to display physical disk data from:

- ◆ a specific physical disk by either its ID or WWN.
- ◆ specific nodes.
- ◆ specific PCI slots.
- ◆ specific ports.

You can use additional filters to customize the way the histogram data is displayed. Refer to the *InForm OS Command Line Reference* for complete details about `histpd` command options and for sample command data output.



NOTE: The Device Speed number does not represent a rotational speed for Solid State Drives (SSD) without spinning media. It is meant as a rough estimation of the performance difference between the drive and the other drives in the system. For FC and NL drives, the number corresponds to both a performance measure and actual rotational speed. For an SSD, the number is to be treated as a relative performance benchmark that takes into account in I/O per second, bandwidth, and the access time.

12.3.4 Viewing Histograms for Ports

- To view histogram data for ports, issue the `histport` command.

By default, only histogram data for data transfers are displayed. You can optionally display histogram data for control transfers or both data and control transfers by issuing the `histport -ctl` or `histport -both` command, respectively.

Histogram data output can be further refined to display only port data from:

- ◆ specific nodes.
- ◆ specific PCI slots.
- ◆ specific port slots.
- ◆ host-connected (target) ports.
- ◆ disk-connected (initiator) ports.
- ◆ Fibre Channel ports (for 3PAR Remote Copy).
- ◆ Ethernet ports (for 3PAR Remote Copy).

You can use additional filters to refine the histogram data output and specify how that data is displayed. Refer to the *InForm OS Command Line Reference* for complete details about `histport` command options and for sample command data output.

12.3.5 Viewing Histograms for VLUNs

- To view histogram data for VLUNs, issue the `histvlun` command.

Histogram data output can be further refined to display only VLUN data from:

- ◆ specific domains.
- ◆ specific hosts.
- ◆ specific virtual volumes.
- ◆ specific LUNs.
- ◆ ports from specific nodes, slots, or ports.

You can use additional filters to refine the histogram data output and specify how that data is displayed. Refer to the *InForm OS Command Line Reference* for complete details about `histvlun` command options and for sample command data output.

12.3.6 Viewing Histograms for Virtual Volumes

- ▶ To view histogram data for virtual volumes, issue the `histvv` command.

You can use additional filters to refine the histogram data output and specify how that data is displayed. Refer to the *InForm OS Command Line Reference* for complete details about `histvv` command options and for sample command data output.

13

Managing Tasks

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13.4.6 Removing Scheduled Tasks

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The purpose of this chapter is to explain how manage and schedule long-running system tasks.

13.1 Overview

Some InServ Storage Server operations with long running times can be managed as system tasks and initiated at scheduled times. The larger your system, the longer some CLI command operations take to complete. With the task manager you can pause, cancel, or remove tasks running on the system. The System Scheduler allows you to create, modify, and remove schedules for initiating tasks.

The group of CLI commands that can be managed with the task manager CLI commands is different from the group of CLI commands that can be scheduled with the System Scheduler commands. For example, the `tunevv` command can be managed as a task but the `tunevv` command cannot be scheduled with the System Scheduler commands.

- See [Table 13-1](#) for a complete list of the task manager commands.
- See [Table 13-2](#) for a complete list of the commands that can be managed with the task manager commands.
- See [Table 13-3](#) for a complete list of the System Scheduler commands.
- See [Table 13-4](#) for a complete list of the commands that can be scheduled with the System Scheduler commands.

13.2 Task Manager

With the task manager CLI commands you can display, cancel, or remove tasks running on the system.

Tasks are created in one of two ways:

- by a user or script issuing certain InForm CLI commands, such as the `tunevv` command.
- by the system initiating certain automated or scheduled processes, such as the periodic resynchronization of remote copy volumes groups.

13.2.1 Task IDs

Each task is identified by a task ID. When a task is started with the InForm CLI, the system displays the task ID as part of the command output. For example, when you issue the `tunevv` command with the InForm CLI, a task is started in order to track the progress of the `tunevv` operation. The task ID is indicated in the output for the `tunevv` command. In the following example Task 454 is started as part of the `tunevv` operation.

```
cli% tunevv usr_cpg testcpg testvol  
Task 454 started
```

Use the CLI `showtask` command to display the task IDs. For information about displaying task IDs in the system, see [13.2.4 Displaying Task Information](#).

13.2.2 Task Manager Commands

You can use the task manager commands to display, cancel, and remove tasks running on the system. See [Table 13-1](#) for a list of the InForm CLI task manager commands.

Table 13-1. Task Manager Commands

Command	Description	Privilege Level
<code>canceltask</code>	Cancel one or more tasks.	Super, Edit
<code>removetask</code>	Remove information about one or more tasks and their details.	Super, Edit, Service
<code>showtask</code>	Display information about tasks on the system.	Super, Edit, Browse, Service
<code>starttask</code>	Start a CLI command that runs as a background task.	Super, Service
<code>waittask</code>	Ask the CLI to wait for a task to complete before proceeding.	Super, Edit, Browse, Service

For a complete list of options available for the CLI task manager commands, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

13.2.3 Starting a Task

You can use the `starttask` command to start a CLI command that runs as a `background_command` task type. The `background_command` manages CLI commands with long running times in the background so that tasks can run concurrently. The `background_command` task type can be managed with the task manager commands.

- See [Table 13-1](#) for a complete list of the task manager commands.
- See the `background_command` task type in [Table 13-2](#) for a list of the commands that can be run by the `starttask` command.

If the command running as a `background_command` requires user confirmation, you must force the command with the `-f` option.

- ▶ To start a `background_command` task, issue the `starttask <command_name>` command, where:
 - ◆ `<command_name>` is the name of the CLI command to run as a `background_command`.

For a complete list of options available for the `starttask` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

13.2.4 Displaying Task Information

Once a task is started, you can use the task ID to obtain information about the task. To see a list of all tasks that have been active within the last 24 hours, you can use the `showtask` command without specifying a task ID. For example:

```
cli% showtask
Id  Type  Name  Status  Phase  Step  -----Start_Time-----  -----Finish_Time-----
1  vv_copy  vv1a  done    0/0    0/0  Wed Oct 06 18:44:05 EDT 2004  Wed Oct 06 18:44:57 EDT 2004
2  vv1b  vv_copy  active  2/3    0/8  Wed Oct 06 19:44:34 EDT 2004  --
```

All tasks are displayed by their task IDs, including active and completed tasks. The system stores information for up to 1,000 tasks. You can use the `showtask -t <hours>` command to show tasks older than 24 hours.

You can use the `showtask -d` command and the task ID to display status information about a specific ongoing or completed task. Task 454 is shown in the following example:

```
cli% showtask -d 454
Id    Type    Name  Status  Phase  Step  -----StartTime-----  -----FinishTime-----
454  tune_vv  testvol  done    0/0    0/0  Fri Apr 29 11:42:06 PDT 2005  Fri Apr 29 11:42:19 PDT 2005

Detailed status:
(...)
```

The columns in the example above are identified as follows:

- **Id** - The task ID for the displayed task.
- **Type** - The task type. Task types are explained in [13.3 Task Types](#) on page 13.9.
- **Name** - The name of the system object that is being operated on. When there are multiple objects, those objects are not identified individually but as a group (for example, multiple `lds` or multiple `cpgs`).
- **Status** - The task state. Task states are as follows:

- ◆ **done** - The task has completed successfully.
- ◆ **active** - The task is still in process.
- ◆ **cancelled** - The task was cancelled by the user.
- ◆ **failed** - The task failed to complete due to a reason other than user cancellation.
- **Phase** - For active tasks, indicates the number of completed phases and the total number of phases in the current step, using the format `<#completed_phase>/<#total_phases>`. See individual task type descriptions for an indication of the number of phases for all tasks of that type.
- **Step** - For active tasks, indicates the number of completed steps and the total number of steps in the current task, using the format `<#completed_step>/<#total_steps>`. For most task types, the total steps is equal to the number of regions in the operation. See individual task type descriptions for step definitions.
- **Start Time** - Indicates the time at which the task was started.
- **Finish Time** - For done, cancelled, and failed tasks, indicates the time at which the task stopped due to completion, cancellation, or failure.

