Perforce 2004.2
System Administrator's Guide

September 2004

Table of Contents

Preface About This Manual 9

Using Perforce? 9
Please Give Us Feedback 9

Chapter 1 Welcome to Perforce: Installing and Upgrading 11

Getting Perforce 11
UNIX Installation 11
Download the files and make them executable 12
Create a Perforce server root directory 12
Telling Perforce servers on which port to listen 13
Telling Perforce client programs which port to connect to 13
Starting the Perforce server 14
Stopping the Perforce server 14
Windows Installation 14
Windows services and servers 15
Starting and stopping Perforce 15
Upgrading a Perforce Server 16
Using old client programs with a new server 16
Important notes for 2001.1 and later 16
UNIX upgrades 17
Windows upgrades 18
Installation and Administration Tips 18
Release and license information 18
Observe proper backup procedures 19
Use separate physical drives for server root and journal 19
Use protections and passwords 19
Allocate disk space for anticipated growth 20
Managing disk space after installation 20
Large filesystem support 21
UNIX and NFS support 21
Windows: Username and password required for network drives 22
UNIX: Run p4d as a non-privileged user 22
Logging errors 22

Case sensitivity issues 23
Tune for performance 23

Chapter 2 Supporting Perforce: Backup and Recovery 25

Backup and Recovery Concepts 25
Checkpoint files 26
Journal files 28
Versioned files 30
Backup Procedures 31
Recovery Procedures 33
Database corruption, versioned files unaffected 33
Both database and versioned files lost or damaged 35
Ensuring system integrity after any restoration 37

Chapter 3 Administering Perforce: Superuser Tasks 39

Basic Perforce Administration 39
Authentication methods: passwords and tickets 39
Server security levels 41
Resetting user passwords 43
Creating users 43
Preventing creation of users 43
Deleting obsolete users 45
Reverting files left open by obsolete users 45
Reclaiming disk space by obliterating files 45
Deleting changelists and editing changelist descriptions 47
File verification by signature 47
Defining filetypes with p4 typemap 48
Forcing operations with the -f flag 50
Advanced Perforce Administration 52
Running Perforce through a firewall 52
Specifying IP addresses in P4PORT 55
Running from inetd on UNIX 55
Case sensitivity and multi-platform development 56
Monitoring server activity 58

Perforce server trace flags 60
Moving a Perforce Server to a new machine 61
Moving your versioned files and Perforce database 61
Changing the IP address of your server 63
Changing the hostname of your server 63
Using Multiple Depots 64
Defining new depots 64
Other depot operations 65
Remote depots and distributed development 65
When to use remote depots 66
How remote depots work 66
Using remote depots for code drops 67

Chapter 4 Administering Perforce: Protections 71

When Should Protections Be Set? 71
Setting Protections with "p4 protect" 71
The permission lines' five fields 71
Access levels 72
Which users should receive which permissions? 73
Default protections 74
Interpreting multiple permission lines 74
Exclusionary protections 75
Granting Access to Groups of Users 76
Creating and editing groups 76
Groups and protections 76
Deleting groups 77
How Protections are Implemented 77
Access Levels Required by Perforce Commands 78

Chapter 5 Customizing Perforce: Job Specifications 81

The Default Perforce Job Template 81
The Job Template's Fields 82
The Fields: field 83
The Values: fields 85

The Presets: field 85
The Comments: field 86
Caveats, Warnings, and Recommendations 87
Example: A Custom Template 88
Working with third-party defect tracking systems 89
Using P4DTI - Perforce Defect Tracking Integration 89
Building your own integration 90
Getting more information 90

Chapter 6 Scripting Perforce: Triggers and Daemons 91

Triggers 91
The trigger table 92
Triggering on changelists 95
Triggering on specifications 98
Using multiple triggers 101
Writing triggers to support multiple Perforce Servers 102
Triggers and security 102
Triggers and Windows 102
Daemons 103
Perforce's change review daemon 103
Creating other daemons 104
Commands used by daemons 105
Daemons and counters 106
Scripting and buffering 106

Chapter 7 Tuning Perforce for Performance 107

Tuning for Performance 107
Memory 107
Filesystem performance 107
Disk space allocation 108
Network 109
CPU 109
Diagnosing Slow Response Times 110
Hostname vs. IP address 110
Try p4 info vs. P4Win 110

Windows wildcards 111
DNS lookups and the hosts file 111
Location of the “p4” executable 111
Preventing Server Swamp 112
Using tight views 112
Assigning protections 113
Limiting database queries 114
Scripting efficiently 116
Using compression efficiently 118
Checkpoints for Database Tree Rebalancing 119

Chapter 8 Perforce and Windows 121

Using the Perforce installer 121
Upgrade notes 121
Installation options 121
Scripted deployment and unattended installation 123
Windows services vs. Windows servers 124
Starting and stopping the Perforce service 124
Starting and stopping the Perforce server 124
Installing the Perforce service on a network drive 125
Multiple Perforce services under Windows 125
Windows configuration parameter precedence 127
Resolving Windows-related instabilities 128
Users having trouble with P4EDITOR or P4DIFF 128

Chapter 9 Perforce Proxy 131

System Requirements 132
Installing P4P 132
UNIX 132
Windows 132
Running P4P 132
Running as a Windows service 132
P4P flags 133
Administering P4P 134
No backups required 134
Stopping P4P 134
Managing disk space consumption 134

Determining if your Perforce client is using the proxy 134
P4P and protections 135
Determining if specific files are being delivered from the proxy 135
Maximizing performance improvement 136
Network topologies versus P4P 136
Pre-loading the cache directory for optimal initial performance 137
Distributing disk space consumption 137
Reducing server CPU usage by disabling file compression 137

Appendix A Perforce Server (p4d) Reference 139

Synopsis 139
Syntax 139
Description 139
Exit Status 139
Options 139
Usage Notes 140
Related Commands 141

Index 143

Preface

About This Manual

This is the *Perforce 2004.2 System Administrator's Guide.*

This guide is intended for people responsible for installing, configuring, and maintaining Perforce servers. This guide covers tasks typically performed by a "system administrator" (for instance, installing and configuring the software, and ensuring uptime and data integrity), as well as tasks performed by a "Perforce administrator", such as setting up Perforce users, configuring Perforce depot access controls, resetting Perforce user passwords, and so on.

Because Perforce requires no special system permissions, a Perforce administrator does not typically require root-level access. Depending on your site's needs, your Perforce administrator need not be your system administrator.

Both the UNIX and Windows versions of the Perforce server are administered from the command line. To familiarize yourself with the Perforce Command-Line Client, see the *Perforce Command Reference.*

Using Perforce?

If you plan to use Perforce as well as administer a Perforce server, see the *Perforce User's Guide* for information on Perforce from a user's perspective.

All of our documentation is available from our web site at `http://www.perforce.com`.

Please Give Us Feedback

We are interested in receiving opinions on it from our users. In particular, we'd like to hear from users who have never used Perforce before. Does this guide teach the topic well? Please let us know what you think; we can be reached at `manual@perforce.com`.

Chapter 1 Welcome to Perforce: Installing and Upgrading

This chapter describes how to install a Perforce server or upgrade an existing installation.

Warning! If you are upgrading an existing installation to Release 2001.1 or later, see the notes in "Upgrading a Perforce Server" on page 16 before proceeding.

This chapter includes a brief overview of things to consider at installation time, along with some basic security and administration tips. More detailed information on administrative tasks is found in later chapters.

Windows Where the UNIX and Windows versions of Perforce differ, a note to that effect is made. For Windows-specific information, see "Perforce and Windows" on page 121.

Many of the examples in this book are based on the UNIX version of the Perforce server. In most cases, the examples apply equally to both Windows and UNIX installations.

OS X The material for UNIX also applies to MacOS X.

Getting Perforce

Perforce requires at least two executables: the server (`p4d`), and at least one Perforce client program (such as `p4` on UNIX, or `p4.exe` or `p4win.exe` on Windows).

The server and client executables are available from the Downloads page on the Perforce web site:

```
http://www.perforce.com/perforce/loadprog.html
```

Go to the web page, select the files for your platform, and save the files to disk.

UNIX Installation

Although you can install `p4` and `p4d` in any directory, on UNIX, the Perforce client programs typically reside in `/usr/local/bin`, and the Perforce server is usually located either in `/usr/local/bin` or in its own server root directory. Perforce client programs can be installed on any machine that has TCP/IP access to the `p4d` host.

To limit access to the Perforce server files, ensure that the `p4d` executable is owned and run by a Perforce user account that has been created for the purpose of running the Perforce server.

To start using Perforce:

1. Download the p4 and p4d files for your platform from the Perforce web site.
2. Make the downloaded p4 and p4d files executable.
3. Create a server root directory to hold the Perforce database and versioned files.
4. Tell the Perforce server what port to listen to by specifying a TCP/IP port to p4d.
5. Start the Perforce server (p4d).
6. Specify the name or TCP/IP address of the Perforce server machine and the p4d port number to the Perforce client program(s) by setting the P4CLIENT environment variable.

Download the files and make them executable

On UNIX (or MacOS X), you must make the Perforce executables (p4 and p4d) executable. After downloading the programs, use the chmod command to make them executable, as follows:

```
chmod +x p4
chmod +x p4d
```

Create a Perforce server root directory

The Perforce server stores all user-submitted files and system-generated metadata in files and subdirectories beneath its own root directory. This directory is called the *server root*.

To specify a server root, set the environment variable P4ROOT to point to the server root, or use the `-r` *`root_dir`* flag when invoking p4d. Perforce client programs never use the P4ROOT directory or environment variable; the p4d server is the only process that uses the P4ROOT variable.

Because all Perforce files are stored beneath the server root, the contents of the server root will grow over time. See “Installation and Administration Tips” on page 18 for a brief overview of diskspace requirements, and “Disk space allocation” on page 108 for more detail.

A Perforce server requires no privileged access; there is no need to run p4d as root or any other privileged user. For more information, see the section entitled “UNIX: Run p4d as a non-privileged user” on page 22.

The server root can be located anywhere, but the account that runs p4d must have read, write, and execute permissions on the server root and all directories beneath it. For security purposes, set the umask(1) file creation-mode mask of the account that runs p4d to a value that denies other users access to the server root directory.

Telling Perforce servers on which port to listen

The p4d server and Perforce client programs communicate with each other using TCP/IP. When p4d starts, it listens (by default) on port 1666. The Perforce client assumes (also by default) that its p4d server is located on a host named perforce, listening on port 1666.

If p4d is to listen on a different port, specify that port with the -p *port_num* flag when starting p4d (as in, p4d -p 1818), or set the port with the P4PORT environment or registry variable.

Unlike P4ROOT, the environment variable P4PORT is used by both the Perforce server and Perforce client programs, and must be set on both Perforce server machines and Perforce client workstations.

Telling Perforce client programs which port to connect to

Perforce client programs need to know on what machine the p4d server resides, and on which TCP/IP port the p4d server program is listening. Set each Perforce user's P4PORT environment variable to *host*:*port#*, where *host* is the name of the machine on which p4d is running, and *port#* is the port on which p4d is listening.

Examples:

If P4PORT is...	Then...
dogs:3435	The client program connects to the p4d server on host dogs listening at port 3435.
x.com:1818	The client program connects to the p4d server on host x.com listening at port 1818.

If the Perforce client program is running on the same host as p4d. only the p4d port number need be provided in P4PORT. If p4d is running on a host named or aliased perforce, and is listening on port 1666, the definition of P4PORT for the client can be dispensed with altogether. For example:

If P4PORT is...	Then...
3435	The client program connects to the p4d server on its local host listening at port 3435.
<not set>	The client program connects to the p4d server on the host named or aliased perforce listening on port 1666.

If your p4d host is not named perforce, you can simplify life somewhat for your Perforce users by setting perforce as an alias to the true host name in your users' workstations' /etc/hosts files, or by doing so via Sun's NIS or Internet DNS.

Starting the Perforce server

After setting p4d's P4PORT and P4ROOT environment variables, start the server by running p4d in the background with the command:

```
p4d &
```

Although the example shown is sufficient to run p4d, other flags that control such things as error logging, checkpointing, and journaling, can be provided.

Example: *Starting a Perforce server.*

P4PORT can be overridden by starting p4d with the -p flag, and P4ROOT can be overridden by starting p4d with the -r flag. A journal file can be specified with the -J flag, and errors can be logged to a file specified with a -L flag. A startup command that overrides the environment variables might look like this:

```
p4d -r /usr/local/p4root -J /var/log/journal -L /var/log/p4err -p 1818 &
```

The -r, -J, and -L flags (and others) are discussed in "Supporting Perforce: Backup and Recovery" on page 25. A complete list of server flags is provided in the "Perforce Server (p4d) Reference" on page 139.

Stopping the Perforce server

To shut down a Perforce server, use the command:

```
p4 admin stop
```

to gracefully shut down the Perforce server. Only a Perforce superuser can use p4 admin stop.

If you are running a release of Perforce from prior to 99.2, you must find the process ID of the p4d server and kill the process manually from the UNIX shell. Use kill -15 (SIGTERM) instead of kill -9 (SIGKILL), as p4d might leave the database in an inconsistent state if p4d is in the middle of updating a file when a SIGKILL signal is received.

Windows Installation

To install Perforce on Windows, use the Perforce installer (perforce.exe) from the Downloads page of the Perforce web site.

Use the Perforce installer to:

- Install Perforce client software ("User install").

  This option enables you to install p4.exe (the Perforce Command-Line Client), p4win.exe (P4Win, the Perforce Windows Client), and p4scc.dll (Perforce's implementation of the Microsoft common SCM interface).

- Install Perforce as either a Windows server or service as appropriate. (“Administrator typical” and “Administrator custom” install).

  These options enable you to install Perforce client programs and the Perforce Windows server (`p4d.exe`) and service (`p4s.exe`) executables, or to automatically upgrade an existing Perforce server or service running under Windows.

  Under Windows 2000 or higher, you must have Administrator privileges to install Perforce as a service, and Power User privileges to install Perforce as a server.

- Uninstall Perforce: remove the Perforce server, service, and client executables, registry keys, and service entries. The Perforce database and the depot files stored under your server root are preserved.

For more about installing on Windows, see “Using the Perforce installer” on page 121.

Windows services and servers

The terms “Perforce server” and “`p4d`” are used interchangeably to refer to “the process which handles requests from Perforce client programs”. In cases where the distinction between an NT server and an NT service is important, the distinction is made.

On UNIX systems, there is only one Perforce “server” program (`p4d`) responsible for this back-end task. On Windows, however, the back-end program can be started either as a Windows service (`p4s.exe`) process that runs at boot time, or as a server (`p4d.exe`) process that must be invoked from a command prompt.

The Perforce service (`p4s.exe`) and the Perforce server (`p4d.exe`) executables are copies of each other; they are identical apart from their filenames. When run, the executables use the first three characters of the name with which they were invoked (either `p4s` or `p4d`) to determine their behavior. (For example, invoking copies of `p4d.exe` named `p4smyservice.exe` or `p4dmyserver.exe` invoke a service and a server, respectively.)

In most cases, it is preferable to install Perforce as a service, not a server. For a more detailed discussion of the distinction between services and servers, see “Windows services vs. Windows servers” on page 124.

Starting and stopping Perforce

If you install Perforce as a service under Windows, the service starts whenever the machine boots. Use the **Services** applet in the **Control Panel** to control the Perforce service’s behavior.

If you install Perforce as a server under Windows, invoke `p4d.exe` from a command prompt. The flags for `p4d` under Windows are the same as those used under UNIX.

To stop a Perforce service (or server) at Release 99.2 or above, use the command:

```
p4 admin stop
```

Only a Perforce superuser can use `p4 admin stop`.

For older revisions of Perforce, shut down services manually by using the **Services** applet in the **Control Panel**. Shut down servers running in command prompt windows by typing CTRL-C in the window or by clicking on the icon to Close the command prompt window.

Although these manual shutdown options work with Release 99.2 and earlier versions of Perforce, they are not necessarily "clean", in the sense that the server or service is shut down abruptly. With the availability of the `p4 admin stop` command in 99.2, the manual shutdown options are obsolete.

Upgrading a Perforce Server

Whether your Perforce server is installed on Windows or UNIX, you *must* back up your server (see "Backup Procedures" on page 31) as part of any upgrade process.

Warning! If you are upgrading to 2001.1 or later, it is imperative that you read the notes pertaining to the 2001.1 upgrade.

Using old client programs with a new server

Although older Perforce client programs (`p4`, `p4.exe`, `p4win.exe`, and `p4scc.dll`) generally work with newer server versions, some features in new server releases require upgrades to Perforce client programs. In general, users with older client programs are able to use features available from the Perforce server at the client program's release level, but are not able to use the new server features offered by subsequent server upgrades.

Perforce's remote depot support is an exception: remote depot support is not guaranteed to work unless *all* Perforce servers are at or above Release 98.2.

Important notes for 2001.1 and later

On small installations (installations with fewer than 1000 submitted changelists), installing a 2001.1 (or more recent) server automatically upgrades the underlying database from versions 98.2 and up.

On larger installations, you must upgrade the database manually. Although the upgraded database is typically smaller than a pre-2001.1 database, the upgrade process may

(temporarily) require approximately three times the size of the existing database to store files required during the upgrade.

Note If you have limited disk space, see the Release Notes for a more precise estimate of the amount of disk space required.

By turning off journaling during the upgrade (by setting `P4JOURNAL` to `off`), you can reduce the amount of disk space required for the upgrade. (Remember to turn journaling back on when the upgrade is complete!)

If you are upgrading from Release 97.3 or earlier to 2001.1 or later, the automatic or manual upgrade procedures will not work; you will likely have to make an intermediate checkpoint. Contact Perforce technical support for assistance before upgrading a Release 97.3 or earlier server.

UNIX upgrades

To upgrade your current Perforce server to a newer version, your Perforce license file must be current. Expired licenses do not work with upgraded servers. (Restrictions on license files are not an issue for users running a two-user installation with no license.)

You *must* back up your server as described in "Backup Procedures" on page 31 as part of any upgrade process.

For additional safety, run `p4 verify` as part of your upgrade. See "Verifying during server upgrades" on page 48 for details.

Warning! Upgrading to Release 2001.1 or later requires an upgrade of your database files. Downgrading thereafter requires a that you restore from backups.

If you wish to keep your pre-2001.1 server available as a fallback option when upgrading to 2001.1 or higher, you must back up your *entire* server root (including the `db.*` files) after stopping the server.

Upgrading from UNIX Release 98.2 or later

If you have a valid license (or require no license) and are upgrading from Release 98.2 or later:

1. Download the new `p4d` executable for your platform
2. Stop the current instance of `p4d`
3. Make a checkpoint and back up your old installation
4. Install the new `p4d` in the desired location

5. Run `p4d -xu` to upgrade the database.

Note If your server has fewer than 1000 changes, the upgrade runs automatically. Larger installations require that you run `p4d -xu` manually.

You must have sufficient disk space to complete the upgrade. The required amount is typically two to three times the size of the larger of the `db.have` or `db.integ` files.

The `db.have` and `db.integ` files reside in your `P4ROOT` directory.

6. Restart the new `p4d` with your site's usual parameters.

Your users should then be able to use the new server.

Windows upgrades

On Windows, download the installer (`perforce.exe`) and follow the installation dialog.

The upgrade process on Windows is extremely conservative; in the event of an error condition during an upgrade, you will be able to revert to your pre-upgrade Perforce server or service.

Note If your server has fewer than 1000 changes, the upgrade runs automatically. Larger installations require that you run `p4d -xu` manually.

Either way, you must have sufficient disk space to complete the upgrade. The required amount is typically two to three times the size of the larger of the `db.have` or `db.integ` files.

The `db.have` and `db.integ` files reside in your `P4ROOT` directory.

If you have any questions or difficulties during an upgrade, contact Perforce technical support.

Installation and Administration Tips

Release and license information

Perforce servers are licensed according to how many users they support.

Licensing information is contained in a file called `license` in the server root directory. The `license` file is a plain text file supplied by Perforce Software. Without the `license` file, the Perforce server limits itself to two users and two client workspaces.

To view current licensing information, invoke `p4d -V` from the server root directory where the `license` file resides, or by specifying the server root directory either on the command line (`p4d -V -r server_root`) or in the `P4ROOT` environment variable.

If the server is running, you can also use `p4 info` to view your licensing information.

The server version is also displayed when invoking `p4d -V` or `p4 -V`.

Observe proper backup procedures

Regular backups of your Perforce data are vital. The key concepts are:

- Make sure journaling is active,
- Create checkpoints regularly, and
- Use `p4 verify` regularly.

See "Supporting Perforce: Backup and Recovery" on page 25 for a full discussion of backup and restoration procedures.

Use separate physical drives for server root and journal

Whether installing on UNIX or Windows, it is advisable to have your `P4ROOT` directory (that is, the directory containing your database and versioned files) on a different physical drive than your journal file.

By storing the journal on a separate drive, you can be reasonably certain that if a disk failure corrupts the drive containing `P4ROOT`, such a failure will *not* affect your journal file. You can then use the journal file to restore any lost or damaged metadata.

Further details are available in "Supporting Perforce: Backup and Recovery" on page 25.

Use protections and passwords

Until you define a Perforce superuser, every Perforce user is a Perforce superuser, and can run any Perforce command on any file. After starting a new Perforce server, use:

```
p4 protect
```

as soon as possible to define a Perforce superuser. To learn more about how `p4 protect` works, see "Administering Perforce: Protections" on page 71.

Without passwords, any user is able to impersonate any other Perforce user, either with the `-u` flag or by setting `P4USER` to an existing Perforce user name. Use of Perforce passwords prevents such impersonation. See the *Perforce User's Guide* for details.

To set (or reset) a user's password, use `p4 passwd username` (as a Perforce superuser), and enter the new password for the user, or invoke `p4 user -f username` (also while as a Perforce superuser) and enter the new password into the user specification form. The

former command is supported in release 99.1 or later; the latter command is supported under all releases from 97.3 onwards.

The security-conscious Perforce superuser also uses `p4 protect` to ensure that no access higher than `list` is granted to non-privileged users, and to ensure that each user has a Perforce password.

Allocate disk space for anticipated growth

Because the collection of versioned files grows over time, a good guideline is to allocate sufficient space in your `P4ROOT` directory to hold three times the size of your users' present collection of versioned files, plus an additional 0.5K per user per file to hold the database files that store the list of depot files, file status, and file revision histories.

For a more detailed example of a disk sizing estimate, see "Disk space allocation" on page 108.

Managing disk space after installation

All of Perforce's versioned files reside in subdirectories beneath the server root, as do the database files, and (by default) the checkpoints and journals. If you are running low on disk space, consider the following approaches to limit disk space usage:

- Configure Perforce to store the journal file on a separate physical disk. Use the `P4JOURNAL` environment variable or `p4d -J` to specify the location of the journal file.
- Checkpoint on a daily basis to keep the journal file short.
- Compress checkpoints, or use the `-z` option to tell `p4d` to compress checkpoints on the fly.
- Use the `-jc` *`prefix`* option with the `p4d` command to write the checkpoint to a different disk. Alternately, use the default checkpoint files, but back up your checkpoints to a different drive and then delete the copied checkpoints from the root directory. Moving checkpoints to separate drives is good practice not only in terms of diskspace, but due to the fact that old checkpoints are needed when recovering from a hardware failure, and if your checkpoint and journal files reside on the same disk as your depot, a hardware failure could leave you without the ability to restore your database.
- On UNIX systems, you can relocate some or all of the depot directories to other disks by using symbolic links. If you use symbolic links to shift depot files to other volumes, create the links only after stopping the Perforce server.
- If your installation's database files have grown to more than 10 times the size of a checkpoint, you may be able to reduce the size of the files by recreating them from a checkpoint. See "Checkpoints for Database Tree Rebalancing" on page 119.

Large filesystem support

Early versions of the Perforce server, as well as some operating systems, limit Perforce database files (the `db.*` files in the `P4ROOT` directory that hold your site's metadata) to 2GB in size. The `db.have` file holds the list of files currently synced to client workspaces, and tends to grow the most quickly.

If you anticipate any of your Perforce database files growing beyond the 2GB level, install the Perforce server on a platform with support for large files. The following combinations of operating system and Perforce server revision support database files larger than 2GB:

Operating System	OS version:	Perforce Server Revision
Windows NT, 2000, XP	All versions, SP6 recommended for NT	98.2/8127 or higher
FreeBSD	All versions	98.2/5713 or higher
Linux x86	Kernels 2.4.0 and higher	2002.2/21749 or higher
HP-UX	HP-UX 11.11 and higher	2001.1/26433 or higher
Solaris	2.6 and higher	98.2/7488 *compiled for 2.6 or higher*
Tru64 UNIX (a.k.a. Digital UNIX, OSF/1)	All versions	98.2/5713 or higher
SGI IRIX 6.2	All versions	98.2/5713 or higher
SGI IRIX 5.3	Only with the SGI-supplied `xfs` upgrade	98.2/5713 or higher `xfs` OS upgrade required

UNIX and NFS support

The Perforce server process has been tested and is supported on the Solaris 2.6 (and higher) implementations of NFS. Because Perforce client programs never directly access the files in `P4ROOT`, the only process needing access to `P4ROOT` is the `p4d` server itself.

Consequently, under Solaris 2.6 or higher, you can store your journal, log, depot, and `db.*` files on NFS-mounted filesystems.

Some issues still remain regarding file locking on non-commercial implementations of NFS (for instance, Linux and FreeBSD). On these platforms, store your journal, log, depot, and `db.*` files on a drive local to the server machine, *not* on an NFS-mounted volume.

These issues affect only the Perforce Server process (`p4d`). Perforce client programs, (such as `p4`, the Perforce Command-Line Client) have always been able to work with client workspaces on NFS-mounted drives, such as client workspaces located in users' home directories.

Windows: Username and password required for network drives

By default, the Perforce service runs under the Windows local `System` account. Because Windows requires a real account name and password to access files on a network drive, if Perforce is installed as a service under Windows with `P4ROOT` pointing to a network drive, the installer requires an account name and a password. The Perforce service is then configured with the supplied data and run as the specified user instead of `System`. (The account running the service must have `Administrator` privileges on the machine.)

Although Perforce operates reliably with its root directory on a network drive, it does so only at a substantial performance penalty, as all writes to the database are performed over the network. For optimal performance, install the Windows service to use local drives rather than networked drives.

For more information, see "Installing the Perforce service on a network drive" on page 125.

UNIX: Run p4d as a non-privileged user

The Perforce server process does not require privileged access. For security reasons, do not run `p4d` as `root` or otherwise grant the owner of the `p4d` process `root`-level privileges.

Create a non-privileged UNIX user (for example, "`perforce`") to manage `p4d` and (optionally) a UNIX group for it (for example, "`p4admin`"). Use the `umask(1)` command to ensure that the server root (`P4ROOT`) and all files and directories created beneath it are writable only by the UNIX user `perforce`, and (optionally) readable by members of the UNIX group `p4admin`.

Under this configuration, the Perforce server (`p4d`), running as UNIX user `perforce`, can write to files in the server root, but no users are able to read or overwrite its files. Access to read the files created by `p4d` (that is, the depot files, checkpoints, journals, and so on) can subsequently be granted to trusted users by making them members of the UNIX group `p4admin`.

Windows On Windows, directory permissions are set securely by default; when running as a server, the Perforce server root is accessible only to the user who invoked the server from the command prompt. When installed as a service, the files are owned by the `LocalSystem` account, and are accessible only to those with `Administrator` access.

Logging errors

Use the `-L` flag to `p4d` or the environment variable `P4LOG` to specify the Perforce server's error output file. If no error output file is defined, errors are dumped to the `p4d` process' standard error.

Although `p4d` tries to ensure that all error messages reach the user, if an error occurs and the client program disconnects before the error is received, `p4d` also logs these errors to its error output.

The Perforce server also supports trace flags used for debugging purposes. See "Perforce server trace flags" on page 60 for details.

Case sensitivity issues

Whether your Perforce server is running on Windows or UNIX, if your site is involved in cross-platform development (that is, if you are using Perforce client programs on both Windows and UNIX workstations), your users must be aware of certain details regarding case sensitivity issues. See "Case sensitivity and multi-platform development" on page 56 for details.

Tune for performance

Perforce is an efficient consumer of network bandwidth and CPU power. The most important variables that determine server performance are the efficiency of your server's disk I/O subsystem and the number of files referenced in any given user-originated Perforce operation.

For more detailed performance tuning information, see "Tuning Perforce for Performance" on page 107.

Chapter 2 Supporting Perforce: Backup and Recovery

The Perforce server stores two kinds of data: *versioned files* and *metadata*. Both are stored in the server's root directory.

- *Versioned files* are files submitted by Perforce users. Versioned files are stored in directory trees called *depots*. There is one subdirectory under the server's root directory for each depot in your Perforce installation. The versioned files for a given depot are stored in a tree of directories beneath this subdirectory.
- *Database files* store *metadata*, including changelists, opened files, client specs, branch specs, and other data concerning the history and present state of the versioned files. Database files appear as `db.*` files in the top level of the server root directory. Each `db.*` file contains a single, binary-encoded database table.

Backup and Recovery Concepts

Disk space shortages, hardware failures, and system crashes can corrupt any of the Perforce server's files. That's why the entire Perforce root directory structure (your versioned files and your database) should be backed up regularly.

As mentioned earlier, versioned files are stored in subdirectories beneath your Perforce server root, and can be restored directly from backups without any loss of integrity.

The files making up the Perforce database, on the other hand, may not have been in a state of transactional integrity at the moment they were copied to the system backups. Restoring the `db.*` files from system backups may result in an inconsistent database. The only way to guarantee the integrity of the database after it's been damaged is to reconstruct the `db.*` files from Perforce checkpoint and journal files.

- A *checkpoint* is a snapshot or copy of the database at a particular moment in time.
- A *journal* is a log that records updates made to the database since the last snapshot was taken.

The checkpoint file is often much smaller than the original database, and can be made smaller still by compressing it. The journal file, on the other hand, can grow quite large; it is truncated whenever a checkpoint is made, and the older journal is renamed. The older journal files can then be backed up offline, freeing up more space locally.

Both the checkpoint and journal are text files, and have the same format. A checkpoint and, if available, its subsequent journal, can restore the Perforce database.

Warning! Checkpoints and journals archive only the Perforce database files, ***not*** the files in the depot directories! You must always back up the depot files (your versioned files) with the standard OS backup commands after checkpointing.

Because the information stored in the Perforce database is as irreplaceable as your versioned files, checkpointing and journaling are an integral part of administering a Perforce server, and should be performed regularly.

Checkpoint files

A *checkpoint* is a file that contains all information necessary to recreate the metadata in the Perforce database. When you create a checkpoint, the Perforce database is locked, enabling you to take an internally consistent snapshot of that database.

Versioned files are backed up separately from checkpoints. This means that a checkpoint does *not* contain the contents of versioned files, and as such, ***you cannot restore any versioned files from a checkpoint.*** You can, however, restore all changelists, labels, jobs, and so on, from a checkpoint.

To guarantee database integrity upon restoration, the checkpoint must be as old as, or older than, the versioned files in the depot. This means that the database should be checkpointed, and the checkpoint generation must be complete, before the backup of the versioned files starts.

Regular checkpointing is important to keep the journal from getting too long. Making a checkpoint immediately before backing up your system is good practice.

Creating a checkpoint

Checkpoints are not created automatically; someone or something must run the checkpoint command on the Perforce server machine. You can create a checkpoint by invoking the `p4d` program with the `-jc` (journal-create) flag:

```
p4d -r root -jc
```

This can be run while the Perforce server (`p4d`) is running.

To make the checkpoint, `p4d` locks the database and then dumps its contents to a file named `checkpoint.`*n*, where *n* is a sequence number. Before it unlocks the database, `p4d` also copies the journal file to a file named journal.*n*`-1`, and then truncates the current journal. This guarantees that the last checkpoint (`checkpoint.`*n*) combined with the current journal (`journal`) always reflects the full contents of the database at the time the checkpoint was created.

(The sequence numbers reflect the roll-forward nature of the journal; to restore databases to older checkpoints, match the sequence numbers. That is, the database reflected by `checkpoint.6` can be restored by restoring the database stored in `checkpoint.5` and rolling forward the changes recorded in `journal.5`. In most cases, you're only interested in restoring the current database, which is reflected by the highest-numbered `checkpoint.`*`n`* rolled forward with the changes in the current `journal`.)

You can specify a prefix for the checkpoint and journal filename by using the `-jc` option. That is, if you create a checkpoint with:

```
p4d -jc prefix
```

your checkpoint and journal files will be named `prefix.ckp.n`, or `prefix.jnl.n` respectively, where *`prefix`* is as specified on the command line and *`n`* is a sequence number. If no *`prefix`* is specified, the default filenames `checkpoint.n` and `journal.n` are used.

Note The meaning of the argument to `-jc` changed in Release 99.2.

Prior to Release 99.2, the files created with `p4d -jc prefix` would have been `prefix.n` (for the checkpoint) and `journal.n` (for the old journal).

The behavior in 99.2 is a change from that in previous releases; if you have scripts which rely on the old behavior, you may have to modify them.

As of Release 99.2, if you need to take a checkpoint but are not on the machine running the Perforce server, you can create a checkpoint remotely with the `p4 admin` command. Use:

```
p4 admin checkpoint [prefix]
```

to take the checkpoint and optionally specify a *`prefix`* to the checkpoint and journal files. (You must be a Perforce superuser to use `p4 admin`.)

A checkpoint file may be compressed, archived, or moved onto another disk. At that time or shortly thereafter, the files in the depot subdirectories should be archived as well.

When recovering, *the checkpoint must be at least as old as the files in the depots*. (that is, the versioned files can be newer than the checkpoint, but not the other way around.) As you might expect, the shorter this time gap, the better.

You can set up an automated program to create your checkpoints on a regular schedule. Be sure to always check the program's output to ensure that checkpoint creation was started.

If the checkpoint command itself fails, contact Perforce Technical Support immediately. Checkpoint failure is usually a symptom of a resource problem (disk space, permissions, etc.) that can put your database at risk if not handled correctly.

Journal files

The *journal* is the running transaction log that keeps track of all database modifications since the last checkpoint. It's the bridge between two checkpoints.

If you have Monday's checkpoint and the journal that was collected from then until Wednesday, those two files (Monday's checkpoint plus the accumulated journal) contain the same information as a checkpoint made Wednesday. If a disk crash were to cause corruption in your Perforce database on Wednesday at noon, for instance, you could still restore the database even though Wednesday's checkpoint hadn't yet been made.

Warning! By default, the current journal file name is `journal` and it resides in the `P4ROOT` directory. However, if a disk failure corrupts that root directory, your journal file will be inaccessible too.

We strongly recommend that you set up your system so that the journal is written to a filesystem other than the `P4ROOT` filesystem. You can specify this from the command line, or set `P4JOURNAL` before starting the Perforce server to tell it where to write the journal.

To restore your database, you only need to keep the most recent journal file accessible, but it doesn't hurt to archive old journals with old checkpoints, should you ever need to restore to an older checkpoint.

Enabling journaling on Windows

For Windows installations, if you used the installer (`perforce.exe`) to install a Perforce server or service, journaling is turned on for you.

If you installed Perforce without the installer (for an example of when you might do this, see "Multiple Perforce services under Windows" on page 125), you do not have to create an empty file named `journal` in order to enable journaling under a manual installation on Windows.

Enabling journaling on UNIX

For UNIX installations, journaling is also automatically enabled.

If `P4JOURNAL` is left unset (and no location is specified on the command line), the default location for the journal is `$P4ROOT/journal`.

After enabling journaling

Be sure to create a new checkpoint with `p4d -jc` (and `-J` *`journalfile`* if required) immediately after enabling journaling. Once journaling is enabled, you'll need make regular checkpoints to control the size of the journal file. An extremely large current journal is a sign that a checkpoint is needed.

Every checkpoint after your first checkpoint starts a new journal file and renames the old one. The old `journal` is renamed to `journal.`*`n`*, (or *`prefix`*`.jnl.`*`n`* for Release 99.2 or later) where *`n`* is a sequence number, and a new `journal` file is created.

By default, the journal is written to the file `journal` in the server root directory (`P4ROOT`). Since there is no sure protection against disk crashes, the journal file and the Perforce server root should be located on different filesystems, ideally on different physical disk drives. The name and location of the journal can be changed by specifying the name of the journal file in the environment variable `P4JOURNAL`, or by providing the `-J` *`filename`* flag to `p4d`.

Warning! If you create a journal file with the `-J` *`filename`* flag, make sure that subsequent checkpoints use the same file, or the journal will not be properly renamed.

Whether you use `P4JOURNAL` or the `-J` *`journalfile`* option to `p4d`, the journal file name can be provided either as an absolute path, or as a path relative to the server root.

Example: *Specifying journal files*

Starting the server with:

```
$ p4d -r $P4ROOT -p 1666 -J /usr/local/perforce/journalfile
Perforce Server starting...
```

requires that you either checkpoint with:

```
$ p4d -r $P4ROOT -J /usr/local/perforce/journalfile -jc
Checkpointing to checkpoint.19...
Saving journal to journal.18...
Truncating /usr/local/perforce/journalfile...
```

or set `P4JOURNAL` *to* `/usr/local/perforce/journal` *and use*

```
$ p4d -r $P4ROOT -jc
Checkpointing to checkpoint.19...
Saving journal to journal.18...
Truncating /usr/local/perforce/journalfile...
```

If your `P4JOURNAL` *environment variable (or command-line specification) doesn't match the setting used when you started the Perforce server, the checkpoint is still created, but the journal is neither saved nor truncated. This is highly undesirable!*

Disabling journaling

To disable journaling, stop the server, remove the existing journal file (if it exists), set the environment variable `P4JOURNAL` to `off`, and restart `p4d` without the `-J` flag.

Versioned files

Your checkpoint and journal files are used to reconstruct the Perforce database files only. Your versioned files are stored in directories under the Perforce server root, and must be backed up separately.

Versioned file formats

Versioned files are stored in subdirectories beneath your server root. Text files are stored in RCS format, with filenames of the form *`filename`*`,v`. There is generally one RCS-format (`,v`) file per text file. Binary files are stored in full in their own directories named *`filename`*`,d`. Depending on the Perforce file type selected by the user storing the file, there may be one or more archived binary files in each *`filename`*`,d` directory. If more than one file resides in a *`filename`*`,d` directory, each one refers to a different revision of the binary file, and is named `1.`*`n`*, where *`n`* is the revision number.

As of Release 99.2, Perforce also supports the AppleSingle file format for Macintosh. On the server, these files are stored in full, compressed, just like other binary files. They are stored in the Mac's AppleSingle file format; if need be, these files can be copied directly from the server root, uncompressed, and used as-is on a Macintosh.

Because Perforce uses compression in the depot files, do not assume compressibility of the data when sizing backup media. Both text and binary files are either compressed by the Perforce server (denoted by the `.gz` suffix) before storage, or are stored uncompressed. At most installations, if any binary files in the depot subdirectories are being stored uncompressed, they were probably incompressible to begin with. (For example, many image, music, and video file formats are incompressible.)

Back up after checkpointing

In order to ensure that the versioned files reflect all the information in the database after a post-crash restoration, the `db.*` files must be restored from a checkpoint that is at least as old as (or older than) your versioned files. For this reason, create the checkpoint before backing up the versioned files in the depot directory or directories.

While your versioned files can be newer than the data stored in your checkpoint, it is in your best interest to keep this difference to a minimum; in general, you'll want your backup script to back up your versioned files immediately after successfully completing a checkpoint.

Backup Procedures

To back up your Perforce server, perform the following steps as part of your nightly backup procedure:

1. Verify the integrity of your server and add file signatures to any new files:

   ```
   p4 verify //...
   p4 verify -u //...
   ```

   You may wish to pass the `-q` (quiet) option to `p4 verify`. If called with the `-q` option, `p4 verify` produces output only when errors are detected.

   The first command (`p4 verify`) recomputes the MD5 signatures of all of your archived files and compares them with those stored when `p4 verify -u` was first run on them. It also ensures that all files known to Perforce actually exist in the depot subdirectories; a disk-full condition that results in corruption of the database or archived files during the day can be detected by examining the output of these commands.

   The second command (`p4 verify -u`) updates the database with MD5 signatures for any new file revisions for which checksums have not yet been computed.

   By running `p4 verify -u` before the backup, you ensure that you create and store checksums for any files new to the depot since your last backup, and that these checksums are stored as part of the backup you're about to take.

   The use of `p4 verify` is optional, but is good practice not only because it enables you to spot any server corruption before a backup is made, but it also gives you the ability, following a crash, to detect whether or not the files restored from your backups are in good condition.

   Note If your site is very large, `p4 verify` may take some time to run, and you may wish to perform this step on a weekly basis rather than on a daily basis. For more about the `p4 verify` command, see "File verification by signature" on page 47.

2. Make a checkpoint by invoking `p4d` with the `-jc` (journal-create) flag, or by using the `p4 admin` command. Use one of:

   ```
   p4d -jc
   ```

   or (as of Release 99.2 or higher):

   ```
   p4 admin checkpoint
   ```

Because `p4d` locks the entire database when making the checkpoint, you do not generally have to stop your Perforce server during any part of the backup procedure.

Note If your site is very large (say, several GB of `db.*` files), creating a checkpoint may take a considerable length of time.

Under such circumstances, you may wish to defer checkpoint creation and journal truncation until times of low system activity. You might, for instance, archive only the `journal` file in your nightly backup, and only create checkpoints and roll the journal file on a weekly basis.

If you are using the `-z` flag to create a gzip-compressed checkpoint, the checkpoint file is named as specified. If you want the compressed checkpoint file to end in `.gz`, you must explicitly specify the `.gz` on the command line.

3. Ensure that the checkpoint has been created successfully before backing up any files. (After a disk crash, the last thing you want to discover is that the checkpoints you've been backing up for the past three weeks were incomplete!)

   You can tell that the checkpoint command has completed successfully by examining the error code returned from `p4d -jc`, or by observing the truncation of the current journal file.

4. Once the checkpoint has been created successfully, back up the checkpoint file, the old journal file, and your versioned files.

   (If you don't require an audit trail, you don't actually need to back up the journal. It is, however, usually good practice to do so.)

   Note There are rare instances (for instance, users obliterating files during backup, or submitting files on Windows during the file backup portion of the process) in which your depot files may change during the interval between the time the checkpoint was taken and the time at which the depot files get backed up by the backup utility.

   Most sites are affected by these issues; having the Perforce server available on a 24/7 basis is generally a benefit worth this minor risk, especially if backups are being performed at times of low system activity.

   If, however, the reliability of every backup is of paramount importance, consider stopping the Perforce server before checkpointing, and restarting it after the backup process has completed. Doing so will eliminate all risk of the system state changing during the backup process.