Use the `showtask -t` option to see older tasks. For a complete list of options available for the `showtask` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

13.2.5 Waiting for Tasks

You can use the task ID and the `waittask` command to ask the system to wait for a task to complete before returning a command prompt. This prevents you from running too many tasks at once. If you use the `waittask -v` option the command displays detailed task status as the task executes, and then return after it completes. For example:

```
cli% waittask -v 454
```

```
Id Type Name Status Phase Step -----StartTime----- -----FinishTime--
454 tune_vv testvol Active 2/3 0/4 Fri Apr 29 11:42:06 PDT 2005
```

Detailed status:

```
{Fri Apr 29 11:42:06 PDT 2005} Created task.
{Fri Apr 29 11:42:06 PDT 2005} Tuning VV 'testvol'.
{Fri Apr 29 11:42:06 PDT 2005} Scheduled region move of 256MB from
(testvol.usr.1:0MB) to (testvol.usr.2:0MB).
{Fri Apr 29 11:42:06 PDT 2005} Scheduled region move of 256MB from
(testvol.usr.0:0MB) to (testvol.usr.3:0MB).
{Fri Apr 29 11:42:06 PDT 2005} Scheduled region move of 256MB from
(testvol.usr.1:256MB) to (testvol.usr.2:256MB).
{Fri Apr 29 11:42:06 PDT 2005} Scheduled region move of 256MB from
(testvol.usr.0:256MB) to (testvol.usr.3:256MB).
{Fri Apr 29 11:42:06 PDT 2005} Storing task data for later restarts.
{Fri Apr 29 11:42:06 PDT 2005} Started region move of 256MB from
(testvol.usr.1:0MB) to (testvol.usr.2:0MB).
{Fri Apr 29 11:42:06 PDT 2005} Started region move of 256MB from
(testvol.usr.0:0MB) to (testvol.usr.3:0MB).
{Fri Apr 29 11:42:06 PDT 2005} Started region move of 256MB from
(testvol.usr.1:256MB) to (testvol.usr.2:256MB).
{Fri Apr 29 11:42:06 PDT 2005} Started region move of 256MB from
(testvol.usr.0:256MB) to (testvol.usr.3:256MB).
{Fri Apr 29 11:42:19 PDT 2005} Completed region move of 256MB from
(testvol.usr.1:256MB) to (testvol.usr.2:256MB) in 13 seconds.
{Fri Apr 29 11:42:19 PDT 2005} Completed region move of 256MB from
(testvol.usr.1:0MB) to (testvol.usr.2:0MB) in 13 seconds.
{Fri Apr 29 11:42:19 PDT 2005} Completed region move of 256MB from
(testvol.usr.0:0MB) to (testvol.usr.3:0MB) in 13 seconds.
{Fri Apr 29 11:42:19 PDT 2005} Completed region move of 256MB from
(testvol.usr.0:256MB) to (testvol.usr.3:256MB) in 13 seconds.
{Fri Apr 29 11:42:19 PDT 2005} Waiting to switch regions to their new locations.
{Fri Apr 29 11:42:19 PDT 2005} Switching regions to their new locations.
{Fri Apr 29 11:42:19 PDT 2005} Reclaiming unused LD space.
{Fri Apr 29 11:42:19 PDT 2005} Deleted LD testvol.usr.1.
{Fri Apr 29 11:42:19 PDT 2005} Deleted LD testvol.usr.0.
{Fri Apr 29 11:42:19 PDT 2005} Cleaning up task data for later restarts.
{Fri Apr 29 11:42:19 PDT 2005} Completed region moves. Moved 4 regions for a total
of 1024 MB in 13 seconds.
```



NOTE: To cancel the `waittask` command, use `CTRL+C`. This stops the `waittask` command and returns a command prompt, but does not affect the task that is running in the background.

13.2.6 Removing a Task

The `removetask` command only works on completed, failed, and cancelled tasks. Information about a task remains on the system unless it is manually removed using the `removetask` command and the task ID. For example:

```
cli% removetask 454  
Remove the following tasks?  
454  
select q=quit y=yes n=no: y
```

The specified task ID and any information associated with it are removed from the system. However, task IDs are not recycled, so the next task started on the system will use the next whole integer that has not already been used (for example, 455). Task ID numbers roll over at 9999.

13.2.7 Canceling a Task

For all task types except `remote_copy_sync`, `scheduled_task`, `snapspace_accounting`, `background_command`, and `system_task` you can cancel an active task using the `canceltask` command and the task ID. For example:

```
cli# canceltask <task_ID>  
select q=quit y=yes n=no: y
```

Information for the task will still be available with the `showtask` command, where the status of the task will now appear as `Cancelled`.

13.3 Task Types

See [Table 13-2](#) for a list of all task types and the their associated operations. The table also includes information about the CLI commands associated with each operation. For a complete list of options available for the CLI commands listed in [Table 13-2](#), see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

Table 13-2. Task Types by Operation and Command

Task Type	Operation (Feature or Product)	Commands	Description
background_ command	The starttask CLI command.	creategroupsv createsv moverelocpd removevv updatevv upgradecage upgradedpd	Tracks commands initiated by the starttask CLI command.
compact_cpg	Reclaiming logical disk space.	compactcpg	Compacts a CPG to reclaim reduce the number of logical disks.
compact_lds	Reclaiming logical disk space.	compactld	Compacts unused logical disk regions mapped to virtual volumes.
vv_copy	Physical Copy.	createvvcopy	Copies a virtual volume.

Table 13-2. Task Types by Operation and Command (*continued*)

Task Type	Operation (Feature or Product)	Commands	Description
<code>promote_sv</code>	Virtual copy promote (3PAR Virtual Copy) (3PAR Remote Copy).	<code>promotesv</code>	Copies the differences of a virtual copy back to its base volume.
<code>remote_copy_sync</code>	Remote copy volume synchronization (3PAR Remote Copy).	<code>startrcopygroup</code>	Starts a remote copy volume group and synchronizes the primary and secondary groups.
<code>remote_copy_sync</code>	Remote copy volume synchronization (3PAR Remote Copy).	<code>syncrcopy</code>	Synchronizes remote copy volume groups.
<code>tune_vv</code>	Tuning virtual volumes (3PAR Dynamic Optimization).	<code>tunevv</code>	Changes the layout of the user space of an existing virtual volume.
<code>tune_vv_restart</code>	Restart tuning virtual volumes (3PAR Dynamic Optimization).	<code>tunevv restart</code>	Restarts a <code>tunevv</code> operation that was previously interrupted.
<code>tune_vv_rollback</code>	Rollback tuning virtual volumes (3PAR Dynamic Optimization).	<code>tunevv rollback</code>	Rolls back a <code>tunevv</code> operation that was previously interrupted.