You never need to back up the `db.*` files. Your latest checkpoint and journal contain all the information necessary to re-create them. More significantly, a database

restored from `db.*` files is not guaranteed to be in a state of transactional integrity. A database restored from a checkpoint is.

Windows

On Windows, if you make your system backup while the Perforce server is running, you must ensure that your backup program doesn't attempt to back up the `db.*` files.

If you try to back up the `db.*` files with a running server, Windows locks them while the backup program backs them up. During this brief period, the Perforce server is unable to access the files; if a user attempts to perform an operation that would update the file, the server may fail.

If your backup software doesn't allow you to exclude the `db.*` files from the backup process, stop the server with `p4 admin stop` before backing up, and restart the server after the backup process is complete.

Recovery Procedures

If the database files become corrupted or lost, either because of disk errors, a hardware failure such as a disk crash, the database can be recreated with your stored checkpoint and journal.

There are many ways in which systems can fail; while this guide cannot address all of them, it can at least provide a general guideline for recovery from the two most common situations, specifically:

- corruption of your Perforce database only, without damage to your versioned files, and
- corruption to both your database and versioned files.

The recovery procedures for each failure are slightly different, and are discussed separately in the following two sections.

If you suspect corruption in either your database or versioned files, contact Perforce technical support.

Database corruption, versioned files unaffected

If only your database has been corrupted, (that is, your `db.*` files were on a drive that crashed, but you were using symbolic links to store your versioned files on a separate physical drive), you need only re-create your database.

You *will* need:

- The last checkpoint file, which should be available from the latest `P4ROOT` directory backup.

- The current journal file, which should be on a separate filesystem from your `P4ROOT` directory, and which should therefore have been unaffected by any damage to the filesystem where your `P4ROOT` directory was held.

You will *not* need:

- Your backup of your versioned files; if they weren't affected by the crash, they're already up to date.

To recover the database

1. Stop the current instance of `p4d`:

   ```
   p4 admin stop
   ```

   (You must be a Perforce superuser to use `p4 admin`.)

2. Rename (or move) the corrupt database ("`db.*`") files:

   ```
   mv your_root_dir/db.* /tmp
   ```

   The corrupt `db.*` files aren't actually used in the restoration process, but it's safe practice not to delete them until you're certain your restoration was successful.

3. Invoke `p4d` with the `-jr` (journal-restore) flag, specifying your most recent checkpoint and current journal. If you explicitly specify the server root (`$P4ROOT`), the `-r $P4ROOT` argument must precede the `-jr` flag:

   ```
   p4d -r $P4ROOT -jr checkpoint_file journal_file
   ```

   This recovers the database as it existed when the last checkpoint was taken, and then apply the changes recorded in the journal file since the checkpoint was taken.

   Note If you're using the `-z` (compress) option to compress your checkpoints upon creation, you'll have to restore the uncompressed journal file separately from the compressed checkpoint.

   That is, instead of using:

   ```
   p4d -r $P4ROOT -jr checkpoint_file journal_file
   ```

   you'll use two commands:

   ```
   p4d -r $P4ROOT -z -jr checkpoint_file.gz
   p4d -r $P4ROOT -jr journal_file
   ```

   You must explicitly specify the `.gz` extension yourself when using the `-z` flag, and ensure that the `-r $P4ROOT` argument precedes the `-jr` flag.

Check your system

Your restoration is complete. See "Ensuring system integrity after any restoration" on page 37 to make sure your restoration was successful.

Your system state

The database recovered from your most recent checkpoint, after you've applied the accumulated changes stored in the current journal file, is up to date as of the time of failure.

After recovery, both your database and versioned files should reflect all changes made up to the time of the crash, and no data should have been lost.

Both database and versioned files lost or damaged

If both your database and your versioned files were corrupted, you need to restore both the database and your versioned files, and you'll need to ensure that the versioned files are no older than the restored database.

You *will* need:

- The last checkpoint file, which should be available from the latest `P4ROOT` directory backup.
- Your versioned files, which should be available from the latest `P4ROOT` directory backup.

You will *not* need:

- Your current journal file. The journal contains a record of changes to the metadata and versioned files that occurred between the last backup and the crash; because you'll be restoring a set of versioned files from a backup taken *before* that crash, the checkpoint alone contains the metadata useful for the recovery, and the information in the journal is of limited or no use.

To recover the database

1. Stop the current instance of `p4d`:

   ```
   p4 admin stop
   ```

   (You must be a Perforce superuser to use `p4 admin`.)

2. Rename (or move) the corrupt database ("`db.`") files:

   ```
   mv your_root_dir/db.* /tmp
   ```

   The corrupt `db.*` files aren't actually used in the restoration process, but it's safe practice not to delete them until you're certain your restoration was successful.

3. Invoke `p4d` with the `-jr` (journal-restore) flag, specifying *only* your most recent checkpoint:

   ```
   p4d -r $P4ROOT -jr checkpoint_file
   ```

This recovers the database as it existed when the last checkpoint was taken, but does not apply any of the changes in the journal file. (The `-r $P4ROOT` argument must precede the `-jr` flag.)

The database recovery without the roll-forward of changes in the journal file brings the database up to date as of the time of your last backup. In this scenario, you do not want to apply the changes in the journal file, because the versioned files you restored reflect only the depot as it existed as of the last checkpoint.

To recover your versioned files

4. After recovering the database, you then need to restore the versioned files according to your system's restoration procedures (for instance, the UNIX `restore(1)` command) to ensure that they are as new as the database.

Check your system

Your restoration is complete. See "Ensuring system integrity after any restoration" on page 37 to make sure your restoration was successful.

Note that files submitted to the depot between the time of the last system backup and the disk crash will not be present in the restored depot.

Note Although "new" files (submitted to the depot but not yet backed up) will not appear in the depot after restoration, it's possible (indeed, highly probable!) that at one or more of your users have up-to-date copies of such files present in their client workspaces.

Your users can find such files by using Perforce to examine how files in their client workspaces differ from those in the depot. If they run:

```
p4 diff -se
```

...they'll be provided with a list of files in their workspace which differ from the files Perforce believes them to have. After verifying that these files are indeed the files you wish to restore, you may wish to have one of your users open these files for `edit` and submit them to the depot in a changelist.

Your system state

After recovery, your depot directories may not contain the newest versioned files. That is, files submitted after the last system backup but before the disk crash may have been lost.

- In most cases, the latest revisions of such files can be restored from the copies still residing in your users' client workspaces.

- In a case where *only* your versioned files (but *not* the database, which may have resided on a separate disk and remained unaffected by the crash) were lost, you may also be able to make a separate copy of your database and apply your journal to it in order to examine recent changelists to track down files submitted between the last backup and the disk crash.

In either case, contact Perforce technical support for further assistance.

Ensuring system integrity after any restoration

After any restoration, it's wise to run `p4 verify` to ensure the versioned files are at least as new as the database:

```
p4 verify -q //...
```

This command verifies the integrity of the versioned files. The `-q` (quiet) option tells the command to only produce output on error conditions. Ideally, this command should produce no output.

If any versioned files are reported as `MISSING` by the `p4 verify` command, you'll know that there is information in the database concerning files that didn't get restored. The usual cause is that you restored from a checkpoint and journal made after the backup of your versioned files. (that is, that your backup of the versioned files was older than the database.)

If (as recommended) you've been using `p4 verify -u` to generate and store MD5 signatures for your versioned files as part of your backup routine, you can run `p4 verify` on the server after restoration to reassure yourself that your restoration was successful.

If you have any difficulties restoring your system after a crash, contact Perforce Technical Support for assistance.

Chapter 3 Administering Perforce: Superuser Tasks

This chapter describes basic tasks associated with day-to-day Perforce administration and advanced Perforce configuration issues related to cross-platform development issues, migration of Perforce servers from one machine to another, and working with remote and local depots.

Most of the tasks described in this chapter requires that you have Perforce superuser (access level `super`) or administrator (access level `admin`) privileges as defined in the Perforce protections table. For more about controlling Perforce superuser access, and protections in general, see "Administering Perforce: Protections" on page 71.

Release 2004.2 of Perforce introduced a new authentication mechanism and a server-configurable security setting to govern password strength requirements and authentication method policy. For details, see "Authentication methods: passwords and tickets" on page 39 and "Server security levels" on page 41.

Basic Perforce Administration

The following tasks commonly performed by Perforce administrators and superusers are:

- User maintenance tasks, including resetting passwords, creating users, disabling the automatic creation of users, and cleaning up files left open by former users,
- Administrative operations, including setting the server security level, obliterating files to reclaim disk space, editing submitted changelists, verifying server integrity, defining filetypes to control Perforce's file type detection mechanism, and the use of the `-f` flag to force operations.

Authentication methods: passwords and tickets

Perforce supports two methods of authentication: password-based and ticket-based.

Warning Although ticket-based authentication provides a more secure authentication mechanism than password-based authentication, it does not encrypt network traffic between client workstations and the Perforce server.

If you are accessing Perforce over an insecure network, use a third-party tunneling solution (for example, `ssh` or a VPN) regardless of the authentication method you choose.

How password-based authentication works

Password-based authentication is stateless; once a password is correctly set, access is granted for indefinite time periods. Prior to Release 2004.2, the password-based authentication mechanism did not enforce password strength or existence requirements.

The concept of the server security level, introduced in Release 2004.2, enables administrators to enforce password strength and existence requirements. See “Server security levels” on page 41 for details.

Password based authentication is supported at security levels 0, 1, and 2.

How ticket-based authentication works

Ticket-based authentication is supported as of Release 2004.2. This new authentication method is based on time-limited tickets that enable users to connect to Perforce servers.

Tickets are authentication tokens stored on client workstations in users' home directories. Tickets are managed automatically by 2004.2 and later Perforce client programs. On Windows and UNIX, tickets are stored in `%USERPROFILE%\p4tickets.txt` and `$HOME/.p4tickets` respectively.

All tickets have a finite lifespan, after which they cease to be valid. By default, tickets are valid for 12 hours (43200 seconds). To set different ticket lifespans for groups of users, edit the `Timeout:` field in the `p4 group` form for each group. The timeout value for a user in multiple groups is the largest timeout value for all groups of which a user is a member.

Although tickets are not passwords, Perforce servers accept valid tickets wherever users can specify Perforce passwords. This behavior provides the security advantages of ticket-based authentication with the ease of scripting afforded by password authentication. Ticket-based authentication is supported at all server security levels, and is required at security level 3.

Logging in to Perforce

To use ticket-based authentication, get a ticket by logging in with the `p4 login` command:

```
p4 login
```

You are prompted for your password and a ticket is created for you in your ticket file. You can extend your ticket's lifespan by calling `p4 login` while already logged in. If you run `p4 login` while logged in, your ticket's lifespan is extended by 1/3 of its initial timeout setting, subject to a maximum of your initial timeout setting.

By default, Perforce tickets are valid for your IP address only. If you have a shared home directory that is used on more than one machine, you can log in to Perforce from both machines by using the command:

```
p4 login -a
```

to create a ticket in your home directory that is valid from all IP addresses.

Logging out of Perforce

To log out of Perforce from one machine by removing your ticket, use the command:

```
p4 logout
```

The entry in your ticket file is removed. If you have valid tickets for the same Perforce server, but those tickets exist on other machines, those tickets remain present (and you remain logged in) on those other machines.

If you are logged in to Perforce from more than one machine, you can invalidate all of your Perforce tickets with one command. Use the command:

```
p4 logout -a
```

to log out of Perforce from all machines from which you were logged in.

Determining ticket status

To see if your current ticket (that is, for your IP address, username, and `P4PORT` setting) is still valid, use the command:

```
p4 login -s
```

If your ticket is valid, the length of time for which it will remain valid is displayed.

To display all tickets you currently have, use the command:

```
p4 tickets
```

The contents of your ticket file are displayed.

Server security levels

Perforce superusers can configure server-wide password usage requirements, password strength enforcement, and supported methods of user/server authentication by setting the `security` counter. To change the `security` counter, issue the command:

```
p4 counter -f security seclevel
```

where *`seclevel`* is 0, 1, 2, or 3. After setting the counter, stop and restart the server.

Choosing a server security level

The default security level is 0: passwords are not required, and password strength is not enforced.

To ensure that all users have passwords, use security level 1. Users of old client programs may still enter weak passwords.

To ensure that all users have strong passwords, use security level 2. Old Perforce software continues to work, but users of old Perforce client software must change their password to a strong password by using a Perforce client program at Release 2003.2 or above.

To require that all users have strong passwords, and to require the use of session-based authentication, use security level 3 and current Perforce client software.

Level 0 corresponds to pre-2003.2 server operation. Levels 1 and 2 were designed for support of legacy client software. Level 3 affords the highest degree of security.

The Perforce server security levels and their effects on the behavior of Perforce client programs are defined below:

Security level	Server behavior
`0` (or unset)	Legacy support: passwords are not required. If passwords are used, password strength is not enforced.
	Users with passwords may use either their `P4PASSWD` setting or the `p4 login` command for ticket-based authentication.
	Users of old Perforce client programs are unaffected.
`1`	Strong passwords are required for users of post-2003.2 Perforce client programs, but existing passwords are not reset.
	Pre-2003.2 Perforce client programs may set passwords with `p4 passwd` or in the `p4 user` form, but password strength is not enforced.
	Users with passwords may use either their `P4PASSWD` setting or the `p4 login` command for ticket-based authentication.
`2`	All unverified strength passwords must be changed.
	Users of pre-2003.2 client programs may not set passwords.
	Users of client programs at release 2003.2 or higher must use `p4 passwd` and enter their passwords at the prompt. Setting passwords with the `p4 user` form or the `p4 passwd -O` *`oldpass`* `-P` *`newpass`* command is prohibited.
	On Windows, passwords are no longer stored in (or read from) the registry. (Storing `P4PASSWD` as an environment variable is supported, but passwords set with `p4 set P4PASSWD` are ignored.)
	Users who have set strong passwords with a 2003.2 or higher Perforce client program may use either their `P4PASSWD` setting for password-based authentication, or the `p4 login` command for ticket-based authentication.
`3`	All password-based authentication is rejected.
	Users must use ticket-based authentication (`p4 login`).
	If you have scripts that rely on passwords, use `p4 login` to create a ticket valid for the user running the script, or use `p4 login -p` to display the value of a ticket that can be passed to Perforce commands as though it were a password (that is, either from the command line, or by setting `P4PASSWD` to the value of the valid ticket).

Resetting user passwords

If you are a Perforce superuser, you can reset a Perforce user's password with:

- Release 99.1 and later:

  ```
  p4 passwd username
  ```

  When prompted, enter a new password for user *username*.

- Pre-99.1 releases:

  ```
  p4 user -f username
  ```

  Enter the password in the `Password:` field of the user specification form.

Password strength defined

Certain combinations of server security level and Perforce client software releases require users to set "strong" passwords. A password is considered strong if it is at least eight characters long, and at least two of the following are true:

- Password contains uppercase letters
- Password contains lowercase letters
- Password contains non-alphabetic characters.

For example, the passwords `a1b2c3d4`, `A1B2C3D4`, `aBcDeFgH` are considered strong.

Creating users

By default, Perforce creates a new user record in its database whenever a command is issued by a user that does not exist. Perforce superusers can also use the `-f` (force) flag to create a new user as follows:

```
p4 user -f username
```

Fill in the form fields with the information for the user you want to create.

The `p4 user` command also has an option (`-i`) to take its input from the standard input instead of the forms editor. To quickly create a large number of users, write a script that reads user data, generates output in the format used by the `p4 user` form, and then pipes each generated form to `p4 user -i -f`.

Preventing creation of users

By default, Perforce creates a new user record in its database whenever a command is issued by a user that does not exist.

To prevent Perforce from automatically creating users, all users must be defined in the protections table. The easiest way to do this is to include all users in a Perforce group, and to configure Perforce to grant access only to members of that group.

Example: *Setting up users in a group.*

A Perforce superuser wants to prevent the server from creating new users. He starts by setting up a group called `p4users` *for the three users currently at his site. He types:*

```
p4 group p4users
```

and fills in the form as follows:

```
# A Perforce Group Specification.
# Group:      The name of the group.
# MaxResults: A limit on the results of operations for users in
#             this group, or 'unlimited'.
# MaxScanRows:A limit on data scanned during operations for users
#             in this group, or 'unlimited'.
# Timeout:    Time in seconds which determines how long a 'p4 login'
#             session ticket remains valid (default is 12 hours).
# Subgroups:  Other groups automatically included in this group.
# Users:      The users in the group.  One per line.
Group:  p4users
MaxResults:     unlimited
MaxScanRows:    unlimited
Timeout:        43200
Subgroups:
Users:
        edk
        lisag
```

He then uses `p4 protect` *to edit the protections table. The relevant line of the default protections table looks like this:*

```
write user * * //...
```

This grants `write` *permission to any* `user` *matching* `*` *(that is, to all users) from any host (the second* `*`*) in all areas of the depot (that is, to files in* `//...`*).*

After using `p4 group p4users` *to create the Perforce group* `p4users`*, he uses* `p4 protect` *to change this line in the protections table to read:*

```
write group p4users * //...
```

The replacement protection grants only `write` *access to users whose* `group` *matches* `p4users`*. Members of* `p4users` *may use Perforce from any host (*`*`*) and have write access to all areas of the depot (*`//...`*).*

As long as no other lines in the protections table grant permission to all users, all users are now defined within `p4 protect`*, and the server will no longer automatically create new user entries when new users attempt to access Perforce.*

For a more in-depth description of Perforce protections, see “Administering Perforce: Protections” on page 71.

Deleting obsolete users

Each user on the system consumes one Perforce license. A Perforce administrator can free up licenses from unused users by deleting them.

```
p4 user -d username
```

You must first revert (or submit) any open files opened by a user before deleting that user. If you attempt to delete a user who has opened files, Perforce will display an error message to that effect.

To free the Perforce license, you must also delete the user from entries in the grouping and protections tables maintained with `p4 group` or `p4 protect`.

Reverting files left open by obsolete users

If files have been left open by a nonexistent or obsolete user (for instance, a departing employee), a Perforce administrator can revert the files by deleting the client spec in which they were opened.

For example, if the output of `p4 opened` shows:

```
//depot/main/code/file.c#8 - edit default change (txt) by jim@stlouis
```

the "`stlouis`" client spec can be deleted with:

```
p4 client -d -f stlouis
```

Deleting a user's client spec automatically reverts all files opened by that client, and also removes that client's "have list". Note that it does *not* affect any files in the workspace actually used by that client; the files can still be accessed by other employees.

Reclaiming disk space by obliterating files

Warning! Use `p4 obliterate` with caution. This is the only command in Perforce that actually removes file data.

The depot is always growing, which is not always desirable: a user may have created hundreds of unneeded files by means of an inadvertent branch or submit, or perhaps there are directories of old files that are no longer in use. Because `p4 delete` merely marks files as deleted in their head revisions, it cannot be used to free up disk space on the server. This is where `p4 obliterate` can be useful.

Perforce administrators can use `p4 obliterate` *`filename`* to remove all traces of a file from a depot, making the file indistinguishable from one that never existed in the first place.

Note The purpose of a software configuration management system is to enable your site to maintain a history of what operations were performed on which files. The `p4 obliterate` command defeats this purpose; as such, it is only intended to be used to remove files that never belonged in the depot in the first place, and not as part of a normal software development process.

Note also that `p4 obliterate` is computationally expensive; obliterating files requires that the entire body of metadata be scanned per file argument. Avoid using `p4 obliterate` during peak usage periods.

By default, `p4 obliterate` *`filename`* does nothing; it merely reports on what it would do. To actually destroy the files, use `p4 obliterate -y` *`filename`*.

To destroy only one revision of a file, specify only the desired revision number on the command line. For instance, to destroy revision #5 of a file, use:

```
p4 obliterate -y file#5
```

Revision ranges are also acceptable. To destroy revisions 5 through 7 of a file, use:

```
p4 obliterate -y file#5,7
```

Warning! If you intend to obliterate a revision range, be certain you've specified it properly. If you fail to specify a revision range, ***all*** revisions of the file are obliterated.

The safest way to use `p4 obliterate` is to use it ***without*** the `-y` flag until you are certain the files and revisions are correctly specified.

The `p4 obliterate` command has one more flag: `-z`. When you branch a file from one area of the depot into another, a "lazy copy" is created - the file itself isn't copied, only a record that a branch was made. If, for some reason, you wish to undo the "lazy copy" and create a new copy of the branched file's contents in your depot subdirectories, you can "obliterate" the lazy copy and create a new one by using `p4 obliterate -y -z` *`filename`*.

Removing lazy copies by using the `-z` flag typically *increases* disk space usage. The only practical use of `p4 obliterate -y -z` is to undo lazy copies in order to enable you to manually remove archive files without breaking any linked metadata that points to the deleted files.

If a user sees the following error message while trying to access files:

```
Operation:user-sync
Librarian checkout path failed
```

where `path` is the path of a previously-obliterated file, the user has probably encountered a problem that resulted from an earlier use of `p4 obliterate` from an older (pre-98.2/10314) Perforce server. Contact Perforce technical support for a workaround.

Deleting changelists and editing changelist descriptions

Perforce administrators can use the `-f` (force) flag with `p4 change` to change the description or username of a submitted changelist. The syntax is `p4 change -f changenumber`. This presents the standard changelist form, but enables you to edit the change time, description, and/or username.

You can also use the `-f` flag to delete any submitted changelists that have been emptied of files with `p4 obliterate`. The full syntax is `p4 change -d -f changenumber`.