Table 13-2. Task Types by Operation and Command (*continued*)

Task Type	Operation (Feature or Product)	Commands	Description
tune_sd	Change the layout of a virtual volume (3PAR Dynamic Optimization)	tunevv snp _cpg	Moves the logical disks used for the volume's snapshot space to the specified CPG.
scheduled_task	System scheduler	checkhealth compactcpg compactld createsv creategroupsv createevcopy creategroupvvcopy moverelocpd removevv syncrcopy tunepd tunevv updatesnapspace updatevv	Schedules when to initiate specified CLI commands.
snapspace_accounting	Refresh the snapshot space usage information.	updatesnapspace	Track progress of the snapshot space usage accounting process.
system_task	Tasks initiated by the 3parsvc user.	moverelocpd removevv	Tracks housekeeping tasks periodically run by the InServ storage server.

Specific system tasks require the following licenses:

- The `promote_sv` task type requires the 3PAR Virtual Copy license.
- The `remote_copy_sync` task types require the 3PAR Remote Copy license.
- The `tune_vv` task types require the 3PAR Dynamic Optimization license.
- The `tune_sd` task type requires the 3PAR Dynamic Optimization license.



NOTE: Contact your 3PAR representative for more information about 3PAR licenses.

13.3.1 background_command

The `background_command` task type tracks commands initiated by the `starttask` CLI command. The `background_command` task type has only one phase and one step.

- See the `background_command` task type in [Table 13-2](#) for a list of the commands that can be run by the `starttask` command.
- See [13.2.3 Starting a Task](#) for more information about the `starttask` command.

13.3.2 compact_cpg

The `compact_cpg` task type tracks the operations of the `compactcpg` command. For more information about compacting CPGs, see [16.9 Compacting Common Provisioning Groups](#). The `compact_cpg` task type has only one phase, and the number of steps is equal to the number of logical disk regions to be moved.

13.3.3 compact_lds

The `compact_lds` task type tracks the operations of the `compactlds` command. For more information about compacting logical disks, see [16.8 Compacting Logical Disks](#). The `compact_lds` task type has only one phase, and the number of steps is equal to the number of logical disk regions to be moved.

13.3.4 vv_copy

The `vv_copy` task type is used to track physical copy operations. This includes creating physical copies and resynchronizing a physical copy with its parent base volume.

You can create physical copies using the `createvvcopy` command (see the *InForm OS Command Line Interface Reference* for details).

You can resynchronize a physical copy using the `createvvcopy` command with the `-r` (resync) option (see [8.3.2 Resynchronizing a Physical Copy](#) on page 8.7 for details).

For `vv_copy` tasks, there is only one phase. The number of steps in that phase is equal to the number of Gigabytes being copied.

13.3.5 promote_sv

The `promote_sv` task type is used to track virtual copy snapshot promote operations. Promoting a virtual copy snapshot copies the differences of the virtual copy back to its base volume. You can promote a virtual copy snapshot using the `promotesv` command (see the [8.2.2 Promoting a Virtual Copy](#) on page 8.3 for details). In addition, virtual copy snapshots may be automatically promoted by systems using 3PAR Remote Copy, for example when issuing the `setrcopytarget reverse` or `setrcopygroup target` commands on a primary storage system or a system with primary groups in order to reverse targets. Use of Remote Copy requires a 3PAR Remote Copy license.

For `promote_sv` tasks, there is only one phase. The number of steps in that phase is equal to the number of Gigabytes being copied.



NOTE: The `promote_sv` task type requires the 3PAR Virtual Copy license.

13.3.6 remote_copy_sync

The `remote_copy_sync` task type is used to track remote copy volume synchronizations on systems using 3PAR Remote Copy. 3PAR Remote Copy is an optional volume mirroring solution that can be used for disaster recovery and backup. The system creates a separate task for each primary volume undergoing synchronization.

You can initiate Remote Copy volume synchronizations manually by issuing CLI commands, or it can be performed automatically by the system. For instance, you can manually synchronize remote copy volume groups using the `syncrcopy` command. Restarting remote copy volume

groups using the `startcopygroup` command can also initiate a remote copy synchronization on the system. However, note that with periodic mode volume groups the `startcopygroup` command will only initiate synchronization the first time that it is issued for that volume group. In addition, periodic mode remote copy volume groups may be automatically resynchronized by systems using 3PAR Remote Copy, but only if the resynchronization period has been set for the volume groups.

For `remote_copy_sync` tasks, there are three phases:

- Phase 1 (startup): sync request has been received and synchronization is scheduled to start.
- Phase 2: performing the resynchronization.
- Phase 3: copying has completed and cleanup (such as deleting snapshots and setting state values) is taking place.

In the `showtask` output, the `Step` column indicates the completed and total volume size, in MBs, using the format `<completed_size>/<total_size>`.

Note that for remote copy synchronizations, in the `showrcopy` output, the finish time for the resynchronization task may not match the **LastSync** column in the `showrcopy` command output for the system holding the primary volumes. This is because the times are taken at different points. The task time is set by the task subsystem when it is marked as `completed`, whereas the `LastSync` time is set when remote copy completes the sync. These two times should be similar, but may differ by up to a few seconds.

You cannot use the `canceltask` command to cancel a remote copy synchronization task.

For details about volume synchronizations and remote copy commands, see the *Remote Copy User's Guide*.



NOTE: The `remote_copy_sync` task type requires the 3PAR Remote Copy license. The `tunevv` CLI command requires the 3PAR Dynamic Optimization license.

13.3.7 tune_vv

The `tune_vv` task type is used to track `tunevv` operations performed with the 3PAR System Tuner `tunevv` command. The 3PAR System Tuner is an optional InForm OS feature that allows you to identify over-used physical disks as candidates for load balancing and perform load balancing on them. The `tunevv` command enables you to perform load balancing and to dynamically change certain volume parameters.

You can suspend an active `tune_vv` task using the `canceltask` command and the task ID as follows:

```
cli# canceltask <task_ID>
select q=quit y=yes n=no: y
```

After cancelling the task, you can perform one of two additional operations:

- You can restart the `tunevv` operation by using `tunevv restart` command. This starts a `tunevv_restart` task.
- You can completely reverse the `tunevv` operation by using `tunevv rollback` command. This starts a `tune_vv_rollback` task.

For `tune_vv` tasks, there are three phases:

- Phase 1: storing away region move information for future restarts and/or rollbacks.
- Phase 2: performing the actual region moves.
- Phase 3: deleting the information stored in Phase 1.

The number of steps in the phase is equal to the number of regions being moved.

For more information about the 3PAR System Tuner and the `tunevv` command, see [Chapter 16, Performance Tuning](#).



NOTE: The `tune_vv` task type and `tunevv` CLI command require the 3PAR Dynamic Optimization license.

13.3.8 tune_vv_restart

The `tune_vv_restart` task type is used to track `tunevv restart` operations performed with the 3PAR System Tuner `tunevv restart` command. The `tunevv restart` command enables you to resume a failed or cancelled `tunevv` operation.

The following examples shows how to start, cancel, and then restart a `tunevv` operation on virtual volume `testvol`:

```
cli% tunevv -t r5 -ha mag testvol
Task 1 started.

cli% canceltask 1
Are you sure you want to cancel task 1?
select q=quit y=yes n=no: y

cli% tunevv -restart testvol
Task 2 started.
```

Note that the `tune_vv_restart` task is a new task and takes a new task ID number.