Example: *Updating changelist* `123` *and deleting changelist* `124`

Use `p4 change` *with the* `-f` *(force) flag:*

```
p4 change -f 123
p4 change -d -f 124
```

The `User:` *and* `Description:` *fields for change* `123` *are edited, and change* `124` *is deleted.*

File verification by signature

Perforce administrators can use the `p4 verify filenames` command to generate 128-bit MD5 signatures of each revision of the named files. The signatures created by `p4 verify -u` can later be used to confirm proper recovery in case of a crash: if the signatures of the recovered files match the previously saved signatures, the files were recovered accurately.

Subsequent verifications of file revisions are performed against the stored signatures; if a new signature does not match the signature in the Perforce database for that file revision, Perforce adds the characters `BAD!` after the signature.

It is good practice to run `p4 verify` before performing your nightly system backups, and to proceed with the backup only if `p4 verify` reports no corruption. Generate and store new checksums with `p4 verify -u` following a successful `p4 verify` on a weekly basis.

As of Release 2003.2, `p4 verify -u` is obsolescent, because Perforce Servers at Release 2003.2 and higher automatically generate and store MD5 checksums of files upon file submission. (You must still run `p4 verify -u` at least once, following an upgrade to 2003.2, to generate signatures for any pre-2003.2 files for which signatures were not generated.)

If you ever see a `BAD!` signature during a `p4 verify` command, your database or versioned files may have been corrupted, and you should contact Perforce Technical Support.

Verifying during server upgrades

It is good practice to use `p4 verify` before and after server upgrades:

1. Before the upgrade, run:

   ```
   p4 verify -qu //...
   ```

   to generate the new checksums.

2. Take a checkpoint and copy the checkpoint and your versioned files to a safe place.

3. Perform the server upgrade.

4. After the upgrade, run:

   ```
   p4 verify -q //...
   ```

   to verify the integrity of your system.

Defining filetypes with p4 typemap

By default, Perforce automatically determines if a file is of type `text` or `binary` based on an analysis of the first 1024 bytes of a file. If the high bit is clear in each of the first 1024 bytes, Perforce assumes it to be `text`; otherwise, it is assumed to be `binary`.

Although this default behavior can be overridden by the use of the `-t` *`filetype`* flag, it's easy for users to overlook this, particularly in cases where files' types are usually (but not always) detected correctly. Certain file formats, such as RTF (Rich Text Format) and Adobe PDF (Portable Document Format), can start with a series of comment fields and/or other textual data. If these comments are sufficiently long, such files may be erroneously detected by Perforce as being of type `text`.

The `p4 typemap` command solves this problem by enabling system administrators to set up a table that links Perforce file types with file name specifications. If an entry in the typemap table matches a file being added, it overrides the file type that would otherwise be assigned by the Perforce client program. For example, to treat all PDF and RTF files as `binary`, use `p4 typemap` to modify the typemap table as follows:

```
Typemap:
        binary //....pdf
        binary //....rtf
```

The first three periods ("`...`") in the specification are a Perforce wildcard specifying that all files beneath the root directory are to be included in the mapping. The fourth period and the file extension specify that the specification applies to files ending in "`.pdf`" (or "`.rtf`").

The following table lists recommended Perforce file types and modifiers for common file extensions.

File Type	Perforce file type	Description
.asp	text	Active server page file
.avi	binary+F	Video for Windows file
.bmp	binary	Windows bitmap file
.btr	binary	Btrieve database file
.cnf	text	Conference link file
.css	text	Cascading style sheet file
.doc	binary	Microsoft Word document
.dot	binary	Microsoft Word template
.exp	binary+w	Export file (Microsoft Visual C++)
.gif	binary+F	GIF graphic file
.htm	text	HTML file
.html	text	HTML file
.ico	binary	Icon file
.inc	text	Active Server include file
.ini	text+w	Initial application settings file
.jpg	binary	JPEG graphic file
.js	text	JavaScript language source code file
.lib	binary+w	Library file (several programming languages)
.log	text+w	Log file
.mpg	binary+F	MPEG video file
.pdf	binary	Adobe PDF file
.pdm	text+w	Sybase Power Designer file
.ppt	binary	Microsoft Powerpoint file
.xls	binary	Microsoft Excel file
.zip	binary	ZIP archive file

Use the following `p4 typemap` table to map all of the file extensions to the Perforce file types recommended in the preceding table.

```
# Perforce File Type Mapping Specifications.
#
#  TypeMap:     a list of filetype mappings; one per line.
#               Each line has two elements:
#               Filetype: The filetype to use on 'p4 add'.
#               Path:     File pattern which will use this filetype.
# See 'p4 help typemap' for more information.

TypeMap:

        text //....asp
        binary+F //....avi
        binary //....bmp
        binary //....btr
        text //....cnf
        text //....css
        binary //....doc
        binary //....dot
        binary+w //....exp
        binary+F //....gif
        text //....htm
        text //....html
        binary //....ico
        text //....inc
        text+w //....ini
        binary //....jpg
        text //....js
        binary+w //....lib
        text+w //....log
        binary+F //....mpg
        binary //....pdf
        text+w //....pdm
        binary //....ppt
        binary //....xls
        binary+F //....zip
```

For more information, see the `p4 typemap` page in the *Perforce Command Reference.*

Forcing operations with the -f flag

Certain commands support the `-f` flag that enables Perforce administrators and superusers to force certain operations unavailable to ordinary users.

Perforce administrators can use this flag with `p4 branch`, `p4 change`, `p4 client`, `p4 job`, `p4 label`, and `p4 unlock`. Perforce superusers can also use it to override the `p4 user` command.

The usages and meanings of this flag are as follows:

Command	Syntax	Function
`p4 branch`	`p4 branch -f` *`branchname`*	Allows the modification date to be changed while editing the branch specification
	`p4 branch -f -d` *`branchname`*	Deletes the branch, ignoring ownership
`p4 change`	`p4 change -f [`*`changelist#`*`]`	Allows the modification date to be changed while editing the changelist specification
	`p4 change -f` *`changelist#`*	Allows the description field and username in a committed changelist to be edited
	`p4 change -f -d` *`changelist#`*	Deletes empty, committed changelists
`p4 client`	`p4 client -f` *`clientname`*	Allows the modification date to be changed while editing the client specification
	`p4 client -f -d` *`clientname`*	Deletes the client, ignoring ownership, even if the client has opened files
`p4 job`	`p4 job -f [`*`jobname`*`]`	Allows the manual update of read-only fields
`p4 label`	`p4 label -f` *`labelname`*	Allows the modification date to be changed while editing the label specification
	`p4 label -f -d` *`labelname`*	Deletes the label, ignoring ownership
`p4 unlock`	`p4 unlock -c` *`changelist`* `-f` *`file`*	Releases a lock (set with `p4 lock`) on an open file in a pending numbered changelist, ignoring ownership.

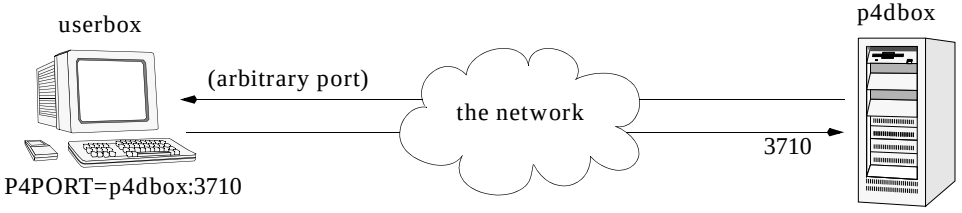
Command	Syntax	Function
`p4 user`	`p4 user -f` *`username`*	Allows the update of all fields, ignoring ownership. This command requires `super` access.
	`p4 user -f -d` *`username`*	Deletes the user, ignoring ownership. This command requires `super` access.

Advanced Perforce Administration

Running Perforce through a firewall

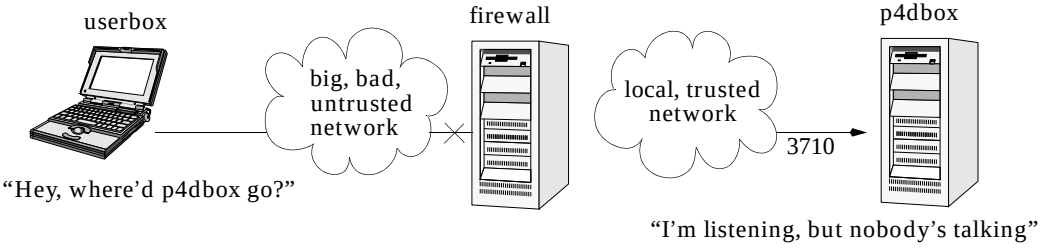
Perforce clients communicate with a Perforce server using TCP/IP. The server listens for connections at a specified port on the machine on which it's running, and clients make connections to that port.

The port on which the server listens is specified when the server is started. The number is arbitrary, so long as it does not conflict with any other networking services and is greater than 1024. The port number on the client machine is dynamically allocated.



A *firewall* is a network element which prevents any packets from outside a local (trusted) network from reaching that local network. This is done at a low level in the network protocol; any packets not coming from a trusted IP address are simply ignored.

In the following diagram, the Perforce client is on an untrusted part of the network. None of its connection requests reach the machine with the Perforce server. Consequently, the user running the client through the firewall is unable to use Perforce.



Secure shell

To solve this problem, you have to make the connection to the Perforce server from within the trusted network. This can be done securely using a package called *secure shell* (`ssh`).

Secure shell (`ssh`) is meant to be a replacement for the UNIX `rsh` (remote shell) command, which allows you to log into a remote system and execute commands on it. The "secure" part of "secure shell" comes from the fact that the connection is encrypted, so none of the data is visible while it passes through the untrusted network. With simple utilities like `rsh`, all traffic - even passwords - is unencrypted and visible to all intermediate hosts, creating an unacceptable security hazard.

Secure shell is available for free in source form for a multitude of UNIX platforms from `http://www.openssh.com`. This page also links to ports of `ssh` for OS/2 and Amiga, as well as commercial implementations for Windows and Macintosh from Data Fellows (`http://www.datafellows.com`) and SSH (`http://www.ssh.com`).

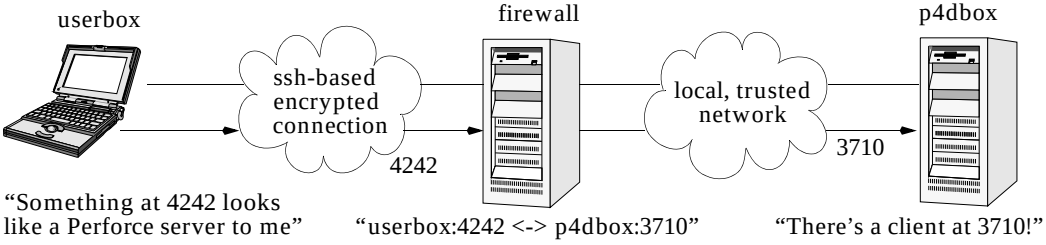
The OpenSSH FAQ (Frequently Asked Questions) can also be found online at the main site (`http://www.openssh.com/faq.html`).

Solving the problem

Once you have `ssh` up and running, the simplest thing to do is to use it to log into the firewall machine and run the Perforce client from the firewall. While it has the advantage of simplicity, it's a poor solution: you typically want your client files accessible on your local machine, and of course, there's no guarantee that your firewall machine will match your development platform.

A good solution takes advantage of `ssh`'s ability to *forward* arbitrary TCP/IP connections. By using `ssh`, you can make your Perforce client appear as though it's connecting from the firewall machine over the local (trusted) network. In reality, your client remains on your local machine, but all packets from your local machine are first sent to the firewall through the secure channel set up by `ssh`.

Suppose the Perforce server is on `p4dbox.bigcorp.com`, and the firewall machine is called `firewall.bigcorp.com`. In our example, we'll arbitrarily choose local port `4242`, and assume that the Perforce server is listening on port `3710`.



Packets ultimately destined for your client's port `4242` are first sent to the firewall, and `ssh` forwards them securely to your client. Likewise, connections made to port `4242` of the firewall machine will end up being routed to port `3710` of the Perforce server.

On UNIX, the `ssh` command on your own machine to set up and forward the TCP/IP connection would be:

```
ssh -L 4242:p4dbox.bigcorp.com:3710 firewall.bigcorp.com
```

At this point, it may be necessary to provide a password to log into `firewall.bigcorp.com`. Once the connection is established, `ssh` listens at port `4242` on the local machine, and forwards packets over its encrypted connection to `firewall.bigcorp.com`; the firewall then forwards them by normal channels to port `3710` on `p4dbox.bigcorp.com`.

All that remains is to tell the Perforce client to use port `4242` by setting the environment variable `P4PORT` to `4242`.

Normally, setting `P4PORT=4242` would normally indicate that we are trying to connect to a Perforce server on the local machine listening at port `4242`. In this case, `ssh` takes the role of the Perforce server. Anything a client sends to port `4242` of the local machine is forwarded by `ssh` to the firewall, which passes it to the real Perforce server at `p4dbox.bigcorp.com`. Since all of this is transparent to the Perforce client, it doesn't matter whether the client is talking to an instance of `ssh` that's forwarding traffic from port `4242` of the local machine, or if it's talking to a real Perforce server residing on the local machine.

The only glitch is that there's a login session you don't normally want on the firewall machine.

This can be solved by running

```
ssh -L 4242:p4dbox.bigcorp.com:3710 firewall.bigcorp.com -f sleep 9999999 -f
```

on the remote system.

This tells `ssh` on `firewall.bigcorp.com` to fork a long-running `sleep` command in the background after the password prompt. Effectively, this sets up the `ssh` link and keeps it up; there is no login session to terminate.

Finally, `ssh` can be configured to "do the right thing" so that it is unnecessary to type such a long command with each session. The Windows version of `ssh`, for instance, has a GUI to configure this.

One final concern: with port `4242` on the local machine now forwarded to a supposedly secure server, your local machine is part of the trusted network; it is prudent to make sure the local machine really *is* secure. The Windows version of `ssh` has an option to *only* permit local connections to the forwarded port, which is a wise precaution; your machine will be able to use port `4242`, but a third party's machine will be ignored.

Specifying IP addresses in P4PORT

Under most circumstances, your Perforce server's `P4PORT` setting consists solely of a port number. If you specify both an IP address *and* a port number in `P4PORT` when starting `p4d`, the Perforce server ignores requests from any IP addresses other than the one specified in `P4PORT`.

Although this isn't the default behavior, it can be useful. For instance, if you want to configure `p4d` to listen only to a specific network interface or IP address, you can force your Perforce server to ignore all non-local connection requests by setting `P4PORT=localhost:`*`port`*.

Running from inetd on UNIX

Under a normal installation, the Perforce server is run on UNIX as a background process which waits for connections from clients. To have `p4d` start up only when connections are made to it, using `inetd` and `p4d -i`, add the following line to `/etc/inetd.conf`:

```
p4dservice stream tcp nowait username /usr/local/bin/p4d p4d -i -rp4droot
```

and add the following to `/etc/services`:

```
p4dservice nnnn/tcp
```

where:

- *`p4dservice`* is the service name you choose for this Perforce server
- `/usr/local/bin` is the directory holding your `p4d` binary
- *`p4droot`* is the root directory (`P4DROOT`) to use for this Perforce server (for example, `/usr/local/p4d`)
- *`username`* is the UNIX user name to use for running this Perforce server
- *`nnnn`* is the port number for this Perforce server to use

The "extra" `p4d` on the `/etc/inetd.conf` line must be present; `inetd` passes this to the OS as `argv[0]`. The first argument, then, is the `-i` flag, which causes `p4d` not to run in the background as a daemon, but rather to serve the single client connected to it on stdin/stdout. (This is the convention used for services started by `inetd`.)

This method is an alternative to running `p4d` from a startup script. It can also be useful for providing special services; for example, at Perforce, we have a number of test servers running on UNIX, each defined as an `inetd` service with its own port number.

There are caveats with this method:

- `inetd` may disallow excessive connections, so a script which invokes several thousand `p4` commands, each of which spawns an instance of `p4d` via `inetd` may cause `inetd` to temporarily disable the service. Depending on your system, you may need to configure `inetd` to ignore or raise this limit.
- There is no easy way to disable the server, since the `p4d` executable is run each time; disabling the server requires modifying `/etc/inetd.conf` and restarting `inetd`.

Case sensitivity and multi-platform development

Early (pre-97.2) releases of the Perforce server treated all filenames, pathnames, and database entity names with case significance, whether the server was running on UNIX or Windows.

For example, `//depot/main/file.c` and `//depot/MAIN/FILE.C` were treated as two completely different files. This caused problems where users on UNIX were connecting to a Perforce server running on Windows, because the filesystem underlying the server could not store files with the case-variant names submitted by UNIX users.

In release 97.3, the behavior was changed, and only the UNIX server supports case-sensitive names. However, there are still some case-sensitivity problems which users can run into when sharing development projects across UNIX and Windows.

If you are running a pre-97.2 server on Windows, please contact `support@perforce.com` to discuss upgrading your server and database.

For current releases of the server:

- The Perforce server on UNIX supports case-sensitive names.
- The Perforce server on Windows ignores case differences.
- Case is always ignored in keyword-based job searches, regardless of platform.

The following table summarizes these rules:

Case-sensitive	UNIX server	Windows server
Pathnames and filenames	Yes	No
Database entities (clients, labels, etc.)	Yes	No
Job search keywords	No	No

To find out what platform your Perforce server runs on, use `p4 info`.

Perforce server on UNIX

If your Perforce server is on UNIX, and you have users on both UNIX and Windows, your UNIX users must be very careful not to submit files whose names differ only by case. Although the UNIX server can support these files, when Windows users sync their workspaces, they'll find files overwriting each other.

Conversely, Windows users will have to be careful to use case consistently in file and path names when adding new files. They may not realize that files added as `//depot/main/one.c` and `//depot/MAIN/two.c` will appear in two different directories in a UNIX user's workspace.

The UNIX Perforce server always respects case in client names, label names, branch view names, and so on. Windows users connecting to a UNIX server should be aware that the lowercased workstation names are used as the default names for new client workspaces. For examples, if a new user creates a client spec on a Windows machine named `ROCKET`, his client workspace is named `rocket` by default. If he later sets `P4CLIENT` to `ROCKET` (or `Rocket`), Perforce will tell him his client is undefined. He must set `P4CLIENT` to `rocket` (or unset it) to use the client workspace he defined.

Perforce server on Windows

If your Perforce server is running on Windows, your UNIX users must be aware that their Perforce server will store case-variant files in the same namespace.

For example, users who try something like this:

```
p4 add dir/file1
p4 add dir/file2
p4 add DIR/file3
```

should be aware that all three files will be stored in the same depot directory. The depot path and filenames assigned to the Windows server will be those first referenced. (In this case, the depot path name would be `dir`, and not `DIR`.)

Monitoring server activity

Use the `p4 monitor` command to obtain information about Perforce-related processes running on your Perforce server machine.

Enabling server process monitoring

You must enable server process monitoring for `p4 monitor` to work. To enable server process monitoring, set the `monitor` counter as follows:

```
p4 counter -f monitor 1
```

After setting the monitor counter, stop and restart the Perforce Server to enable server process monitoring. Server process monitoring requires minimal system resources.

Listing running processes

To list the processes running on the Perforce server, use the command:

```
p4 monitor show
```

By default, each line of `p4 monitor` output looks like this:

```
pid status owner hh:mm:ss command [args]
```

where *`pid`* is the UNIX process ID (or Windows thread ID), *`status`* is `R` or `T` depending on whether the process is running or marked for termination, *`owner`* is the Perforce user name of the user who invoked the command, *`hh:mm:ss`* is the time elapsed since the command was called, and *`command`* and *`args`* are the command and arguments as received by the Perforce server. For example:

```
$ p4 monitor show
74612 R qatool     00:00:47 job
78143 R edk        00:00:01 filelog
78207 R p4admin    00:00:00 monitor
```

To show the arguments with which the command was called, use the `-a` (arguments) flag:

```
$ p4 monitor show -a
74612 R qatool     00:00:48 job job004836
78143 R edk        00:00:02 filelog //depot/main/src/proj/file1.c //dep
78208 R p4admin    00:00:00 monitor show -a
```

To obtain more information about user environment, use the `-e` flag. The `-e` flag produces output of the form:

```
pid client IP-address status owner workspace hh:mm:ss command [args]
```

where *client* is the Perforce client program (if known), *IP-address* is the IP address of the user's Perforce client program, and *workspace* is the name of the calling user's current client workspace setting. For example:

```
$ p4 monitor show -e
74612 p4        192.168.10.2   R qatool    buildenvir 00:00:47 job
78143           192.168.10.4   R edk       eds_elm    00:00:01 filelog
78207 p4        192.168.10.10  R p4admin   p4server   00:00:00 monitor
```

By default, all user names and (if applicable) client workspace names are truncated at 10 characters, and lines are truncated at 80 characters. To disable truncation, use the `-l` (long-form) option:

```
$ p4 monitor show -a -l
74612 R qatool     00:00:50 job job004836
78143 R edk        00:00:04 filelog //depot/main/src/proj/file1.c //dep
ot/main/src/proj/file1.mpg
78209 R p4admin    00:00:00 monitor show -a -l
```

Only Perforce administrators and superusers may use the `-a`, `-l`, and `-e` options.

Marking processes for termination

If a process on a Perforce Server is consuming excessive resources, administrators and superusers can mark it for termination with `p4 monitor terminate`.

Once marked for termination, the process is terminated by the Perforce server within 50000 scan rows or lines of output. Only processes that have been running for at least ten seconds can be marked for termination. Users of terminated processes are notified with the following message:

```
Command has been canceled, terminating request
```

Processes that involve the use of interactive forms (such as `p4 job` or `p4 user`) can also be marked for termination, but data entered by the user into the form is preserved. Some commands, such as `p4 obliterate`, cannot be terminated.