After restarting the `tunevv` operation, you can use the `showtask` command to see the cancelled and restarted tasks:

```
cli% showtask
Id Type      Name      Status Phase Step -----Start_Time----- -----Finish_Time-----
1 tune_vv    testvol  cancelled  2/3  8/8  Thu Oct 07 19:55:33 EDT 2004 Thu Oct 07 19:56:54 EDT 2004
2 tune_vv_restart testvol  active   1/2  0/8  Thu Oct 07 19:57:23 EDT 2004 -
```

For `tune_vv_restart` tasks, there are two phases:

- Phase 1: performing the actual region moves.
- Phase 2: deleting the information stored in Phase 1 of the corresponding `tune_vv` task.

The number of steps in the phase is equal to the number of regions being moved.

For more information about the 3PAR System Tuner and the `tunevv` command, see [Chapter 16, Performance Tuning](#).



NOTE: The `tune_vv` task type and `tunevv` CLI command require the 3PAR Dynamic Optimization license.

13.3.9 tunevv_rollback

The `tune_vv_rollback` task type is used to track `tunevv rollback` operations performed with the 3PAR System Tuner `tunevv rollback` command. The `tunevv rollback` command enables you to reverse any changes that resulted from a previously interrupted `tunevv` operation.

The following examples shows how to start, cancel, and then rollback a `tunevv` operation on virtual volume `testvol`:

```
cli% tunevv -t r5 -ha mag testvol
Task 3 started.

cli% canceltask 1
Are you sure you want to cancel task 3?
select q=quit y=yes n=no: y

cli% tunevv -rollback testvol
Task 4 started.
```

Note that the `tune_vv_rollback` task is a new task and takes a new task ID number.

You cannot start a `tune_vv_rollback` task for a `tunevv` operation that completed successfully. The following error message appears:

```
cli% tunevv -rollback testvol2
Are you sure you want to rollback the tune process for VV 'testvol2' ?
select y=yes n=no: y
Command failed
error: No restart state for VV testvol2.
```

For `tune_vv_rollback` tasks, there are two phases:

- Phase 1: performing the actual region moves.
- Phase 2: deleting the information stored in Phase 1 of the corresponding `tune_vv` task.

The number of steps in the phase is equal to the number of regions being moved.

For more information on 3PAR System Tuner and the `tunevv` command see [Chapter 16, Performance Tuning](#), and the *InForm OS Command Line Interface Reference*.

For more information about the 3PAR System Tuner and the `tunevv` command, see [Chapter 16, Performance Tuning](#).



NOTE: The `tune_vv` task type and `tunevv` CLI command require the 3PAR Dynamic Optimization license.

13.3.10 `tune_sd`

The `tune_sd` task type is used to track the movement of the logical disks used for the volume's snapshot space to the specified CPG. Changing the layout of a virtual volume with the `tunevv` commands requires the 3PAR Dynamic Optimization license. For more information about tuning virtual volumes, see [16.2 Dynamic Optimization](#).

For `tune_sd` tasks, there are three phases:

- Phase 1: storing away region move information for future restarts and/or rollbacks.
- Phase 2: performing the actual region moves.
- Phase 3: deleting the information stored in Phase 1.

The number of steps in the phase is equal to the number of regions being moved.

13.3.11 `scheduled_task`

The `scheduled_task` task type is used to track system operations initiated by the System Scheduler commands. See [Table 13-3](#) for a complete list of the System Scheduler commands. See [Table 13-4](#) for a complete list of the CLI commands that can be initiated with the System Scheduler commands. The `scheduled_task` task type has only one phase and one step.



NOTE: Only users with super level privileges can use the `canceltask` CLI command with the task type `scheduled_task`.

13.3.12 `snapspace_accounting`

The `snapspace_accounting` task type tracks the progress of the snapshot space usage accounting process and runs the `updatesnapspace` command. The snapshot space usage displayed by `showvv -s` is not necessarily the current usage. You have to run another command `showvv -hist` to see when To display the last time `updatesnapspace` was run on the

virtual volumes, run the `showvv -hist` command. The `TimeCalculated` column shows the last time the usage was last calculated. The `updatesnapspace` command causes the system to start calculating current snapshot space usage. If one or more virtual volume names or patterns are specified, only the specified virtual volumes are updated. If no virtual volume names are specified, all virtual volumes are updated.

This command immediately returns the task ID associated with the updated snapshot space usage accounting process. The `canceltask` command cannot be used to cancel the `snapspace_accounting` task type. To wait for completion, use the `waittask` command. The `snapspace_accounting` task type has only one phase, and the number of steps is equal to the number of virtual volumes affected by the `updatesnapspace` command.

13.3.13 system_task

The `system_task` task type tracks the housekeeping tasks periodically run by the InServ storage server. You can display any active housekeeping tasks with the `showtask -all` command. Only the `3parsvc` user can run, change, or remove these tasks.

CLI housekeeping tasks and commands:

- The `move_back_chunklet` runs the `moverelocpd` command.
- The `remove_expired_vvs` runs the `removevv` command.

The `system_task` task type has only one phase and one step.

13.4 System Scheduler

The System Scheduler allows you to create, modify, and remove schedules for initiating system operations with long running times. With the System Scheduler commands you can schedule specific CLI commands to run at regularly scheduled intervals, or to run once at a specified time.

13.4.1 System Scheduler Commands

Table 13-3 summarizes the System Scheduler commands.

Table 13-3. System Scheduler Commands

Command	Description	Privilege Level
showsched	Show the state of tasks currently scheduled on the system.	Super, Service
createsched	Create tasks to be initiated by the System Scheduler.	Super, Service
setsched	Modify tasks started by the System Scheduler.	Super, Service
removesched	Remove tasks initiated by the System Scheduler from the system.	Super, Service

Only the following commands can be scheduled with the System Scheduler commands:

Table 13-4. Commands Initiated by the System Scheduler

Command	Description	Privilege Level
checkhealth	Displays the status of the system hardware and software components.	Super, Service
compactcpg	Consolidates logical disk space in a CPG into as few logical disks as possible, allowing unused logical disks to be removed.	Super, Edit

Table 13-4. Commands Initiated by the System Scheduler

Command	Description	Privilege Level
<code>compactld</code>	Consolidates space on the logical disks.	Super, Edit
<code>creategroupsv</code>	Creates consistent group virtual copies or <i>snapshots</i> of a list of virtual volumes.	Super, Edit
<code>creategroupvvcopy</code>	Creates consistent group physical copies of a list of virtual volumes.	Super, Edit
<code>createsv</code>	Creates a virtual copy or snapshot of a virtual volume.	Super, Edit
<code>createvvcopy</code>	Creates a physical copy of a virtual volume.	Super, Edit
<code>moverelocpd</code>	Relocates chunklets to specified physical disks.	Super, Service
<code>removevv</code>	Removes virtual volumes from the system.	Super, Edit
<code>syncrcopy</code>	Synchronizes Remote Copy volume groups.	Super, Edit
<code>tunepd</code>	Displays physical disks with high service times and optionally performs load balancing.	Super, Edit
<code>tunevv</code>	Changes the layout of a virtual volume.	Super, Edit

Table 13-4. Commands Initiated by the System Scheduler

Command	Description	Privilege Level
updatesnapspace	Updates the snapshot space actually used by a virtual volume. This task cannot be cancelled.	Super, Edit
updatevv	Updates a snapshot virtual volume with a new snapshot.	Super, Edit

The `canceltask` command cannot be used with the CLI commands initiated by the System Scheduler commands. The task type `scheduled_task` can be canceled with the `canceltask` command by users with super level privileges. The following task manager commands can be used on CLI command operations initiated by the System Scheduler with the task type `scheduled_task`:

- `showtask`
- `waittask`
- `removetask`

For more information about the task manager commands, see [13.2.2 Task Manager Commands](#).