Clearing entries in the process table

Under some circumstances (for example, a Windows machine is rebooted while certain Perforce commands are running), entries may remain in the process table even after the process has terminated.

Perforce administrators and superusers can remove these erroneous entries from the process table altogether with `p4 monitor clear` *pid*, where *pid* is the erroneous process ID. To clear all processes from the table (running or not), use `p4 monitor clear all`.

Running processes removed from the process table with `p4 monitor clear` continue to run to completion.

Perforce server trace flags

You can turn on command tracing in the Perforce server by adding the `-v server=1` flag to the `p4d` startup command. Use `P4LOG` or the `-L` *`logfile`* flag to name a log file:

```
p4d -r /usr/perforce -v server=1 -p 1666 -L /usr/perforce/logfile
```

Trace output appears in the specified log file, and shows the date, time, username, IP address, and command for each request processed by the server. Before turning on logging, you should make sure that you have adequate disk space.

Windows

Prior to Release 98.1, you could not set this trace flag when running Perforce as a service; you could set this flag (on Windows only) when running `p4d.exe` a server process from the MS-DOS command line.

As of Release 98.1, you can use the `p4 set` command to set `P4DEBUG` as a registry variable to "`server=1`" and thereby use this trace flag with Perforce installed as a service on Windows.

Prior to Release 97.3, server trace flags were unavailable.

The server trace flags and their meanings are as follows:

Trace flag	Meaning
`server=1`	Logs server commands to the server log file. (Requires server at release 98.1 or higher)
`server=2`	In addition to data logged at level 1, logs server command completion and basic information on CPU time used. Time elapsed is reported in seconds. On UNIX, CPU usage (system and user time) is reported in milliseconds, as per `getrusage()`. (Requires server at release 2001.1 or higher)
`server=3`	In addition to data logged at level 2, adds usage information for compute phases of `p4 sync` and `p4 flush` commands. (Requires server at release 2001.2 or higher)

Setting server debug levels on a Perforce server (`p4d`) has no effect on the debug level of a Perforce Proxy (`p4p`) process, and vice versa.

In most cases, the Perforce server trace flags are useful only to administrators working with Perforce Technical Support to diagnose or investigate a problem.

Moving a Perforce Server to a new machine

The procedure for moving an existing Perforce Server from one machine to another depends on whether or not you're moving between machines

- of identical architectures,
- of different architectures using the same text file (CR/LF) format, or
- of different architecture *and* different text file format.

Additional considerations apply if the new machine has a different IP address/hostname.

The Perforce server stores two types of data under the Perforce root directory: *versioned files* and a *database* containing *metadata* describing those files. Your versioned files are the ones created and maintained by your users, and your database is a set of Perforce-maintained binary files holding the history and present state of the versioned files. In order to move a Perforce server to a new machine, both the versioned files and the database must be successfully migrated from the old machine to the new machine.

For more about the distinction between versioned files and database, as well as for an overview of backup and restore procedures in general, see "Backup and Recovery Concepts" on page 25.

For more about moving a Perforce server from one machine to another, see also the Perforce Tech Note at:

```
http://www.perforce.com/perforce/technotes/note010.html
```

Moving your versioned files and Perforce database

Between machines of the same architecture

If the architecture of the two machines is the same (e.g., SPARC/SPARC, x86/x86), the versioned files and database can be copied directly between the machines, and you only need to move the server root directory tree to the new machine. You can use `tar`, `cp`, `xcopy.exe`, or any other method. Copy everything in and under the `P4ROOT` directory - the `db.*` files (your database) as well as the depot subdirectories (your versioned files).

1. Back up your server (including a `p4 verify` before the backup) and take a checkpoint.
2. On the old machine, stop `p4d`.
3. Copy the contents of your old server root (`P4ROOT`) and all its subdirectories on the old machine into the new server root directory on the new machine.
4. Start `p4d` on the new machine with the desired flags.
5. Run `p4 verify` on the new machine to ensure that the database and your versioned files were transferred correctly to the new machine.

(Although the backup, checkpoint, and subsequent `p4 verify` are not strictly necessary in this case, it's always good practice to verify, checkpoint, and back up your system before any migration, and likewise to perform a subsequent verification after migration.)

Between different architectures using the same text format

If the internal data representation (big-endian vs. little-endian) convention differs between the two machines (e.g., Linux-on-x86/SPARC, NT-on-Alpha/NT-on-x86), but their operating systems use the same CR/LF text file conventions, you can still simply move the server root directory tree to the new machine.

Although the versioned files are portable across architectures, the database, as stored in the `db.*` files, is not. To transfer the database, you will need to create a checkpoint of your Perforce server on the old machine and use that checkpoint to recreate the database on the new machine. The checkpoint is a text file which can be read by a Perforce server on any architecture. For more details, see "Creating a checkpoint" on page 26.

After creating the checkpoint, you can use `tar`, `cp`, `xcopy.exe`, or any other method to copy the checkpoint file and the depot directories to the new machine. (You don't need to copy the `db.*` files, because they will be recreated from the checkpoint you took.)

1. On the old machine, use `p4 verify` to ensure that the database is in a consistent state.
2. On the old machine, stop `p4d`.
3. On the old machine, create a checkpoint:

   ```
   p4d -jc checkpointfile
   ```

4. Copy the contents of your old server root (`P4ROOT`) and all its subdirectories on the old machine into the new server root directory on the new machine.

   (To be precise, you don't need to copy the `db.*` files, just the checkpoint and the depot subdirectories. The `db.*` files will be recreated from the checkpoint. If it's more convenient to copy everything, then copy everything.)
5. On the new machine, if you copied the `db.*` files, be sure to remove them from the new `P4ROOT` before continuing.
6. Recreate a new set of `db.*` files suitable for your new machine's architecture from the checkpoint you created:

   ```
   p4d -jr checkpointfile
   ```

7. Start `p4d` on the new machine with the desired flags.
8. Run `p4 verify` on the new machine to ensure that the database and your versioned files were transferred correctly to the new machine.

Between Windows and UNIX

In this case, both the architecture of the system *and* the CR/LF text file convention may be different. You still have to create a checkpoint, copy it, and recreate the database on the new platform, but when you move the depot subdirectories containing your versioned files, you will also have to address the issue of the differing linefeed convention between the two platforms.

Depot subdirectories can contain both text and binary files. The text files (in RCS format, ending with "`,v`") and binary files (directories of individual binary files, each directory ending with "`,d`") will need to be transferred differently in order to translate the line endings on the text files while leaving the binary files unchanged.

As with all other migrations, be sure to run `p4 verify` after your migration.

Warning Windows is a case-insensitive operating system. Files that differ by case only on a UNIX server will occupy the same namespace when transferred to a Windows machine. For instance, files `Makefile` and file `makefile` on a UNIX server will appear to be the same file on a Windows machine.

Due to the risk of data loss due to case collision, migrations from UNIX server to Windows are not encouraged.

Contact Perforce Technical Support for assistance when migrating a Perforce server from Windows to UNIX or vice-versa.

Changing the IP address of your server

If the IP address of the new machine is not the same as that of the old machine, you may need to update any IP-address-based protections in your protections table. See "Administering Perforce: Protections" on page 71 for information on setting protections for your Perforce server.

If you are a licensed Perforce customer, you will also need a new license file to reflect the new IP address. Contact Perforce technical support to obtain an updated license.

Changing the hostname of your server

If the hostname of the new machine serving Perforce is different from that of its predecessor, your users will need to change their `P4PORT` settings. If the old machine is being retired or renamed, consider setting an alias for the new machine to match that of the old machine, so that your users won't have to change their `P4PORT` settings.

Using Multiple Depots

Just as Perforce servers can host multiple depots, Perforce client programs can access files from multiple depots. These other depots may reside within the Perforce server normally accessed by the Perforce client, or they may reside within other, *remote*, Perforce servers.

When using local depots, the user's Perforce client program communicates with the Perforce server specified by the user's `P4PORT` environment variable or equivalent setting.

When using remote depots, the user's Perforce client program uses the Perforce server specified by the user's `P4PORT` environment variable or equivalent setting as a means to access a second, *remote*, Perforce server. The local Perforce server communicates with the remote Perforce server in order to access a subset of its files. Remote depots are primarily used to facilitate the sharing of code (that is, "code drops") between separate organizations, and are discussed in "Remote depots and distributed development" on page 65.

Remote depots are not a generalized solution for load-balancing or network access problems. To support shared development or to deal with load-balancing or network access problems, see "Perforce Proxy" on page 131.

Defining new depots

New depots (local or remote) in a server namespace are defined with the command `p4 depot` *`depotname`*. Depots may be defined as either *local* or *remote* depots.

Defining local depots

To define a new local depot (that is, a new depot in the current Perforce server namespace), call `p4 depot` with the new depot name, and edit only the `Map:` field in the resulting form.

For example, to create a new depot called `book` with the files stored in the local Perforce server namespace in a root subdirectory called `book` (that is, `$P4ROOT/book`), enter the command `p4 depot book`, and fill in the resulting form as follows:

```
Depot:      book
Type:       local
Address:    subdir
Map:        book/...
```

By default, the `Map:` field on a local depot points to a depot directory matching the depot name, relative to the server root (`P4ROOT`) setting for your server. To store a depot's versioned files on another volume or drive, specify an absolute path in the `Map:` field. This path need not be under `P4ROOT`.

Absolute paths in the `Map:` field on Windows must be specified with forward slashes (for instance, `d:/newdepot/`) in the depot form.

Other depot operations

The following operations apply to both local and remote depots.

Naming depots

Depot names share the same namespace as branches, client workspaces, and labels. For example, `//rel2` refers uniquely to one of the depot `rel2`, the workspace `rel2`, the branch `rel2`, or the label `rel2`; you can't simultaneously have both a depot and a label named `rel2`.

Listing depots

You can list all depots known to the current Perforce server with the `p4 depots` command.

Deleting depots

You can delete depots with `p4 depot -d` *`depotname`*.

To delete a depot, it must be empty; you must first obliterate all files in the depot with `p4 obliterate`.

For `local` depots, `p4 obliterate` deletes the versioned files as well as all their associated metadata. For `remote` depots, `p4 obliterate` erases *only* the locally held client and label records; the files and metadata still residing on the remote server remain intact.

Before using `p4 obliterate`, and *especially* if you're about to use it to obliterate all files in a depot, read and understand the warnings in "Reclaiming disk space by obliterating files" on page 45.

Remote depots and distributed development

Remote depots are designed to support shared *code*, not shared *development*. They enable independent organizations with separate Perforce installations to integrate changes between Perforce installations. Briefly:

- A "remote depot" is a depot on your Perforce server of type `remote`. It acts as a pointer to a depot of type "local" that resides on a second Perforce server.
- A user of a remote depot is typically a build engineer or handoff administrator responsible for integrating software between separate organizations.
- Control over what files are available to a user of a remote depot resides with the administrator of the remote server - not the users of the local server.
- See "Restricting access to remote depots" on page 69 for security requirements.

When to use remote depots

Perforce is designed to cope with the latencies of large networks and inherently supports users with client workspaces at remote sites. A single Perforce installation is ready, out of the box, to support a shared development project, regardless of the geographic distribution of its contributors.

Partitioning joint development projects into separate Perforce installations will not improve throughput, and usually only complicates administration. If your site is engaged in distributed development (that is, developers in multiple sites working on the same body of code), it is usually preferable to set up a Perforce installation with all code in depots resident on one Perforce server, and to cache frequently-accessed files at each development site with Perforce Proxy.

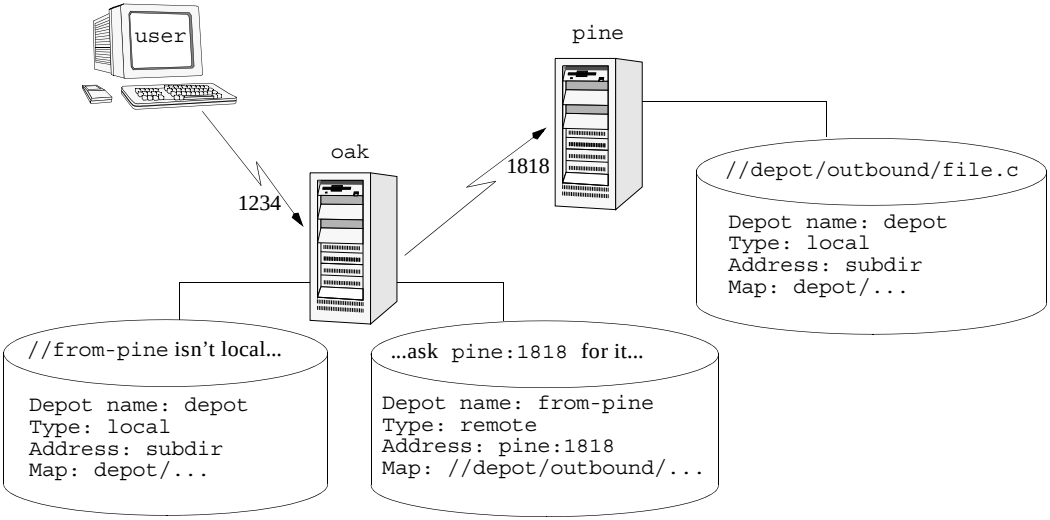
If, however, your organization regularly imports or exports material from other organizations, you may wish to consider using Perforce's remote depot functionality to streamline your code drop procedures.

How remote depots work

The following diagram illustrates how Perforce client programs use a user's default Perforce server to access files in a depot hosted on another Perforce server.

In this example, an administrator of a Perforce server at `oak:1234` is retrieving a file from a remote server at `pine:1818`.

```
P4PORT=oak:1234
p4 integ //from-pine/file.c //depot/codedrops/file.c
```



Although it is possible to permit individual developers to sync files from remote depots into their client workspaces, this is generally an inefficient use of resources.

The preferred technique for using remote depots is for your organization's build or handoff administrator to integrate files from a remote depot into an area of your local depot. After the integration, your developers can access copies of the files from the local depot into which the files were integrated.

To accept a code drop from a remote depot, create a branch in a local depot from files in a remote depot, and then integrate changes from the remote depot into the local branch. This integration is a one-way operation; you cannot make changes in the local branch and integrate them back into the remote depot. The copies of the files integrated into your Perforce installation become the responsibility of your site's development team; the files on the depot remain under the control of the development team at the other Perforce installation.

Restrictions on remote depots

Prior to Release 99.2, remote depots were accessible only by Perforce servers running at the same release levels. At Release 99.2 and higher, remote depots are interoperable between release levels.

Remote depots facilitate the sharing of code between organizations (as opposed to the sharing of development within a single organization). Consequently, access to remote depots is restricted to read-only operations, and server metadata (information about client workspaces, changelists, labels, and so on) cannot be accessed using remote depots.

Using remote depots for code drops

Performing a code drop requires coordination between two organizations, namely the site receiving the code drop, and the site providing the code drop. In most cases, the following three things must be configured:

- The Perforce administrator at the site receiving the code drop must create a remote depot on his or her Perforce server that points to the site providing the code drop.

  This is described in "Defining remote depots" on page 68.

- The Perforce administrator at the site providing the code drop should configure his or her Perforce server to allow the recipient site's remote depot to access the providing site's Perforce server.

  This is described in "Restricting access to remote depots" on page 69.

- The configuration manager or integration manager at the receiving site must integrate the desired files from the remote depot into a local depot under his or her control.

  This is described in "Receiving a code drop" on page 70.

Defining remote depots

To define a new remote depot:

1. Create the depot with `p4 depot` *`depotname`*.
2. Set the `Type:` to `remote`.
3. Direct your Perforce server to contact the remote Perforce server by providing the remote server's name and listening port in the `Address:` field.

   A remote server's host and port are specified in the `Address:` field just as though it were a `P4PORT` setting.
4. Set the `Map:` field to map into the desired portion of the remote server's namespace.

   For remote depots, the mapping contains a subdirectory relative to the remote depot namespace. For example, `//depot/outbound/...` maps to the `outbound` subdirectory of the depot named `depot` hosted on the remote server.

   The `Map:` field must contain a single line pointing to this subdirectory, specified in depot syntax, and containing the "`...`" wildcard on its right side.

   If you are unfamiliar with client views and mappings, see the *Perforce User's Guide* for general information about how Perforce mappings work.

In order for anyone on your site to access files in the remote depot, the administrator of the remote server must grant `read` access to user `remote` to the depot(s) and subdirectories within the depots specified in the `Map:` field.

Example: *Defining a remote depot*

Lisa is coordinating a project and wants to provide a set of libraries to her developers from a third party development shop. The third party development shop uses a Perforce server on host `pine` *that listens on port* `1818`*. Their policy is to place releases of their libraries on their server's single depot* `depot` *under the subdirectory* `outbound`*.*

Lisa creates a new depot from which she can access the code drop; she'll call this depot `from-pine`*; she'd type* `p4 depot from-pine` *and fill in the form as follows:*

```
Depot:      from-pine
Type:       remote
Address:    pine:1818
Map:        //depot/outbound/...
```

This creates a remote depot called `from-pine` *on Lisa's Perforce server; this depot (*`//from-pine`*) maps to the third party's* `depot`*'s namespace under its* `outbound` *subdirectory.*

Restricting access to remote depots

Remote depots are always accessed by a virtual user named `remote`. This virtual user does not consume a Perforce license.

By default, all the files on any Perforce server may be accessed remotely. To limit or eliminate remote access to a particular server, use `p4 protect` to set permissions for user `remote` on that server. Perforce recommends that administrators deny access to user `remote` across all files and all depots by adding the following permission line in the `p4 protect` table:

```
list user remote *  -//...
```

Since `remote` depots can only be used for `read` access, it is not necessary to remove `write` or `super` access to user `remote`.

Example security configuration

Using the two organizations described in "Receiving a code drop" on page 70, a basic set of security considerations for each site would include:

On the local (`oak`) site:

- Deny access to `//from-pine` to all users. Developers at the `oak` site have no need to access files on the `pine` server by means of the remote depot mechanism.
- Grant `read` access to `//from-pine` to your integration or build manager(s). The only user at the `oak` site who requires access the `//from-pine` remote depot is the user (in this example, "`adm`") performing the integration from the remote depot to the local depot.

  To accomplish this, the `oak` Perforce administrator should include the following lines to the `p4 protect` table:

  ```
  list user * * -//from-pine/...
  read user adm * //from-pine/...
  ```

On the remote (`pine`) site, access to code residing on `pine` is entirely the responsibility of the `pine` server's administrator. At a minimum, this administrator should:

- Pre-emptively deny access to user `remote` across all depots from all IP addresses:

  ```
  list user remote * -//...
  ```

  Adding these lines to the `p4 protect` table is sound practice for any Perforce installation whether its administrator intends to use remote depots or not.

- Grant `read` access to user `remote` to only those areas of the `pine` server into which code drops are to be placed. In this example, outgoing code drops are published in the `//depot/outbound/...` subdirectory on the `pine` server.

- Grant `read` access for user `remote` only to the IP address of the Perforce server(s) authorized to receive code drops. If `oak`'s IP address was `192.168.41.2`, the `pine` Perforce administrator should add the following to the `p4 protect` table:

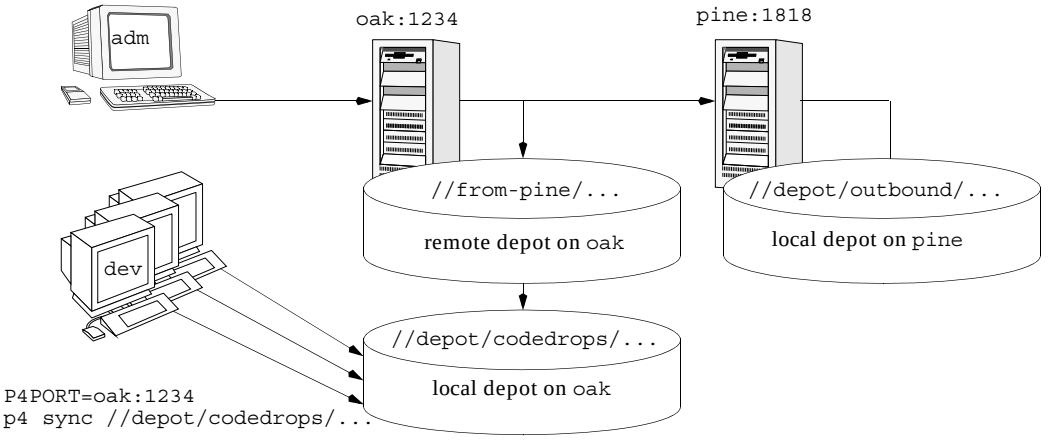
```
read user remote 192.168.41.2 //depot/outbound/...
```

Receiving a code drop

To perform a handoff and/or code drop between two Perforce installations:

1. Developers on `pine:1818` complete work on a body of code for delivery.
2. The build or release manager on `pine:1818` branches the deliverable code into an area of `pine:1818` intended for outbound code drops. In this example, the released code is branched to `//depot/outbound/...`
3. A Perforce administrator at `oak:1234` configures a remote depot called `//from-pine` on the `oak` server. This remote depot contains a `Map:` field that directs the `oak` server to the `//depot/outbound` area of `pine:1818`.
4. Upon notification of the release's availability, a build or release manager at `oak:1234` performs the code drop by integrating files in the `//from-pine/...` remote depot into a suitable area of the local depot, such as `//depot/codedrops/pine`.
5. Developers at `oak:1234` may now use the `pine` organization's code, now hosted locally under `//depot/codedrops/pine`. Should patches be required to `pine`'s code, `oak` developers can make such patches under `//depot/codedrops/pine`. The `pine` group retains control over its code.

```
P4PORT=oak:1234
p4 integrate //from-pine/... //depot/codedrops/pine/...
```



Chapter 4 Administering Perforce: Protections

Perforce provides a protection scheme to prevent unauthorized or inadvertent access to the depot. The protections determine which Perforce commands can be run, on which files, by whom, and from which host. Configure protections with the `p4 protect` command.