13.4.2 Displaying Scheduled Tasks

- ▶ To display all scheduled user and system tasks, issue the `showsched -all` command.
- ▶ To display specific scheduled tasks, issue the `showsched <schedule_name> | <pattern>` command, where:
 - ◆ `<schedule_name>` is the name of the schedule to display.
 - ◆ `<pattern>` displays all schedules that match the pattern.

For a complete list of options available for the `showsched` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

13.4.3 Scheduling Tasks

- ▶ To create a scheduled task, issue the `createsched <command> <task_schedule> <schedule_name>` command, where:
 - ◆ `<command>` is the name of the CLI command to be initiated. The CLI command must be one of the commands listed in [Table 13-4](#).
 - ◆ `<task_schedule>` is a crontab-style argument that specifies when the CLI command is initiated. You can use the minute, hour, day-of-month, month, and day-of-week format or use one of the special entrees to schedule when the CLI command is initiated.
 - ◆ `<schedule_name>` specifies the name of the schedule.

For a complete list of options available for the `createsched` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

13.4.4 Modifying a Scheduled Task

- ▶ To change the name of a scheduled task or change when the task is initiated, issue the `setsched -s <new_schedule> -name <new_name> <schedule_name>` command, where:
 - ◆ `<new_schedule>` is a crontab-style argument that changes when the schedule is initiated. You can use the minute, hour, day-of-month, month, and day-of-week format or use one of the special entrees to schedule when the CLI command is initiated.
 - ◆ `<new_name>` is new name to be applied to the existing schedule name.
 - ◆ `<schedule_name>` is the existing schedule name.

13.4.5 Suspending and Resuming Scheduled Tasks

- ▶ To suspend or resume scheduled tasks, issue the `setsched [-suspend | -resume] <schedule_name>` command, where:
 - ◆ `<suspend>` suspends the schedule specified by the schedule name.
 - ◆ `<resume>` resumes the schedule specified by the schedule name.
 - ◆ `<schedule_name>` is the name of the schedule to suspend or resume.



NOTE: You can use the `-suspend_all` and `-resume_all` options in place of the `-suspend` and `-resume` options to suspend or resume all scheduled tasks in the system.

For a complete list of options available for the `setsched` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

13.4.6 Removing Scheduled Tasks

- ▶ To remove scheduled tasks, issue the `removesched <schedule_name> | <pattern>` command, where:

- ◆ `<schedule_name>` is the name of the schedule to remove.
- ◆ `<pattern>` is the name of the pattern according to which schedules are removed.

For a complete list of options available for the `removesched` command, see the *InForm OS Command Line Interface Reference* and InForm CLI Help.

```
removesched [options] <name|pat>
```

Where options are `-pat` and `-f`, without `-pat` the system does not match the pattern but looks for a specific name.

14

Using SNMP

In this chapter

14.1	Overview	14.1
14.2	The 3PAR SNMP Agent	14.2
14.3	Registering an SNMP Manager	14.3
14.3.1	Viewing Registered Managers	14.3
14.3.2	Removing a Manager	14.4
14.3.3	Agent Community Strings	14.4

The purpose of this chapter is to explain how to monitor the InServ Storage Server with SNMP.

14.1 Overview

In addition to managing the InServ storage system with the InForm CLI, the 3PAR InForm OS includes an SNMP agent that allows you to perform some basic management functions via network management software running on a management station. These SNMP management functions require that you have SNMP management software not provided by 3PAR (refer to Chapter 15, *SNMP*, in the *InForm OS Concepts Guide* for information about SNMP).

14.2 The 3PAR SNMP Agent

The 3PAR SNMP agent runs on the InServ Storage Server and provides a management interface to enable other software products to manage 3PAR hardware using SNMP. The 3PAR SNMP agent responds to GET, SET, GETNEXT, and GETBULK SNMP requests and also generates notification messages (*traps*) for critical events (*alerts*) and alert state changes (see Chapter 15, *SNMP*, in the *InForm OS Concepts Guide* for information about requests and traps). These traps include the same information as the alerts described in the *InForm OS Messages and Operator's Guide*.

The 3PAR SNMP agent supports SNMPv2c and SMI-v2 standards, and supports the SNMPv2-MIB and a proprietary 3PAR MIB. Refer to Chapter 15, *SNMP*, in the *InForm OS Concepts Guide* for detailed information about these standards and MIBs.

14.2.1 Locating the 3PAR MIB

The 3PAR MIB is located on the *InForm CLI and SNMP* CD, part number 780-200051.

14.2.2 alertNotify Traps

All alerts generated by the system as well as all alert status change events are translated into alertNotify traps. For all alerts, use the message code provided (e.g., 1703938) to refer to the *InForm OS Messages and Operator's Guide* for instructions on how to handle the alert.



NOTE: If you receive a trap with `messageCode == 1245186`, this is to notify you that an alert has changed state. In order to find out which alert has changed state, you must extract the alert ID from the `id` trap field.

See Chapter 15, *SNMP*, in the *InForm OS Concepts Guide* for additional information about alertNotify traps.

14.3 Registering an SNMP Manager



NOTE: For all InForm CLI commands used in this section, refer to the *InForm OS Command Line Interface Reference* for additional information and examples.

To register the manager with the agent, use the `addsnmpmgr` command followed by the manager's IP address. If you need to use one of the following options, enter it after the command and before the IP address.

- `-p <port_number>` - Specifies the port number where the manager receives traps. The default port 162.
- `-pw <password>` - Specifies the manager's access password, if the manager has one.
- `-r <number>` - Specifies the number of times the system will attempt to resend the trap if the manager is not available. You can specify from 1 to 15 retries. The default is 2.
- `-t <seconds>` - Specifies the number of seconds to wait between retries. You can set this timeout from 1 to 300 seconds. The default is 200.



NOTE: The InForm OS supports a maximum of 10 registered SNMP managers.

14.3.1 Viewing Registered Managers

Use the InForm CLI command `showsnmpmgr` to see which managers are already registered with the SNMP agent.



NOTE: If the manager that monitors the storage server has changed, you need to remove the old manager and register the new one.

14.3.2 Removing a Manager

To remove a manager from the agent's list of registered managers, thus preventing that manager from receiving traps, use the `removesnmpmgr` command. If there is more than one manager running on the same server, you can distinguish between them with the `-p` option followed by the port to which the manager is listening. Follow the command (and the option and its argument, if necessary) with the IP address of the manager's server. Refer to the *InForm OS Command Line Interface Reference* for more information about this command.

14.3.3 Agent Community Strings

In order for the SNMP Manager to communicate with the 3PAR SNMP agent, it must pass the agent the correct community string. To do this, the manager needs to know the agent community string. The storage server comes with the single default community string "public" with reading permissions for the agent. You can add read-only and write-only community strings and you can change or remove any of the community strings.

To see what community strings are currently on the system, use the InForm CLI command `showsnmppw`. By default, this command shows the read/write community string. If the community string you are requesting does not exist, you will get an error message.

To add or update a community string, use the `setsnmppw` command followed by the new community string. By default, this command changes the read/write community string.

To remove a community string, use the `removesnmppw` command. Once the community string is removed, the manager can no longer send requests to the SNMP agent. By default, this command removes the read/write community string.

For any of these three InForm CLI commands (`showsnmppw`, `setsnmppw`, and `removesnmppw`), you can follow the command with one or more of the following options to specify which community string the command applies to:

- `-r` for the read-only community string.
- `-w` for the write-only community string.
- `-rw` for the read/write community string.