When Should Protections Be Set?

Run `p4 protect` immediately after installing Perforce for the first time. Before the first call to `p4 protect`, every Perforce user is a superuser, and may access and change anything in the depot. The first time a user runs `p4 protect`, a protections table is created that gives superuser access to the user from all IP addresses, and lowers all other users' access level to `write` permission on all files from all IP addresses.

The Perforce protections table is stored in the `db.protect` file in the server root directory; if `p4 protect` is first run by an unauthorized user (or if you accidentally lock yourself out!) the depot can be brought back to its unprotected state by removing this file.

Setting Protections with "p4 protect"

The `p4 protect` form contains a single form field called `Protections:` that consists of multiple lines. Each line in `Protections:` contains subfields, and the table looks like this:

Example: *A sample protections table:*

```
Protections:
read        user       emily       *            //depot/elm_proj/...
write       group      devgrp      *            //...
write       user       *           195.3.24.*   -//...
write       user       joe         *            -//...
write       user       lisag       *            -//depot/...
write       user       lisag       *            //depot/doc/...
super       user       edk         *            //...
```

(The five fields may not line up vertically on your screen; they are aligned here for readability.)

The permission lines' five fields

Each line specifies a particular permission; each permission is defined by five fields.

The meanings of these fields are:

Field	Meaning
`Access Level`	Which access level is being granted: `list`, `read`, `open`, `write`, `review`, `admin`, or `super`. These are described below.
`User/Group`	Does this protection apply to a user or a group? The value must be `user` or `group`.
`Name`	The user or group whose protection level is being defined. This field may contain the "`*`" wildcard. A "`*`" by itself grants this protection to everyone, "`*e`" grants this protection to every user (or group) whose username ends with an "`e`".
`Host`	The TCP/IP address of the host being granted access. This must be provided as the numeric address of the host in dotted quad notation (for instance, `192.168.41.2`). This field may contain the "`*`" wildcard. A "`*`" by itself means that this protection is being granted for all hosts. The wildcard can be used as in any string, so "`192.168.41.*`" would define access to any subnet within `192.168.41`, and "`*3*`" would refer to any IP address with a "`3`" in it. Because the client's IP address is provided by the Internet Protocol itself, this field provides as much security as is provided by the network. If you are using Perforce Proxy, see "P4P and protections" on page 135 to find out how to use host-based protections for users connecting to a Perforce Server from behind a Perforce Proxy.
`Files`	A file specification representing the files in the depot on which permissions are being granted. Perforce wildcards can be used in the specification. "`//...`" means all files in all depots.

Access levels

The access level is described by the first value on each line. The seven access levels are:

Level	Meaning
`list`	Permission is granted to run Perforce commands that display file metadata, such as `p4 filelog`. No permission is granted to view or change the contents of the files.
`read`	The user(s) can run those Perforce commands that are needed to read files, such as `p4 client` and `p4 sync`. The `read` permission includes `list` access.

Level	Meaning
`open`	Grants permission to read files from the depot into the client workspace, and gives permission to open and edit those files. This permission does not permit the user to write the files back to the depot. `open` is similar to `write`, except that with `open` permission, users are not permitted to run `p4 submit` or `p4 lock`. The `open` permission includes `read` and `list` access.
`write`	Permission is granted to run those commands that edit, delete, or add files. The `write` permission includes `read`, `list`, and `open` access. This permission allows use of all Perforce commands except `protect`, `depot`, `obliterate`, and `verify`.
`review`	A special permission granted to review daemons. It includes list and read access, plus use of the `p4 review` command. Only review daemons require this permission.
`admin`	For Perforce administrators; grants permission to run Perforce commands that affect metadata, but not server operation. Provides `write` and `review` access plus the added ability to override other users' branch specifications, client specifications, jobs, labels, and change descriptions, as well as to update the typemap table, verify and obliterate files, and to customize job specifications.
`super`	For Perforce superusers; grants permission to run all Perforce commands. Provides `write`, `review`, and `admin` access plus the added ability to create depots and triggers, edit protections and user groups, delete users, reset passwords, and to shut down the server.

Each Perforce command is associated with a particular minimum access level. For example, to run `p4 sync` on a particular file, the user must have been granted at least `read` access on that file.

The access level required to run a particular command can usually be reasoned from knowledge of what the command does. For example, it is somewhat obvious that `p4 print` would require `read` access. For a full list of the minimum access levels required to run each Perforce command, see "How Protections are Implemented" on page 77.

Which users should receive which permissions?

The simplest method of granting permissions is to give `write` permission to all users who don't need to manage the Perforce system, and give `super` access to those who do, but there are times when this simple solution isn't sufficient.

`Read` access to particular files should be granted to users who never need to edit those files. For example, an engineer may have `write` permission for source files, but have only `read` access to the documentation, and managers not working with code may be granted `read` access to all files.

Because `open` access enables local editing of files, but does not permit these files to be written to the depot, `open` access is granted only in unusual circumstances. You might choose `open` access over `write` access when users are testing their changes locally, but when these changes should not be seen by other users. For instance, bug testers may want to change code in order to test theories as to why particular bugs occur, but these changes are not to be written to the depot. Perhaps a codeline has been frozen, and local changes are to be submitted to the depot only after careful review by the development team. In these cases, `open` access is granted until the code changes have been approved, after which time the protection level is upgraded to `write` and the changes submitted.

Default protections

Before `p4 protect` is invoked, every user has superuser privileges. When `p4 protect` is first run, two permissions are set by default. The default protections table looks like this:

```
write        user        *        *        //...
super        user        edk      *        //...
```

This indicates that `write` access is granted to all users, on all hosts, to all files. Additionally, the user who first invoked `p4 protect` (in this case, `edk`) is granted superuser privileges.

Interpreting multiple permission lines

The access rights granted to any user are defined by the union of mappings in the protection lines that match her user name and client IP address. (This behavior is slightly different when exclusionary protections are provided and is described in the next section.)

Example: *Multiple Permission Lines*

Lisa, whose Perforce username is `lisag`*, is using a client with the* IP *address* `195.42.39.17`*. The protections file reads as follows:*

```
read         user     *        195.42.39.17    //...
write        user     lisag    195.42.39.17    //depot/elm_proj/doc/...
read         user     lisag    *               //...
super        user     edk      *               //...
```

The union of the first three permissions apply to Lisa. Her username is `lisag`*, and she's currently using a client workspace on the host specified in lines 1 and 2. Thus, she can write files located in the depot's* `doc` *subdirectory, but can only read other files. Lisa tries the following:*

She types `p4 edit //lisag/doc/elm-help.1`*, and is successful.*

She types `p4 edit //lisag/READ.ME`*, and is told that she doesn't have the proper permission. She is trying to write to a file to which has only* `read` *access. She types* `p4 sync //lisag/READ.ME`*, and this command succeeds, as only* `read` *access is needed, and this is granted to her on line 1.*

Lisa later switches to another machine with IP *address* `195.42.39.13`*. She types* `p4 edit //lisag/doc/elm-help.1`*, and the command fails; when she's using this host, only the third permission applies to her, and she only has* `read` *privileges.*

Exclusionary protections

A user can be denied access to particular files by prefacing the fifth field in a permission line with a minus sign ("`-`"). This is useful for giving most users access to a particular set of files, while denying access to the same files to only a few users.

To use exclusionary mappings properly, it is necessary to understand some of their peculiarities:

- When an exclusionary protection is included in the protections table, the order of the protections is relevant: the exclusionary protection is used to remove any matching protections above it in the table.
- No matter what access level is provided in an exclusionary protection, all access levels for the matching files and IP addresses are denied. The access levels provided in exclusionary protections are irrelevant. See "How Protections are Implemented" on page 77 for a more detailed explanation.

Example: *Exclusionary protections.*

Ed has used `p4 protect` *to set up protections as follows:*

```
write       user       *          *       //...
read        user       emily      *       //depot/elm_proj/...
super       user       joe        *       -//...
list        user       lisag      *       -//...
write       user       lisag      *       //depot/elm_proj/doc/...
```

The first permission looks like it grants write access to all users to all files in all depots, but this is overruled by later exclusionary protections for certain users.

The third permission denies Joe permission to access any file from any host. No subsequent lines grant Joe any further permissions; thus, Joe has been effectively locked out of Perforce.

The fourth permission denies Lisa all access to all files on all hosts, but the fifth permission gives her back `write` *access on all files within a specific directory. If the fourth and fifth lines were switched, Lisa would be unable to run any Perforce command.*

Granting Access to Groups of Users

Perforce *groups* simplify maintenance of the protections table. The names of users with identical access requirements can be stored in a single group; the group name can then be entered in the table, and all the users in that group receive the specified permissions.

Groups are maintained with `p4 group` and their protections assigned with `p4 protect`. Only Perforce superusers may use these commands.

Creating and editing groups

If `p4 group` *groupname* is called with a non-existent *groupname*, a new group named *groupname* is created. Calling `p4 group` with an existing *groupname* allows editing of the user list for this group.

To add users to a group, add user names in the `Users:` field of the form generated by the `p4 group` *groupname* command. User names are entered under the `Users:` field header; each user name must be typed on its own line, indented. A single user may be listed in any number of groups.

Groups may contain other groups as well as individual users. To add all users in a previously defined group to the group you're working with, include the group name in the `Subgroups:` field of the `p4 group` form. User and group names occupy separate namespaces, so groups and users can have the same names.

Groups and protections

To use a group with the `p4 protect` form, specify a group name instead of a user name in any line in the protections table, and set the value of the second field on the line to `group` instead of `user`. All the users in that group will be granted the specified access.

Example: *Granting access to Perforce groups.*

This protections table grants `list` *access to all members of the group* `devgrp`*, and* `super` *access to user* `edk`*:*

```
list        group       devgrp      *       //...
super       user        edk         *       //...
```

If a user belongs to multiple groups, one permission may override another. For instance, if you use exclusionary mappings to deny access to an area of the depot to members of `group1`, but grant access to the same area of the depot to members of `group2`, a user who is a member of both `group1` and `group2` is granted, not denied, access. The actual permissions granted to a specific user can be determined by replacing the names of all groups to which a particular user belongs with the user's name within the protections table, and applying the rules described earlier in this chapter.

Deleting groups

To delete a group, invoke

```
p4 group -d groupname
```

Alternately, invoke `p4 group groupname` and delete all the users from the group in the resulting editor form. The group will be deleted when the form is closed.

How Protections are Implemented

This section describes the algorithm that Perforce follows to implement its protection scheme. Protections can be used properly without reading this section, as the material here is provided to explain the logic behind the behavior described above.

Users' access to files is determined by the following steps:

- The command is looked up in the command access level table shown in "Access Levels Required by Perforce Commands" on page 78 to determine the minimum access level needed to run that command. In our example, `p4 print` is the command, and the minimum access level required to run that command is `read`.
- Perforce makes the first of two passes through the protections table. Both passes move up the protections table, bottom to top, looking for the first relevant line.

  The first pass determines whether or not the user is permitted to know whether or not the file exists. This search simply looks for the first line encountered that matches the user name, host IP address, and file argument. If the first matching line found is an inclusionary protection, then the user has permission to at least list the file, and Perforce proceeds to the second pass. Otherwise, if the first matching protection found is an exclusionary mapping, or if the top of the protections table is reached without a matching protection being found, then the user has no permission to even list the file, and will receive a message like `File not on client`.

Example: *Interpreting the order of mappings in the protections table.*

Suppose the protections table is as follows:

```
write       user        *       *       //...
read        user        edk     *       -//...
read        user        edk     *       //depot/elm_proj/...
```

If Ed runs `p4 print //depot/file.c`*, Perforce examines the protections table bottom to top, and first encounters the last line. The files specified there don't match the file that Ed wants to print, so this line is irrelevant. The second-to-last line is examined next; this line matches Ed's user name, his* IP *address, and the file he wants to print; since this line is an exclusionary mapping, Ed isn't allowed to list the file.*

- If the first pass is successful, a second pass is made at the protections table; this pass is the same as the first, except that access level is now taken into account.

  If an inclusionary protection line is the first line encountered that matches the user name, IP address, file argument, and has an access level greater than or equal to the access level required by the given command, then the user is given permission to run the command.

  If an exclusionary mapping is the first line encountered that matches according to the above criteria, or if the top of the protections table is reached without finding a matching protection, then the user has no permission to run the command, and will receive the message "`You don't have permission for this operation`".

Access Levels Required by Perforce Commands

The following table lists the minimum access level required to run each command. For example, because `p4 add` requires at least `open` access, you can run `p4 add` if you have `open`, `write`, `admin`, or `super` access.

Command	Access Level	Command	Access Level
`add`	`open`	`job` [b e]	`open`
`admin`	`super`	`jobs` [a]	`list`
`annotate`	`read`	`jobspec` [b]	`admin`
`branch` [e]	`open`	`label` [a e]	`open`
`branches`	`list`	`labels` [a b]	`list`
`change` [e]	`open`	`labelsync`	`open`
`changes` [a]	`list`	`lock`	`write`
`client` [e]	`list`	`login`	`none`
`clients`	`list`	`logout`	`none`
`counter` [c]	`review`	`obliterate`	`admin`
`counters`	`list`	`opened`	`list`
`delete`	`open`	`passwd`	`list`
`depot` [a b]	`super`	`print`	`read`
`depots` [a]	`list`	`protect` [a]	`super`
`describe`	`read`	`reopen`	`open`
`describe -s`	`list`	`resolve`	`open`

Command	Access Level	Command	Access Level
diff	read	resolved	open
diff2	read	revert	open
dirs	list	review [a]	review
edit	open	reviews [a]	list
filelog	list	set	list
files	list	submit	write
fixes [a]	list	sync	read
fstat	list	tag	open
group [a b]	super	tickets	none
groups [a]	list	triggers	super
have	list	typemap	admin
help	none	unlock [e]	open
info	none	user [a b]	list
integrate [d]	open	users [a]	list
integrated	list	verify	admin
		where [a]	none

[a] This command doesn't operate on specific files. Thus, permission is granted to run the command if the user has the specified access to at least one file in the depot.

[b] The `-o` flag to this command, which allows the form to be read but not edited, requires only `list` access.

[c] `list` access is required to view an existing counter's value; `review` access is required to change a counter's value or create a new counter.

[d] To run `p4 integrate`, the user needs `open` access on the target files and `read` access on the donor files.

[e] The -f flag to override existing metadata or other users' data requires `admin` access.

Commands that list files, such as `p4 describe`, list only those files to which the user has at least `list` access.

Some commands (for example, `p4 change`, when editing a previously submitted changelist) take a `-f` flag which can only be used by Perforce superusers. See "Forcing operations with the -f flag" on page 50 for details.

Chapter 5 Customizing Perforce: Job Specifications

Perforce's jobs feature enables users to link changelists to enhancement requests, problem reports, and other user-defined tasks. Perforce also offers P4DTI (Perforce Defect Tracking Integration) as a way to integrate third-party defect tracking tools with Perforce. See "Working with third-party defect tracking systems" on page 89 for details.

The Perforce user's use of `p4 job` is discussed in the *Perforce User's Guide*. This chapter covers administrator modification of the jobs system.

Perforce's default jobs template has five fields for tracking jobs. These fields are sufficient for small-scale operations, but as projects managed by Perforce grow, the information stored in these fields may be insufficient. To modify the job template, use the `p4 jobspec` command. You must be a Perforce administrator to use `p4 jobspec`.

This chapter discusses the mechanics of altering the Perforce job template.

Warning! Improper modifications to the Perforce job template can lead to corruption of your server's database. Recommendations, caveats, and warnings about changes to job templates are summarized at the end of this chapter.

The Default Perforce Job Template

To understand how Perforce jobs are specified, we will examine the default Perforce job template. The examples that follow in this chapter are based upon modifications to the default Perforce job template.

A job created with the default Perforce job template has this format:

```
# A Perforce Job Specification.
#
#  Job:         The job name.  'new' generates a sequenced job number.
#  Status:      Either 'open', 'closed', or 'suspended'. Can be changed.
#  User:        The user who created the job. Can be changed.
#  Date:        The date this specification was last modified.
#  Description: Comments about the job.  Required.
Job:    new
Status: open
User:   edk
Date:   1998/06/03 23:16:43
Description:
        <enter description here>
```

The template from which this job was created can be viewed and edited with `p4 jobspec`. The default job specification template looks like this:

```
# A Perforce Job Specification.
#
#  Updating this form can be dangerous!
#  See 'p4 help jobspec' for proper directions.
Fields:
        101 Job word 32 required
        102 Status select 10 required
        103 User word 32 required
        104 Date date 20 always
        105 Description text 0 required
Values:
        Status open/suspended/closed
Presets:
        Status open
        User $user
        Date $now
        Description $blank
Comments:
        # A Perforce Job Specification.
        #
        # Job: The job name. 'new' generates a sequenced job number.
        # Status: Either 'open', 'closed', or 'suspended'. Can be changed.
        # User: The user who created the job. Can be changed.
        # Date: The date this specification was last modified.
        # Description: Comments about the job. Required.
```

The Job Template's Fields

There are four fields in the `p4 jobspec` form. These fields define the template for all Perforce jobs stored on your server. The fields and field types are:

Field / Field Type	Meaning
`Fields:`	A list of fields to be included in each job. Each field consists of an ID#, a name, a datatype, a length, and a setting.
`Values:`	A list of fields whose datatype is `select`. For each `select` field, you must add a line containing the field's name, a space, and its list of acceptable values, separated by slashes.

Field / Field Type	Meaning
`Presets:`	A list of fields and their default values. Values can be either literal strings or variables supported by Perforce.
`Comments:`	The comments that appear at the top of the `p4 job` form. These comments are also used by P4Win, the Perforce Windows Client.

The Fields: field

The `p4 jobspec` field `Fields:` lists the fields to be tracked by your jobs, and specifies the order in which they appear on the `p4 job` form.

The default `Fields:` field includes these fields:

```
Fields:
        101 Job word 32 required
        102 Status select 10 required
        103 User word 32 required
        104 Date date 20 always
        105 Description text 0 required
```

Warning Do not attempt to change, rename, or redefine fields 101 through 105. Fields 101 through 105 are used by Perforce and should not be deleted or changed. Only use `p4 jobspec` to add new fields (106 and above) to your jobs.

- Field 101 is required by Perforce and cannot be renamed nor deleted.
- Fields 102 through 105 are reserved for use by Perforce client programs. Although it is possible to rename or delete these fields, it is highly undesirable to do so. Perforce client programs may continue to set the value of field 102 (the `Status:` field) to `closed` upon changelist submission, even if the administrator has redefined field 102 for use as a field that does not contain `closed` as a permissible value, leading to unpredictable and confusing results.

Each field must be listed on a separate line, and is comprised of five separate descriptors:

Field Descriptor	Meaning
`ID#`	A unique integer identifier by which this field is indexed. After a field has been created and jobs entered into the system, the name of this field can change, but the data becomes inaccessible if the ID number changes. ID numbers must be between `106` and `199`.
`Name`	The name of the field as it should appear on the `p4 job` form.
`Data Type`	One of five datatypes (`word`, `text`, `line`, `select`, or `date`), as described in the next table.
`Length`	The recommended size of the field's text box as displayed in P4Win, the Perforce Windows Client. To display a text box with room for multiple lines of input, use a length of `0`; to display a single line, enter the `Length` as the maximum number of characters in the line. The value of this field has no effect on jobs edited from the Perforce command line, and is not related to the actual length of the values stored by the server.
`Persistence`	Determines whether a field is read-only, contains default values, is required, and so on. The valid values for this field are: • `optional`: field can take any value or can be deleted. • `default`: a default value is provided, but it can be changed or erased. • `required`: a default is given; it can be changed but the field can't be left empty. • `once`: read-only; the field is set once to a default value and is never changed. • `always`: read-only; the field value is reset to the default value when the job is saved. Useful only with the `$now` variable to change job modification dates, and with the `$user` variable to change the name of the user who last modified the job. In version 98.2 of Perforce, a field's persistence was specified in a very different way. If you have upgraded from 98.2, no conversion need be done; the old persistences will appear in the `p4 jobspec` form in the new template.

The five field datatypes are:

Field Type	Explanation	Example
`word`	A single word.	A userid: `edk`
`text`	A block of text that can span multiple lines.	A job's description
`line`	One line of text.	A user's real name: `Ed K.`
`select`	One of a set of values. Each field with datatype `select` must have a corresponding line in the `Values:` field entered into the job specification.	A job's status. One of: `open/suspended/closed`
`date`	A date value.	The date and time of job creation: `1998/07/15:13:21:46`

The Values: fields

You specify the set of possible values for any field of datatype `select` by entering lines in the `Values:` field. Each line should contain the name of the field, a space, and the list of possible values, separated by slashes.

In the default Perforce job specification, the `Status:` field is the only `select` field, and its possible values are defined as follows:

```
Values:
        Status open/suspended/closed
```

Note Prior to version 2000.1 of Perforce, the `Values:` and `Presets:` fields were specified differently.