15

Using mySnapshot

In this chapter

15.1 Overview	15.1
15.2 About mySnapshot	15.2
15.3 Setting Administrative Permissions	15.2
15.4 Replacing Virtual Volume Snapshots	15.3
15.4.1 Replacing a Read-Only Snapshot	15.3
15.4.2 Replacing a Read-Write Snapshot	15.4

The purpose of this chapter is to explain how to use the mySnapshot feature to for development environments.

15.1 Overview

This chapter describes how to use the 3PAR mySnapshot utility. 3PAR mySnapshot enables safe and easy copy and provisioning access to non-storage professionals such as DBAs, software developers, and test engineers working with InServ Storage Servers. Users can safely and easily restore their own copies of test data in seconds without relying on the storage administrator.

15.2 About mySnapshot

mySnapshot is a copy utility that uses an access control list to associate a user with certain administrative permissions and specified storage resources. Once these administrative permissions are granted for the specified resources, the user can easily replace and restore copies of their own test database with the InForm CLI `updatevv` command. This enables users who normally only have `browse` capabilities on the InServ storage system to be able to update specific snapshots with more recent snapshots, a process usually only permitted for users with an `edit` privilege level or higher. This enables faster turnaround times for developers who need to have their snapshots refreshed and alleviates workload for storage administrators.



NOTE: See [4.1 User Accounts](#) on page 4.2 for more information about privilege levels and permissions.

15.3 Setting Administrative Permissions

To enable a user to easily replace and restore copies of a test database using mySnapshot, it is necessary to set administrative permissions for that user. Administrative permissions are set with the InForm CLI `setuseracl` command. In order to use this command, you must have at least an `Edit` privilege level. See [4.1 User Accounts](#) on page 4.2 for additional details.

The following example shows how to set administrative permissions for user `testuser1` to allow `testuser1` to update copies of virtual volumes `test.rw1` and `test.rw2`:

```
cli% setuseracl testuser1 updatevv test.rw1 test.rw2
```

This command sets the access control list (ACL) for user `testuser1`, therefore enabling this user access to the `updatevv` command for the specified volumes only (in this example, `test.rw1` and `test.rw2`). The `updatevv` command is described further in the following section, [15.4 Replacing Virtual Volume Snapshots](#) on page 15.3.



NOTE: In place of the specific virtual volume names used in the above example, it is also possible to specify a pattern. See the *InForm OS Command Line Interface Reference* for additional details.

You can view current administrative permissions for all users with the `showuseracl` command as follows:

```
cli% showuseracl
User           Operation Object_Names_or_Patterns
testuser1      updatevv test.rw1, test.rw2
testuser2      updatevv avvro*
```

15.4 Replacing Virtual Volume Snapshots

A user with the appropriate permissions set (see [15.3 Setting Administrative Permissions](#) on page 15.2) can use the `updatevv` command to replace a copy of a test database.



CAUTION: It may be necessary to unmount the filesystem(s) on the host before replacing snapshots with mySnapshot. In replacing snapshots, the system automatically removes volume exports. Some hosts may not react gracefully when volume exports are unexpectedly removed.

15.4.1 Replacing a Read-Only Snapshot

The following example shows how to replace a read-only snapshot volume with a new read-only snapshot volume.

In this example:

- `test` is a base volume (or a read-write snapshot).
This volume holds the database.
- `test.ro` is a read-only snapshot of `test`.
This snapshot is a read-only copy of the database.
- `testuser1` is a user with `updatevv` privileges for volume `test.ro`
See [15.3 Setting Administrative Permissions](#) on page 15.2 for instructions on setting privileges for this command.
- ▶ When `test.ro` needs to be updated, `testuser1` unmounts the filesystem on the host and then issues the following InForm CLI command to replace `test.ro` with a new read-only copy:

```
cli% updatevv test.ro
```

This command removes `test.ro` and replaces it with a new read-only snapshot of `test`. This new volume is also called `test.ro`.



NOTE: In this example, `test.ro` can have a VLUN associated with it. The command will remember the VLUN, remove the snapshot, create the new snapshot, and re-create the VLUN with the new snapshot.

After the snapshot is replaced, `testuser1` must remount the filesystem on the host.

15.4.2 Replacing a Read-Write Snapshot

The following example shows how to replace a read-write snapshot volume with a new read-write snapshot volume.

In this example:

- `test` is a base volume (or a read-write snapshot).
This volume holds the database.
- `test.ro1` is a read-only snapshot of `test`.
This snapshot is the reference copy of the database.
- `test.rw1` is a read-write snapshot of `test.ro1`.
This is a snapshot of the reference copy of the database, created for development purposes.
- `testuser1` is a user with `updatevv` privileges for volume `test.rw1`.
See [15.3 Setting Administrative Permissions](#) on page 15.2 for instructions on setting privileges for this command.
- When `test.rw1` needs to be restored, `testuser1` unmounts the filesystem on the host and then issues the following InForm CLI command to replace `test` copy `test.rw1` with a new copy:

```
cli% updatevv test.rw1
```

This command removes `test.rw1` and replaces it with a new snapshot of `test.ro1`. This new volume is also called `test.rw1`.



NOTE: In this example, `test.rw1` can have VLUNs associated with it. The command will remember the VLUN, remove the snapshot, create the new snapshot, and re-create the VLUN with the new snapshot.

After the snapshot is replaced, `testuser1` must remount the filesystem on the host.

Note that, in the above example, the replaced copy (`test.rw1`) is a new copy of the database made from the reference copy (`test.ro1`) and not the database itself (`test`).

- To get an up-to-date read-write copy of the original database, `testuser1` must have `updatevv` privileges for volumes `test.rw1` and `test.ro1` and then unmount the filesystem on the host before issuing the following InForm CLI command:

```
cli% updatevv -ro test.rw1
```

This command removes `test.rw1` and `test.ro1` and replaces them with a new read-only snapshot of `test` called `test.ro1` and a new read/write snapshot of `test.ro1` called `test.rw1`. This gives the user an up-to-date read-write copy of the original database by creating a new read-only snapshot of the original in addition to the new read-write copy.



NOTE: In this example, only the read-write snapshot (`test.rw1`) can have a VLUN associated with it. The command will remember the VLUN, remove the snapshot, create the new snapshot, and re-create the VLUN with the new snapshot. However, the read-only parent cannot have any VLUNs. If the read-only parent (`test.ro1`) has any associated VLUNs, this command will fail.

After the snapshot is replaced, `testuser1` must remount the filesystem on the host.

16

Performance Tuning

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The purpose of this chapter is to explain how to modify the layout of virtual volumes and removing unused space from data components.

16.1 Overview

The InForm OS automatically creates a balanced system layout by mapping virtual volumes to many logical disks, and creating logical disks from chunklets drawn from many physical disks. The I/O for each volume is striped across many physical disks, increasing the throughput of the volume. As the system grows and new applications are introduced, new storage usage patterns can emerge and the system performance can degrade.

There are several tools you can use to tune your system for peak performance.

- Optimize virtual volumes with the optional 3PAR Dynamic Optimization feature. The Dynamic Optimization feature uses the `tunevv` command.
- Reclaim unused logical disk and Common Provisioning Group (CPG) space with the compact CLI commands. Compact logical disks with the `compactld` command and CPGs with the `compactcpg` command.
- Tune physical disks with the optional 3PAR System Tuner feature. The System Tuner feature uses the `tunepd` command.

For more information about optimizing your system, see the *3PAR InForm OS Concepts Guide*.

16.2 Dynamic Optimization

3PAR Dynamic Optimization is an optional feature that allows you to improve the performance of virtual volumes without interrupting access. Use this feature to avoid over provisioning for peak system usage by optimizing the layout of your virtual volumes. Dynamic Optimization enables you to change the layout of virtual volumes without interrupting access to the system. This functionality promotes system optimization through improved use of all physical resources present in the system at a given time. In addition, Dynamic Optimization enables you to alter the service levels associated with a given volume by changing volume parameters. You must have a 3PAR Dynamic Optimization license to use this feature and the `tunevv` command.

For example, when an InServ Storage Server is upgraded by adding nodes, cages, or physical disks, the initial volume and logical disk layouts may no longer be optimal for the new system configuration. Dynamic Optimization enables you to change the layout of volumes and use entirely new parameters to take advantage of the current system configuration.

There are four general cases where Dynamic Optimization may be desirable:

- **Volume layout changes after hardware upgrades.** Existing virtual volumes only take advantage of resources that were present at the time of volume creation. When an InServ Storage Server is upgraded by adding nodes, cages, or disks, the original volume and logical disk layouts may no longer be optimal. Changing the layout of a virtual volume enables volumes to take full advantage of new system resources.

By default, Thinly-Provisioned Virtual Volumes (TPVVs) and their underlying Common Provisioning Groups (CPGs) dedicate space from all available resources as they grow, both from pre-existing and new drive capacity resources. This natural expansion capability of TPVVs reduces the need for Dynamic Optimization to change the layout of TPVVs after adding disks.

- **Volume RAID level changes.** Since different RAID levels have varying capacity requirements and offer differing degrees of performance relative to each other, you may desire to convert volumes from one RAID type to another when system requirements change. Volume RAID level changes are non-disruptive.
- **Volume availability level changes.** The availability of a virtual volume determines its level of fault tolerance. For example, a volume with a cage-level availability can tolerate the failure of a drive cage because its RAID sets use chunklets from different drive cages. A volume with a magazine-level availability can tolerate the failure of a drive magazine because its RAID sets use chunklets from different magazines. As applications and business requirements change, it may be desirable to non-disruptively alter the availability characteristics of existing virtual volumes.
- **Volume service level changes.** In addition to non-disruptively altering RAID and availability levels for a given volume or volumes, it may also be useful to change volume parameters such as the disk filtering parameters applied when the volume was created.

Each Dynamic Optimization operation is treated as a task. For information about system tasks, see [Chapter 13, Managing Tasks](#). Eight Dynamic Optimization tasks can run simultaneously. If more than eight Dynamic Optimization tasks are started, task number nine and above are queued until one or more of the initial eight tasks are completed.

16.3 Changing Virtual Volume Layouts

With the `tunevv` command you can change the virtual volume's parameters, RAID levels, set sizes, and disk filters by associating the virtual volume with a new CPG. You must purchase a 3PAR Dynamic Optimization license to use this command.

To change the layout of volumes following a hardware upgrade, perform the following:

- 1 Create a new CPG. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Change the layout of the volume by issuing the `tunevv usr_cpg <CPG_name> <VV_name>` command, where:
 - ♦ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#), indicating the user space of the new CPG will be used.
 - ♦ `<VV_name>` is the volume you are modifying.

16.3.1 Thinly-Provisioned Virtual Volumes

By default, Thinly-Provisioned Virtual Volumes (TPVVs) and their underlying Common Provisioning Groups (CPGs) dedicate space from all available resources as they grow, both from pre-existing and new drive capacity resources. This natural expansion capability of TPVVs reduces the need for changing the layout of TPVVs after adding disks.

To change the layout of TPVVs following a hardware upgrade, perform the following:

- 1 Create a new CPG. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Tune the user space of the volume by issuing the `tunevv usr_cpg <CPG_name> <volume_name>` command, where:
 - ♦ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#), indicating the user space of the new CPG will be used.
 - ♦ `<volume_name>` is the TPVV you are modifying.
- 3 Tune the snapshot space of the volume by issuing the `tunevv snp_cpg <CPG_name> <volume_name>` command, where:
 - ♦ `snp_cpg <CPG_name>` indicates the CPG to where the snapshot space is moved.

- ◆ `<volume_name>` is the TPVV you are modifying.

16.3.2 Fully-Provisioned Virtual Volumes

To change the layout of fully-provisioned virtual volumes following a hardware upgrade, perform the following:

- 1 Create a new CPG. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Tune the user space of the volume by issuing the `tunevv usr_cpg <CPG_name> <volume_name>` command, where:
 - ◆ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#), indicating the user space of the new CPG will be used.
 - ◆ `<volume_name>` is the fully-provisioned virtual volume you are modifying.
- 3 Tune the snapshot space of the volume by issuing the `tunevv snp_cpg <CPG_name> <volume_name>` command.
 - ◆ `snp_cpg <CPG_name>` indicates the CPG to where the snapshot space is moved.
 - ◆ `<volume_name>` is the fully-provisioned virtual volume you are modifying.

16.4 Changing Virtual Volume RAID Types

16.4.1 Thinly-Provisioned Virtual Volumes

To change the RAID type of a TPVV, perform the following:

- 1 Create a new CPG with the RAID type to which you wish to change the volume. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Change the TPVV's RAID type by issuing the `tunevv usr_cpg <CPG_name> <TPVV_name>` command, where:
 - ◆ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#).
 - ◆ `<TPVV_name>` is the TPVV whose RAID type you are changing.

16.4.2 Fully-Provisioned Virtual Volumes

To change the RAID type of a fully-provisioned virtual volume, perform the following:

- 1 Create a new CPG with the RAID type to which you wish to change the volume. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Tune the user space of the volume by issuing the `tunevv usr_cpg <CPG_name> <volume_name>` command, where:
 - ◆ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#), indicating the user space of the new CPG will be used.
 - ◆ `<volume_name>` is the fully-provisioned virtual volume you are modifying.
- 3 Tune the snapshot space of the volume by issuing the `tunevv snp_cpg <CPG_name> <volume_name>` command.
 - ◆ `snp_cpg <CPG_name>` indicates the CPG to where the snapshot space is moved.
 - ◆ `<volume_name>` is the fully-provisioned virtual volume you are modifying.

16.5 Changing Virtual Volume Availability Levels

16.5.1 Thinly-Provisioned Virtual Volumes

To change the volume availability level of a TPVV, perform the following:

- 1 Create a new CPG with the device availability and RAID type to which you wish to change the volume. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Change the TPVV's availability level by issuing the `tunevv usr_cpg <CPG_name> <TPVV_name>` command, where:
 - ◆ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#).
 - ◆ `<TPVV_name>` is the TPVV you are modifying.

16.5.2 Fully-Provisioned Virtual Volumes

To change the volume availability level of a fully-provisioned virtual volume, perform the following:

- 1 Create a new CPG with the device availability and RAID type to which you wish to change the volume. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Change the fully-provisioned virtual volume's availability level by issuing the `tunevv usr_cpg <CPG_name> <volume_name>` command, where:
 - ♦ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#).
 - ♦ `<volume_name>` is the fully-provisioned virtual volume you are modifying.
- 3 Tune the snapshot space of the volume by issuing the `tunevv snp_cpg <CPG_name> <volume_name>` command.
 - ♦ `snp_cpg <CPG_name>` indicates the CPG to where the snapshot space is moved.
 - ♦ `<volume_name>` is the fully-provisioned virtual volume you are modifying.