If you have scripts that rely upon the old style of jobspecs, you might have to modify them. (Scripts that manipulate jobs, but not jobspecs, do not require modification.)

The Presets: field

All fields with a persistence of anything other than `optional` require default values. To assign a default value to a field, create a line in the jobspec form under `Presets`, consisting of the field name to which you're assigning the default value. Any single-line string can be used as a default value.

Three variables are available for use as default values:

Variable	Value
`$user`	The Perforce user creating the job, as specified by the `P4USER` environment or registry variable, or as overridden with `p4 -u` *username* job.
`$now`	The date and time at the moment the job is saved.
`$blank`	The text `<enter description here>`. When users enter jobs, any fields in your jobspec with a preset of `$blank` must be filled in by the user before the job is added to the system.

The lines in the `Presets:` field for the standard jobs template are:

```
Presets:
        Status open
        User $user
        Date $now
        Description $blank
```

The Comments: field

The `Comments:` field supplies the comments that appear at the top of the `p4 job` form. Because `p4 job` does not automatically tell your users the valid values of `select` fields, which fields are required, and so on, your comments must tell your users everything they need to know about each field.

Each line of the `Comments:` field must be indented by at least one tab stop from the left margin, and must begin with the comment character `#`.

The comments for the default `p4 job` template appear as:

```
Comments:
        # A Perforce Job Specification.
        # Job: The job name. 'new' generates a sequenced job number.
        # Status: Either 'open', 'closed', or 'suspended'. Can be changed
        # User: The user who created the job. Can be changed.
        # Date: The date this specification was last modified.
        # Description: Comments about the job. Required.
```

If you administer a Perforce server and your users use P4Win, the Perforce Windows Client, you must take extra care when writing your comments.

P4Win displays these comments in two ways:

- When the P4Win user creates or edits a job and presses the **Form Info** button in the job dialog box, a popup window displays the comments.

- As the (Windows) cursor moves over each field, the first line of the comment following the colon after the field name in the jobspec is displayed in a ToolTip. The remainder of each of these lines is displayed as the ToolTip for the field that matches the first word of the line. Only the first line of the comment is displayed.

  For instance, the ToolTip for the `Status:` field in the preceding jobspec reads:

  ```
  Either 'open', 'closed', or 'suspended'. Can be changed
  ```

Caveats, Warnings, and Recommendations

Although the material in this section has already been presented elsewhere in this chapter, it is important enough to bear repeating. Please follow the guidelines presented here when editing job specifications with `p4 jobspec`.

Warning! Please read and understand the material in this section before attempting to edit a job specification.

- Do not attempt to change, rename, or redefine fields 101 through 105. These fields are used by Perforce and should not be deleted or changed. Only use `p4 jobspec` to add new fields (106 and above) to your jobs.

  Field 101 is required by Perforce and cannot be renamed nor deleted.

  Fields 102 through 105 are reserved for use by Perforce client programs. Although it is possible to rename or delete these fields, it is highly undesirable to do so. Perforce client programs may continue to set the value of field 102 (the `Status:` field) to `closed` upon changelist submission, even if the administrator has redefined field 102 for use as a field that does not contain `closed` as a permissible value, leading to unpredictable and confusing results.

- After a field has been created and jobs have been entered, do not change the field's ID#. Any data entered in that field through `p4 job` will be inaccessible.

- Field names can be changed at any time. When changing a field's name, be sure to also change the fieldname in other `p4 jobspec` fields that reference this fieldname. For example, if you create a new field `106` named `severity` and subsequently rename it to `bug-severity`, then the corresponding line in the jobspec's `Presets:` field must be changed to `bug-severity` to reflect the change.

- The comments that you write in the `Comments:` field are the only way to let your users know the requirements for each field. Make these comments understandable and complete. These comments are treated specially in P4Win, the Perforce Windows Client. For P4Win ToolTip compatibility, the first line of each field's comment should be understandable if read on its own.

Example: A Custom Template

The following example shows a more complicated jobspec and the resulting job form:

```
# A Custom Job Specification.
#
#  Updating this form can be dangerous!
#  See 'p4 help jobspec' for proper directions.
Fields:
        101 Job word 32 required
        102 Status select 10 required
        103 User word 32 required
        104 Date date 20 always
        111 Type select 10 required
        112 Priority select 10 required
        113 Subsystem select 10 required
        114 Owned_by word 32 required
        105 Description text 0 required
Values:
        Status open/closed/suspended
        Type bug/sir/problem/unknown
        Priority A/B/C/unknown
        Subsystem server/gui/doc/mac/misc/unknown
Presets:
        Status open
        User setme
        Date $now
        Type setme
        Priority unknown
        Subsystem setme
        Owned_by $user
        Description $blank
Comments:
        # Custom Job fields:
        # Job:    The job name. 'new' generates a sequenced job number.
        # Status: Either 'open', 'closed', or 'suspended'. Can be changed
        # User:   The user who created the job. Can be changed.
        # Date:   The date this specification was last modified.
        # Type:          The type of the job. Acceptable values are
        #                'bug', 'sir', 'problem' or 'unknown'
        # Priority:      How soon should this job be fixed?
        #                Values are 'a', 'b', 'c', or 'unknown'
        # Subsystem:     One of server/gui/doc/mac/misc/unknown
        # Owned_by:      Who's fixing the bug
        # Description: Comments about the job. Required.
```

The order of the listing under `Fields:` in the `p4 jobspec` form determines the order in which the fields appear to users in job forms; fields need not be ordered by numeric identifier.

Running `p4 job` against the example custom jobspec displays the following job form:

```
# Custom Job fields:
# Job:    The job name. 'new' generates a sequenced job number.
# Status: Either 'open', 'closed', or 'suspended'. Can be changed
# User:   The user who created the job. Can be changed.
# Date:   The date this specification was last modified.
# Type:          The type of the job. Acceptable values are
#                'bug', 'sir', 'problem' or 'unknown'
# Priority:      How soon should this job be fixed?
#                Values are 'a', 'b', 'c', or 'unknown'
# Subsystem:     One of server/gui/doc/mac/misc/unknown
# Owned_by:      Who's fixing the bug
# Description: Comments about the job. Required.

Job:    new
Status: open
User:   setme
Type:   setme
Priority:       unknown
Subsystem:      setme
Owned_by:       edk
Description:
        <enter description here>
```

Working with third-party defect tracking systems

With P4DTI, you can integrate Perforce with any third-party defect tracking or process management software.

Activity in your Perforce depot (enhancements, bug fixes, propagation of changes into release branches, and so forth) can be automatically entered into your defect tracking system by P4DTI. Conversely, issues and status entered into your defect tracking system (such as bug reports, change orders, work assignments) can be converted automatically to Perforce metadata for access by Perforce users.

P4DTI can be easily extended to other products; TeamShare and Bugzilla are the first two integrations published.

P4DTI is open source and available under a FreeBSD-like license.

Using P4DTI - Perforce Defect Tracking Integration

If you want to integrate Perforce with your in-house defect tracking system, or develop an integration with a third-party defect tracking system, P4DTI is probably the best place to start.

To get started with P4DTI, see the P4DTI product information page at:

`http://www.perforce.com/perforce/products/p4dti.html`

Available from this page are the TeamShare and Bugzilla implementations, an overview of the P4DTI's capabilities, and a kit (including source code and developer documentation) for building integrations with other products or in-house systems.

Building your own integration

Even if you don't use the P4DTI kit as a starting point, you can still use Perforce's job system as the interface between Perforce and your defect tracker. Depending on the application, the interface you set up will consist of one or more of the following:

- A trigger or script on the defect tracking system side that adds, updates, or deletes a job in Perforce every time a bug is added, updated, or deleted in the defect tracking system.

  The third-party system should generate the data and pass it to a script which reformats the data to resemble the form used by a manual (interactive) invocation of `p4 job`. The script can then pipe the generated form to a the standard input of a `p4 job -i` command.

  (The `-i` flag to `p4 job` is used when you want `p4 job` to read a job form directly from the standard input, rather than using the interactive "form-and-editor" approach typical of user operations. Further information on automating Perforce with the `-i` option is available in the *Perforce Command Reference*.)

- A trigger on the Perforce side that checks changelists being submitted for any necessary bug fix information.

- A Perforce review daemon that checks successfully-submitted changelists for job fixes and issues the appropriate commands to update the corresponding data in your defect tracking system.

For more about triggers and review daemons, including examples, see "Scripting Perforce: Triggers and Daemons" on page 91.

Getting more information

In addition to the P4DTI-based TeamTrack and Bugzilla integrations, Perforce customers currently integrate Perforce with their own home-grown defect tracking systems, and with third-party systems such as Remedy, Scopus, and ClearTrack.

If you are interested in seeing what other Perforce users have done, visit the Perforce web site and examine the `perforce-user` mailing list archives, which are available under our Documentation page.

You may also wish to consider posting to `perforce-user` to ask if anyone has integrated Perforce with the third-party tool you're interested in, as someone may have already done all the setup work required to work with your system.

Chapter 6 Scripting Perforce: Triggers and Daemons

There are two primary methods of scripting Perforce:

- Perforce *triggers* are user-written scripts that are called by a Perforce server whenever certain operations (such as changelist submission or changes to forms) are performed. If the script returns a value of `0`, the operation continues; if the script returns any other value, the operation fails. Upon failure, the script's standard output (not error output) is sent to the Perforce client program as an error message.
- *Daemons* run at predetermined times, looking for changes to the Perforce metadata. When a daemon determines that the state of the depot has changed in some specified way, it runs other commands. For example, a daemon might look for newly submitted changelists and send email to users interested in tracking changes to those files. Perforce provides a number of tools that make writing daemons easier.

This chapter assumes that you know how to write scripts.

Triggers

Triggers can be useful in many situations. Consider the following common uses:

- To validate changelist contents beyond the mechanisms afforded by the Perforce protections table. For example, you can use a pre-submit trigger to ensure that whenever `file1` is submitted in a changelist, `file2` is also submitted.
- To validate file contents as part of changelist submission. For example, you can use a mid-submit trigger to ensure that, when `file1` and `file2` are submitted, both files refer to the same set of header files.
- To start build processes after successful changelist submission.
- To validate specifications, or to provide customized versions of Perforce specification forms. For example, you can use specification triggers to generate a customized default workspace view in the `p4 client` command, or to ensure that users enter a meaningful workspace description.
- To notify other users of attempts to change forms such as the user form or the job specification form, or to trigger process control tools following updates to Perforce metadata.

Warning! When writing trigger scripts, Perforce commands that write data to the depot are dangerous and should be avoided. In particular, do not run the `p4 submit` command from within a trigger script.

Example: *A basic trigger.*

The development group wants to ensure that whenever an `.exe` *file is submitted to the depot, a set of release notes for the program are submitted at the same time.*

You write a trigger script that takes a changelist number as its only argument, performs a `p4 opened` *on the changelist, parses the results to find the files included in the changelist, and ensures that for every executable file that's been submitted, a* `RELNOTES` *file in the same directory has also been submitted. If the changelist includes a* `RELNOTES` *file, the script terminates with an exit status of* `0`*; otherwise the exit status is set to* `1`*.*

After writing the script, you add it to the trigger table by editing the `p4 trigger` *form as follows:*

```
Triggers:
   rnotes  submit  //depot/....exe   "/usr/bin/test.pl %changelist%"
```

Whenever a file ending in `.exe` *is submitted, this trigger is fired. If the trigger script fails, it returns a nonzero exit status, and the user's* `submit` *fails.*

The trigger table

After you have written a trigger script, create the trigger by issuing the `p4 triggers` command. The `p4 triggers` form looks like this:

```
Triggers:
   relnotes_check  submit  //depot/bld/... "/usr/bin/relcheck.pl %user%"
   verify_jobs     submit  //depot/...     "/usr/bin/job.py %change%"
```

You must be a Perforce superuser to run `p4 triggers`.

Trigger table fields

Each line in the trigger table has four fields:

Field	Meaning
name	The user-defined name of the trigger.
type	There are six trigger types. The first three trigger types (`submit`, `content`, and `commit`) are fired when users submit changelists, and are referred to as *changelist submission triggers*. The remaining trigger types (`save`, `out`, and `in`) are fired when users generate or modify form specifications, and are referred to as *specification triggers*. • `submit`: Execute a changelist trigger after changelist creation, but before file transfer. Trigger may not access file contents. • `content`: Execute a changelist trigger after changelist creation and file transfer, but before file commit. To obtain file contents, use commands such as `p4 diff2`, `p4 files`, `p4 fstat`, and `p4 print` with the revision specifier `@=`*change*, where *change* is the changelist number of the pending changelist as passed to the script in the `%changelist%` variable. • `commit`: Execute a changelist trigger after changelist creation, file transfer, and changelist commit. • `save`: Execute specification trigger after its contents are parsed, but before its contents are stored in the Perforce database. Trigger may not modify form specified in `%formfile%` variable. • `out`: Execute specification trigger upon generation of form to end user. Trigger may modify form. • `in`: Execute specification trigger on edited form before contents are parsed and validated by the Perforce server. Trigger may modify form.
path	For changelist submission triggers (`submit`, `content`, or `commit`), a file pattern in depot syntax. When a user submits a changelist that contains any files that match this file pattern, the script linked to this trigger is run. Use exclusionary mappings to prevent triggers from running on specified files. For specification triggers (`save`, `out`, or `in`), the name of the type of form, such as `branch`, `client`, and so on. Triggers that fire on the `p4 triggers` command are ignored.

Field	Meaning
command	The command for the Perforce server to run when a matching *path* applies for the trigger type. Specify the command in a way that allows the Perforce server account to locate and run the command. The command must be quoted, and can take the variables specified in "Trigger script variables" on page 94 as arguments. For `submit` and `content` triggers, changelist submission continues if the trigger script exits with 0, or fails if the script exits with a nonzero value. For `commit` triggers, changelist submission succeeds regardless of the trigger script's exit code, but subsequent `commit` triggers do not fire if the script exits with a nonzero value. For `in`, `out`, and `save` triggers, the data in the specification becomes part of the Perforce database if the script exits with 0. Otherwise, the database is not updated.

Trigger script variables

Use the following variables in the `command` field to pass data to a trigger script:

Argument	Description	Available for type
`%changelist%`	The number of the changelist being submitted. (The abbreviated form `%change%` is equivalent.)	`submit`, `content`, and `commit`
`%client%`	Triggering user's client workspace name.	all
`%clienthost%`	Hostname of the client.	all
`%clientip%`	The IP address of the client.	all
`%serverhost%`	Hostname of the Perforce server.	all
`%serverip%`	The IP address of the server.	all
`%serverport%`	The IP address and port of the Perforce server, in the format *ip_address*`:`*port*.	all
`%serverroot%`	The `P4ROOT` directory of the Perforce server.	all
`%user%`	Perforce username of the triggering user.	all
`%formfile%`	Path to temporary specification file. To modify the form from an `in` or `out` trigger, overwrite this file. The file is read-only for triggers of type `save`.	`save`, `out`, and `in`
`%formname%`	Name of form (for instance, a branch name or a changelist number).	`save`, `out`, and `in`
`%formtype%`	Type of form (for instance, `branch`, `change`, and so on).	`save`, `out`, and `in`

Triggering on changelists

To configure Perforce to run trigger scripts when users submit changelists, use *changelist submission triggers:* these are triggers of type `submit`, `content`, and `commit`.

For changelist submission triggers, the *`path`* column of each trigger line is a file pattern in depot syntax. If a changelist being submitted contains any files in this path, the trigger fires. To prevent changes to a file from firing a trigger, use an exclusionary mapping in the path.

Submit triggers

Use the `submit` trigger type to create triggers that fire after changelist creation, but before files are transferred to the server. Because submit triggers fire before files are transferred to the server, submit triggers cannot access file contents. Submit triggers are useful for integration with reporting tools or systems that do not require access to file contents.

Example: *The following submit trigger is an* MS-DOS *batch file that rejects a changelist if the submitter has not assigned a job to the changelist. This trigger fires only on changelist submission attempts that affect at least one file in the* `//depot/qa` *branch.*

```
@echo off
if not x%1==x goto doit
echo Usage is %0[change#]
:doit
p4 describe -s %1|findstr "Jobs:\n\n\t" > nul
if errorlevel 1 echo No jobs found for changelist %1
p4 describe -s %1|findstr "Jobs:\n\n\t" > nul
```

To use the trigger, add the following line to your triggers table:

```
sample1   submit //depot/qa/...   "jobcheck.bat %changelist%"
```

Every time a changelist is submitted that affects any files under `//depot/qa`*, the* `jobcheck.bat` *file is called. If the string "*`Jobs:`*" (followed by two newlines and a tab character) is detected, the script assumes that a job has been attached to the changelist and permits changelist submission to continue. Otherwise, the submit is rejected.*

The second `findstr` *command ensures that the final error level of the trigger script is the same as the error level that determines whether to output the error message.*

Content triggers

Use the `content` trigger type to create triggers that fire after changelist creation and file transfer, but prior to committing the submit to the database. Content triggers can access file contents by using the `p4 diff2`, `p4 files`, `p4 fstat`, and `p4 print` commands with the `@=`*`change`* revision specifier, where *`change`* is the number of the pending changelist as passed to the trigger script in the `%changelist%` variable.

Use content triggers to validate file contents as part of changelist submission, and to abort changelist submission if the validation fails.

Example: *The following content trigger is a Bourne shell script that ensures that every file in every changelist contains a copyright notice for the current year.*

The script assumes the existence of a client workspace called `copychecker` *that includes all of* `//depot/src`*. This workspace does not have to be synced.*

```
#!/bin/sh

# Set target string, files to search, location of p4 executable...

TARGET="Copyright `date +%Y` Example Company"
DEPOT_PATH="//depot/src/..."
CHANGE=$1
P4CMD="/usr/local/bin/p4 -p 1666 -c copychecker"
XIT=0
echo ""

# For each file, strip off #version and other non-filename info
# Use sed to swap spaces w/"%" to obtain single arguments for "for"

for FILE in `$P4CMD files $DEPOT_PATH@=$CHANGE | \
  sed -e 's/\(.*\)\#[0-9]* - .*$/\1/' -e 's/ /%/g'`
do
  # Undo the replacement to obtain filename...
  FILE="`echo $FILE | sed -e 's/%/ /g'`"

  # ...and use @= specifier to access file contents:
  # p4 print -q //depot/src/file.c@=12345
  if $P4CMD print -q "$FILE@=$CHANGE" | grep "$TARGET" > /dev/null
  then
  else
      echo "Submit fails: '$TARGET' not found in $FILE"
      XIT=1
  fi
done

exit $XIT
```

To use the trigger, add the following line to your triggers table:

```
sample2 content //depot/src/... "copydate.sh %change%"
```

The trigger fires when any changelist with at least one file in `//depot/src` *is submitted. The corresponding* `DEPOT_PATH` *defined in the script ensures that of all the files in the triggering changelist, only those files actually under* `//depot/src` *are checked.*

Commit triggers

Use the `commit` trigger type to create triggers that fire after changelist creation, file transfer, and changelist commission to the database. Use commit triggers for processes that assume (or require) the successful submission of a changelist.

Example: *The following commit trigger sends emails to other users who have files open in the submitted changelist:*

```
#!/bin/sh
# mailopens.sh - Notify users when open files are updated
changelist=$1
workspace=$2
user=$3
p4 fstat @$changelist,@$changelist | while read line
do
  # Parse out the name/value pair.
  name=`echo $line | sed 's/[\. ]\+\([^ ]\+\) .\+/\1/'`
  value=`echo $line | sed 's/[\. ]\+[^ ]\+ \(.\+\)/\1/'`
  if [ "$name" = "depotFile" ]
  then
    # Line is "... depotFile <depotFile>". Parse to get depotFile.
    depotfile=$value
  elif [ "`echo $name | cut -b-9`" = "otherOpen" -a \
    "$name" != "otherOpen" ]
  then
    # Line is "... ... otherOpen[0-9]+ <otherUser@otherWorkspace>".
    # Parse to get otherUser and otherWorkspace.
    otheruser=`echo $value | sed 's/\(.\+\)@.\+/\1/'`
    otherworkspace=`echo $value | sed 's/.\+@\(.\+\)/\1/'`
    # Get email address of the other user from p4 user -o.
    othermail=`p4 user -o $otheruser | grep Email: \
      | grep -v \# | cut -b8-`
    # Mail other user that a file they have open has been updated
    mail -s "$depotfile was just submitted" $othermail <<EOM
The Perforce file: $depotfile
was just submitted in changelist $changelist by Perforce user $user
from the $workspace workspace.  You have been sent this message
because you have this file open in the $otherworkspace workspace.
EOM
  fi
done
exit 0
```

To use the trigger, add the following line to your triggers table:

```
sample3  commit //... "mailopens.sh %changelist% %client% %user%"
```

Whenever a user submits a changelist, any users with open files affected by that changelist receive an email notification.

Triggering on specifications

To configure Perforce to run trigger scripts when users edit specifications, use *specification triggers:* these are triggers of type `save`, `in`, and `out`.

Use specification triggers to generate customized specifications for users, validate customized specifications, to notify other users of attempted changes to specification forms, and to otherwise interact with process control and management tools.

Save triggers

Save triggers are called when users send changed specifications to the server, and are called after the specification has been parsed by the server, but before the changed specification is stored in the Perforce metadata.