16.6 Changing Virtual Volume Parameters

16.6.1 Thinly-Provisioned Virtual Volumes

To change the parameters of a TPVV, perform the following:

- 1 Create a new CPG with the parameters you wish to apply to the volume. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Issue the `tunevv usr_cpg <CPG_name> <TPVV_name>` command, where:
 - ♦ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#).
 - ♦ `<TPVV_name>` is the TPVV you are modifying.

16.6.2 Fully-Provisioned Virtual Volumes

To change the parameters of a fully-provisioned virtual volume, perform the following:

- 1 Create a new CPG with the parameters you wish to apply to the volume. See [7.4 Creating a Common Provisioning Group](#) on page 7.6 for instructions.
- 2 Issue the `tunevv usr_cpg <CPG_name> <volume_name>` command, where:

- ◆ `usr_cpg <CPG_name>` is the name of the CPG created previously in [step 1](#).
 - ◆ `<volume_name>` is the fully-provisioned virtual volume you are modifying.
- 3** Tune the snapshot space of the volume by issuing the `tunevv snp_cpg <CPG_name> <volume_name>` command.
- ◆ `snp_cpg <CPG_name>` indicates the CPG to where the snapshot space is moved.
 - ◆ `<volume_name>` is the fully-provisioned virtual volume you are modifying.

16.7 Tracking Dynamic Optimization Progress

While running `tunevv` Dynamic Optimization tasks, you can check the status of each task by issuing the `showtask` command. The output from this command allows you to determine the following:

- The start time, completion time, and date of each task.
- Whether a task has completed or failed.
- The number of phases (processes) involved for each task, and in what phase a specific task is running.
- The number of steps involved for each phase, and on what step a specific task is running.

Issuing the `showtask` command displays tasks started within the last 24 hours.

If you wish to view a task or set of tasks that were started more than 24 hours ago, issue the `showtask -t <hours>` command, where `<hours>` specifies the number of hours to trace back. Refer to the *InForm OS Command Line Interface Reference* for detailed information about this command.

- For more information about running tasks, see [Chapter 13, Managing Tasks](#).

16.7.1 Troubleshooting

When performing a Dynamic Optimization task, errors can occur that can interrupt the task. Depending on the cause of interruption, you can either rollback or restart a Dynamic Optimization task.



NOTE: Rollback and restart operations should not be performed on Thinly-Provisioned Virtual Volumes.

16.7.2 Rolling Back a Dynamic Optimization Operation

Rolling back a Dynamic Optimization task restores a volume to its state prior to the initiation of the task. Essentially, issuing a rollback command performs an undo of the operation. You may choose to roll back a Dynamic Optimization task if the operation was interrupted because of:

- Lack of space.
- User-initiated cancellation of a task.

To perform a rollback operation, perform the following:

- 1 Issue the `canceltask <task_ID>` command, where `<task_ID>` is the ID of the Dynamic Optimization task you wish to cancel. Refer to [Chapter 13, Managing Tasks](#), for information about tasks and viewing tasks.
- 2 Issue the `tunevv rollback <VV_name>` command.

16.7.3 Restarting a Dynamic Optimization Operation

Restarting a Dynamic Optimization task restarts a task that was previously interrupted. You may choose to restart a Dynamic Optimization task if the operation was interrupted because of:

- User-initiated cancellation of a task.
- Component failure.
- ▶ To restart a Dynamic Optimization task, issue the `tunevv restart <VV_name>` command.

16.8 Compacting Logical Disks

Reclaim unused Logical Disk (LD) space with the `compactcpg` command. When multiple identical virtual volumes are created as a result of a single volume creation operation, the underlying logical disks that support those volumes are shared by the volume group. If several of the members of that volume group are later deleted, the underlying logical disks may become less efficient in the usage of space. One or more logical disks shared by the volume group may have only a small portion of their regions mapped to existing virtual volumes. However, their unused regions are not available to the system for use in creating new logical disks. Compacting the logical disk regions mapped to these volumes may recover and free logical disk space. For more information about how the InServ Storage Server manages space usage, see the *3PAR InForm OS Concepts Guide*.

You can compact logical disks for a group of volumes that share logical disks with the `compactld` command. Existing regions on the fragmented logical disks are migrated to new, fully use logical disks and the older ones are deleted so that unused space can be returned to the system's free chunklet pool.

- ▶ To reclaim unused logical disk space from the group of virtual volumes, issue the `compactld <LD_name>` or `compactld -pat <pattern>` command, where:
 - ◆ `<LD_name>` is the name of the LD you wish to compact.
 - ◆ `<pattern>` displays all LDs that match the pattern.

Refer to the *InForm OS Command Line Interface Reference* and CLI Help for detailed information about this command.

16.9 Compacting Common Provisioning Groups

Reclaim unused Common Provisioning Group (CPG) space with the `compactld` command. CPGs provide a shared pool of logical disk capacity for use by all virtual volumes that draw space from that pool. If volumes that draw from a CPG are deleted, or if copy space for these volumes grows and then shrinks, the underlying logical disks in the CPG pool can become less efficient in space usage. Compacting a CPG allows you to reclaim space from a CPG that has become less efficient in space usage from creating, deleting, and relocating volumes. Compacting consolidates logical disk space in CPGs into as few logical disks as possible. For more information about how the InServ Storage Server manages space usage, see the *3PAR InForm OS Concepts Guide*.

- ▶ To consolidate CPG space, issue the `compactcpg <CPG_name> or compactcpg <pattern>` command, where:
 - ◆ `<CPG_name>` is the name of the CPG you wish to compact.
 - ◆ `<pattern>` displays all CPGs that match the pattern.

Refer to the *InForm OS Command Line Interface Reference* and CLI Help for detailed information about this command.

16.10 Tuning Physical Disks

3PAR System Tuner is an optional feature that improves performance by identifying over-used physical disks, and performing load balancing on those disks without interrupting access. Use the `tunepd` command to perform tuning tasks on physical disks. You must purchase the 3PAR System Tuner license to use the `tunepd` command.

If the performance of one or more physical disks degrades, the throughput of the logical disks is reduced and the entire system performance may decline. There are two general reasons why a physical disk may have degraded performance:

- The physical disk has reached its maximum throughput due to an unbalanced load. A disk in this state typically has unusually high average service times when compared to other disks.
- The physical disk is a bad disk. A bad disk typically has unusually high maximum service times when compared to other disks.

The `tunepd` command allows you to:

- Perform physical disk performance tuning on an entire InServ Storage Server or on a specified subset of disks.
- Set performance thresholds for physical disk tuning.
- Identify and relocate under-performing chunklets.

In the following example, physical disks with average service times exceeding 50 milliseconds are identified and their chunklets are automatically relocated to re-balance the load on the physical disks.

- ▶ To tune physical disks, issue the `tunepd -vvlayout -chstat -movech auto avgsvct 50` command, where:

- ◆ `<vvlayout>` specifies that the layout of the virtual volume is displayed.
- ◆ `<chstat>` specifies that chunklet statistics are displayed.
- ◆ `<movech>` specifies that if any disks with unbalanced loads are detected, the chunklets are moved from those disks for load balancing
- ◆ `<auto>` specifies that the system automatically chooses source and destination chunklets.
- ◆ `<avgsvct>` specifies the average service time threshold in milliseconds.

For more information about viewing system performance statistics, see [Chapter 12, Viewing Statistics and Histograms](#). For more information about how the InServ Storage Server manages space usage, see the *3PAR InForm OS Concepts Guide*.

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