Example: *To prohibit certain users from modifying their client workspaces, add the users to a group called* `lockedws`*, and use the following* `save` *trigger.*

This trigger denies attempts to change client specifications for users in the `lockedws` *group, outputs an error message containing the user name, IP address of the user's workstation, and the name of the client workspace on which a modification was attempted, and notifies an administrator.*

```
#!/bin/bash
NOAUTH=lockedws
USERNAME=$1
WSNAME=$2
IPADDR=$3
GROUPS=`p4 groups "$1"`
if echo "$GROUPS" | grep -qs $NOAUTH
then
   echo "$USERNAME ($IPADDR) in $NOAUTH may not change $WSNAME"
   mail -s "User $1 workspace mod denial" admin@127.0.0.1
   exit 1
else
   exit 0
fi
```

The `save` *trigger fires on* `client` *specifications only, and appears in the trigger table as follows:*

```
sample5 save client "ws_lock.sh %user% %client% %clientip%"
```

Users whose names appear in the output of `p4 groups lockedws` *have changes to their client workspaces parsed by the server, and even if those changes are syntactically correct, the attempted change to the workspace is denied and an administrator is notified of the attempt.*

Out triggers

Out triggers are called whenever the Perforce Server generates a specification for display to the user. For example, the command `p4 job -o` fires an `out` trigger on the `job` path.

Warning! Never use a Perforce command in an `out` trigger that fires the same `out` trigger, or infinite recursion will result. For example, never run `p4 job -o` from within an `out` trigger script that fires on `job` specifications.

Example: *The default Perforce client workspace view maps the entire depot* `//depot/...` *to the user's client workspace. To prevent novice users from attempting to sync the entire depot, this Perl script changes the default workspace view used by* `p4 client` *to map only the current release codeline of* `//depot/releases/main/...`

```
#!/usr/bin/perl
# default_ws.pl - Customize the default client workspace view.

$p4 = "p4 -p localhost:1666";
$formname = $ARGV[0];  # from %formname% in trigger table
$formfile = $ARGV[1];  # from %formfile% in trigger table

# Default server-generated workspace view and modified view
$defaultin = "\t//depot/... //$formname/...\n";
$defaultout = "\t//depot/releases/main/... //$formname/...\n";

# Check "p4 clients" to be sure this is a new workspace.
# If it's an existing workspace, exit without modifying the view.
open CLIENTS, "$p4 clients |" or die "Couldn't get workspace list";
while ( <CLIENTS> )
{
        if ( /^Client $formname .*/ ) { exit 0; }
}

# Build a modified workspace spec based on contents of %formfile%
$modifiedform = "";
open FORM, $formfile or die "Trigger couldn't read form tempfile";
while ( <FORM> )
{       ## Do the substitution as appropriate.
        if ( m:$defaultin: ) { $_ = "$defaultout"; }
        $modifiedform .= $_;
}

# Write the modified spec back to the %formfile%,
open MODFORM, ">$formfile" or die "Couldn't write form tempfile";
print MODFORM $modifiedform;
exit 0;
```

The `out` *trigger fires on* `client` *specifications only, and appears as follows:*

```
sample3  out client "default_ws.pl %formname% %formfile%"
```

New users creating client workspaces are presented with your customized default view.

In triggers

In triggers are called when users submit specifications, and before the specification is parsed by the Perforce server.

Example: *All users authorized to edit jobs have been placed in a designated group called* `jobbers`. *The following Python script runs* `p4 group -o jobbers` *with the* `-G` *(Python marshaled objects) flag to determine if the user who triggered the script is in the jobbers group.*

```
import sys, os, marshal

# Configure for your environment
tuser = "triggerman"    # trigger username
auth_group = "jobbers"  # Perforce group authorized to edit jobs

# Get trigger input args
user = sys.argv[1]

# Get authorized user list
# Use global -G flag to get output as marshaled Python dictionary
CMD = "p4 -G -u %s -p 1666 group -o %s" % \
        (tuser, auth_group)
result = {}
result = marshal.load(os.popen(CMD, 'r'))

auth_users = []
for k in result.keys():
        if k[:4] == 'User': # user key format: User0, User1, ...
                u = result[k]
                auth_users.append(u)

# Compare current user to authorized users.
if not user in auth_users:
        print "\n\t>>> You don't have permission to edit jobs."
        print "\n\t>>> You must be a member of '%s'.\n" % auth_group
        sys.exit(1)
else: # authorized user -- OK to create/edit jobs
        sys.exit(0)
```

The `in` *trigger fires on* `job` *specifications only, and appears in the trigger table as follows:*

```
sample3  in  job  "python jobgroup.py %user%"
```

If the user is in the `jobbers` *group, the in trigger succeeds and the changed job is passed to the Perforce server for parsing. Otherwise, an error message is displayed and changes to the job are rejected.*

Using multiple triggers

Triggers are run in the order in which they appear in the triggers table. If you have multiple triggers of the same type that fire on the same path, each is run in the order in which it appears in the triggers table. If one of these triggers fails, no further triggers are executed.

Example: *Multiple triggers on the same file:*

All `*.c` *files must pass through the scripts* `check1.sh`, `check2.sh`, *and* `check3.sh`*:*

```
Triggers:
   check1  submit   //depot/src/*.c  "/usr/bin/check1.sh %change%"
   check2  submit   //depot/src/*.c  "/usr/bin/check2.sh %change%"
   check3  submit   //depot/src/*.c  "/usr/bin/check3.sh %change%"
```

If any trigger fails (for instance, `check1.sh`*), the submit fails immediately and none of the subsequent triggers (that is,* `check2.sh` *and* `check3.sh`*) are called. Each time a trigger succeeds, the next matching trigger is run.*

To link multiple file specifications to the same trigger (and trigger type), list the trigger multiple times in the trigger table.

Example: *Activating the same trigger for multiple filespecs:*

```
Triggers:
   bugcheck  submit   //depot/*.c   "/usr/bin/checkit.pl %change%"
   bugcheck  submit   //depot/*.h   "/usr/bin/checkit.pl %change%"
   bugcheck  submit  //depot/*.cpp  "/usr/bin/checkit.pl %change%"
```

In this case, the `bugcheck` *trigger runs on the* `*.c` *files, the* `*.h` *files, and the* `*.cpp` *files.*

Multiple changelist submission triggers of different types that fire on the same path fire in the following order:

1. `submit` (fired on changelist submission, before file transmission)
2. `content` triggers (after changelist submission and file transmission)
3. `commit` triggers (fired any automatic changelist renumbering by the server).

Similarly, specification triggers of different types are fired in the following order

1. `out` (form generation)
2. `in` (changed form is transmitted to the server)
3. `save` (validated form is ready for storage in the Perforce database).

Writing triggers to support multiple Perforce Servers

To call the same trigger script from more than one Perforce Server, use the `%serverhost%`, `%serverip%`, and `%serverport%` variables to make your trigger script more portable.

For instance, if you have a script that uses hardcoded port numbers and addresses...

```
#!/bin/sh
# Usage: jobcheck.sh changelist
CHANGE=$1
P4CMD="/usr/local/bin/p4 -p 192.168.0.12:1666"
$P4CMD describe -s $1 | grep "Jobs fixed...\n\n\t" > /dev/null
```

...and you call it with the following line in the trigger table...

```
sample1  submit //depot/qa/... "jobcheck.sh %change%"
```

...you can improve portability by changing the script as follows...

```
#!/bin/sh
# Usage: jobcheck.sh changelist server:port
CHANGE=$1
P4PORT=$2
P4CMD="/usr/local/bin/p4 -p $P4PORT"
$P4CMD describe -s $1 | grep "Jobs fixed...\n\n\t" > /dev/null
```

...and passing the server-specific data as an argument to the trigger script:

```
sample2  submit //depot/qa/... "jobcheck.sh %change% %serverport%"
```

For a complete list of variables that apply for each trigger type, see “Trigger script variables” on page 94.

Triggers and security

Warning! Because triggers are spawned by the `p4d` process, never run `p4d` as `root` on UNIX systems.

Triggers and Windows

By default, the Perforce service runs under the Windows local `System` account.

Because Windows requires a real account name and password to access files on a network drive, if the trigger script resides on a network drive, you must configure the service to use a real userid and password to access the script.

For details, see “Installing the Perforce service on a network drive” on page 125.

Daemons

Daemons are processes that are called periodically or run continuously in the background. Daemons that use Perforce usually work by examining the server metadata as often as needed and taking action as often as necessary.

Typical daemon applications include:

- A change review daemon that wakes up every ten minutes to see if any changelists have been submitted to the production depot. If any changelists have been submitted, the daemon sends email to those users who have "subscribed" to any of the files included in those changelists. The message informs them that the files they're interested in have changed.
- A jobs daemon that generates a report at the end of each day to create a report on open jobs. It shows the number of jobs in each category, the severity each job, and more. The report is mailed to all interested users.
- A Web daemon that looks for changes to files in a particular depot subdirectory. If new file revisions are found there, they are synced to a client workspace that contains the live web pages.

Daemons can be used for almost any task that needs to occur when Perforce metadata has changed. Unlike triggers, which are used primarily for submission validation, daemons can also be used to write information (that is, submit files) to a depot.

Perforce's change review daemon

The Perforce change review daemon (`p4review.py`) is available from the Perforce Supporting Programs page:

```
http://www.perforce.com/perforce/loadsupp.html#daemon
```

The review daemon runs under Python, available at `http://www.python.org/`. Before running the review daemon, please be sure to read and follow the configuration instructions included in the daemon itself.

Users subscribe to files by calling `p4 user`, entering their email addresses in the `Email:` field, and entering any number of file patterns corresponding to files in which they're interested in to the `Reviews:` field.

```
User:     sarahm
Email:    sarahm@elmco.com
Update:   1997/04/29 11:52:08
Access:   1997/04/29 11:52:08
FullName: Sarah MacLonnogan
Reviews:
        //depot/doc/...
        //depot.../README
```

The change review daemon monitors the files were included in each newly submitted changelist and emails all users who have subscribed to any files included in a changelist, letting those users know that the file(s) in question have changed.

By including the special path `//depot/jobs` in the `Reviews:` field, users can also receive mail from the Perforce change review daemon whenever job data is updated.

The change review daemon implements the following scheme:

1. `p4 counter` is used to read and change a variable, called a *counter*, in the Perforce metadata. The counter used by this daemon, `review`, stores the number of the latest changelist that's been reviewed.
2. The Perforce depot is polled for submitted, unreviewed changelists with the `p4 review -t review` command.
3. `p4 reviews` generates a list of reviewers for each of these changelists.
4. The Python mail module mails the `p4 describe` changelist description to each reviewer.
5. The first three steps are repeated every three minutes, or at some other interval configured the time of installation.

The command used in the fourth step (`p4 describe`) is a straightforward reporting command. The other commands (`p4 review`, `p4 reviews`, and `p4 counter`) are used almost exclusively by review daemons.

Creating other daemons

You can use `p4review.py` (see "Perforce's change review daemon" on page 103) as a starting point to create your own daemons, changing it as needed. As an example, another daemon might upload Perforce job information into an external bug tracking system after changelist submission. It would use the `p4 review` command with a new review counter to list new changelists, and use `p4 fixes` to get the list of jobs fixed by the newly submitted changelists. This information might then be fed to the external system, notifying it that certain jobs have been completed.

If you write a daemon of your own and would like to share it with other users, you can submit it into the Perforce Public Depot. For more information, go to `http://www.perforce.com` and follow the "Perforce Public Depot" link.

Commands used by daemons

Certain Perforce commands are used almost exclusively by review daemons.

These commands are:

Command	Usage
`p4 counter` *`name`* [*`value`*]	When a *`value`* argument is not included, `p4 counter` returns the value of the variable name. When a *`value`* argument appears, `p4 counter` sets the value of the variable name to *`value`*. Requires at least `review` access to run. ***WARNING:*** The review counters `journal`, `job`, and `change` are used internally by Perforce; ***use of any of these three names as review numbers could corrupt the Perforce database.*** For Release 99.2 and above, Perforce will not let you change the values of `journal`, `job`, and `change`. Counters are represented internally as signed `int`s. For most platforms, the largest value that can be stored in a counter is 2^{31} - 1, or 2147483647. A server running on a 64-bit platform can store counters up to 2^{63} - 1, or 9223372036854775807
`p4 counters`	List all counters and their values.
`p4 review -c` *`change#`*	For all changelists between *`change#`* and the latest submitted changelist, this command lists the changelists' numbers, creators, and creators' email addresses. Requires at least `review` access to run.
`p4 reviews -c` *`change# filespec`*	Lists all users who have subscribed to review the named files or any files in the specified changelist.
`p4 changes -m 1 -s submitted`	Output a single line showing the changelist number of the last submitted changelist, as opposed to the highest changelist number known to the Perforce server.

Daemons and counters

If you're writing a change review daemon or other daemon that deals with submitted changelists, you may also wish to keep track of the changelist number of the last *submitted* changelist, which is the second field in the output of a `p4 changes -m 1 -s submitted` command.

This is *not* the same as the output of `p4 counter change`. The last changelist number known to the Perforce server (the output of `p4 counter change`) includes pending changelists created by users, but not yet submitted to the depot.

Scripting and buffering

Depending on your platform, the output of individual `p4` commands may be fully-buffered (output flushed only after a given number of bytes generated), line-buffered (as on a tty, one line sent per linefeed), or unbuffered.

In general, stdout to a file or pipe is fully-buffered, and stdout to a tty is line-buffered. If your trigger or daemon requires line-buffering (or no buffering), you can disable buffering by supplying the `-v0` debug flag to the `p4` command in question.

If you're using pipes to transfer standard output from a Perforce command (with or without the `-v0` flag), you may also experience buffering issues introduced by the kernel, as the `-v0` flag can only unbuffer the output of the command itself.

Chapter 7 Tuning Perforce for Performance

Your Perforce server should normally be a light consumer of system resources. As your installation grows, however, you may wish to revisit your system configuration to ensure that it is configured for optimal performance.

The following chapter briefly outlines some of the factors that can affect the performance of a Perforce server, provides a few tips on diagnosing network-related difficulties, and offers some suggestions on decreasing server load for larger installations.

Tuning for Performance

The following variables can affect the performance of your Perforce server.

Memory

Server performance is highly dependent upon having sufficient memory. Two bottlenecks are relevant: the first can be avoided by ensuring that the server doesn't page when running large queries, and the second by ensuring that the `db.rev` table (or at least as much of it as practical) can be cached in main memory.

- Determining memory requirements for large queries is fairly straightforward: the server requires about 1KB / file of RAM to avoid paging; 10,000 files will require 10MB of RAM.
- To cache `db.rev`, the size of the `db.rev` file in an existing installation can be observed and used as an estimate. New installations of Perforce can expect `db.rev` to require about 150-200 bytes per revision, and roughly 3 revisions per file, or about 0.5KB of RAM per file.

Thus, if there is 1.5KB of RAM available per file, or 150MB for 100,000 files, the server will not page, even when performing an operation involving all files. It is still possible that multiple large operations will be performed simultaneously and thus require more memory to avoid paging. On the other hand, the vast majority of operations will only involve a small subset of files.

For most installations, a system with enough RAM for 1.5KB per file in the depot will suffice.

Filesystem performance

Perforce is judicious with regards to its use of disk I/O; its metadata is well-keyed and accesses are mostly sequential scans of limited subsets of the data.

The only disk-intensive activity is file check-in, where the Perforce server must write and rename files in the archive. Server performance depends heavily upon the operating system's filesystem implementation, and in particular, whether directory updates are synchronous.

Although Perforce does not recommend any specific filesystem, Linux servers are generally fastest (owing to Linux's asynchronous directory updating), but may have poor recovery if power is cut at the wrong time. The BSD filesystem (also used in Solaris) is relatively slow, but much more reliable. NTFS performance falls somewhere in between these two ranges. The filesystems used by IRIX and OSF have demonstrated an excellent combination of both speed and robustness.

Performance in systems where database and versioned files are stored on NFS-mounted volumes is typically dependent on the implementation of NFS in question and/or the underlying storage hardware. Perforce has been tested and is supported under the Solaris implementation of NFS.

Under Linux and FreeBSD, database updates over NFS can be an issue as file locking is relatively slow; if the journal is NFS-mounted on these platforms, all operations will be slower. In general (but in particular on Linux and FreeBSD) we recommend that the Perforce database, depot, and journal files be stored on disks local to the machine running the Perforce server process.

These issues affect only the Perforce Server process (`p4d`). Perforce client programs, (such as `p4`, the Perforce Command-Line Client) have always been able to work with client workspaces on NFS-mounted drives (for instance, workspaces in users' home directories).

Disk space allocation

Perforce disk space usage is a function of three variables:

- Number and size of client workspaces
- Size of server database
- Size of server's archive of all versioned files

All three variables depend on the nature of your data and how heavily you use Perforce.

The client file space required is the size of the files that your users will need in their client workspaces at any one time.

The server's database size can be calculated with a fair level of accuracy; as a rough estimate, it requires 0.5KB per user per file. (For instance, a system with 10,000 files and 50 users will require 250MB of disk space for the database). The database can be expected to grow over time as histories of the individual files grow.

The size of the server's archive of versioned files depends on the sizes of the original files stored and grows as revisions are added. For most sites, allocate space equivalent to at least three times the aggregate size of the original files.

If you anticipate your database growing into the gigabyte range, you should ensure that your platform has adequate support for large filesystems. See "Allocate disk space for anticipated growth" on page 20.

The `db.have` file holds the list of files opened in client workspaces, and tends to grow more rapidly than other files in the database. If you are experiencing issues related to the size of your `db.have` file and are unable to quickly switch to a server with adequate support for large files, deleting unused client workspace specifications and reducing the scope of client workspace views can help alleviate the problem.

Network

Perforce can run over any TCP/IP network. Although we have not yet seen network limitations, the more bandwidth the better. Presumably FDDI would be better than 10Mb/s Ethernet, but some users have reported that using a T1 (1.5 Mb/s) provides response times comparable to using Perforce locally. Perforce employees work successfully over ISDN (64 Kb/s) lines.

Perforce uses a TCP/IP connection for each client interaction with the server. The server's port address is defined by `P4PORT`, but the TCP/IP implementation picks a client port number. After the command completes and the connection is closed, the port is left in a state called `TIME_WAIT` for two minutes. While the port number ranges from `1025` to `32767`, generally only a few hundred or thousand can be in use simultaneously. It is therefore possible to occupy all available ports by invoking a Perforce client command many times in rapid succession, such as with a script.

Before release 99.2, both the server and client side of the connection remained in `TIME_WAIT`, which meant that a script running on one user's machine could deprive other users of service by tying up all available ports on the server side. As of Release 99.2, only the client side goes into `TIME_WAIT`, leaving the Perforce server free to handle other clients.

CPU

Perforce is based on a client/server architecture. Both the client and server are lightweight in terms of CPU resource consumption. By way of example, a server supporting 80 users on a low-end (140 MHz) SPARC Ultra server can use as little as 7 CPU-minutes per day, or about 0.5% of available processing power. Weighting this for peak use and headroom, such a server could support upwards of 800 users.

In general, CPU power is not a major consideration when determining the platform on which to install a Perforce server.

Diagnosing Slow Response Times

Perforce is normally a light user of network resources. While it is possible that an extremely large user operation could cause the Perforce server to respond slowly, consistently slow responses to `p4` commands are usually caused by network problems. Any of the following may cause slow response times:

1. misconfigured domain name system (DNS)
2. misconfigured Windows networking
3. difficulty accessing the `p4` executable on a networked file system

A good initial test is to run `p4 info`. If this does not respond immediately, then there is a network problem. Although solving network problems is beyond the scope of this manual, here are some suggestions for troubleshooting them.

Hostname vs. IP address

On a client machine, try setting `P4PORT` to the server's IP address instead of its hostname. For example, instead of using

```
P4PORT=host.domain:1666
```

try using:

```
P4PORT=1.2.3.4:1666
```

with your site-specific IP address and port number.

On most systems, you can determine the IP address of a host by invoking:

```
ping hostname
```

If `p4 info` responds immediately when you use the IP address, but not when you use the hostname, the problem is likely related to DNS.

Try p4 info vs. P4Win

If you are using P4Win, you can compare the response of P4Win's "Show Connection Info" (**Help -> Show Connection Info**) with the response from the command-line `p4 info`.

If the former is fast and the latter is slow, you have a DNS-related problem. (When the Perforce server receives a `p4 info` request, it does a reverse name lookup in order to send back the client and server hostnames along with other configuration information. When

the server receives a P4Win"Show Connection Info" request, however, it simply returns the IP addresses.)

Note This test is only valid for Release 99.1 and newer servers. In releases prior to 99.1, the server always did a reverse name lookup, whether the request was coming from `p4 info` or P4win

Windows wildcards

In some cases, `p4` commands using unquoted filepatterns with a combination of depot syntax and wildcards, such as:

```
p4 files //depot/*
```

can result in a delayed response on Windows. You can prevent the delay by putting double quotes around the file pattern, like so:

```
p4 files "//depot/*"
```

The cause of the problem is the `p4` command's use of a Windows function to expand wildcards. When quotes are not used, the function interprets `//depot` as a networked computer path and spends time in a futile search for a machine on the network named `depot`.

DNS lookups and the hosts file

On Windows, the `%SystemRoot%\system32\drivers\etc\hosts` file can be used to hardcode IP address-hostname pairs. You may be able to work around DNS problems by adding entries to this file.

The corresponding UNIX file is `/etc/hosts`.

Location of the "p4" executable

If none of the above diagnostic steps explains the sluggish response time, it's possible that the `p4` executable itself is on a networked file system which is performing very poorly. To check this, try running:

```
p4 -V
```

This merely prints out the version information, without attempting any network access. If you get a slow response, network access to the `p4` executable itself may be the problem. Copying or downloading a copy of `p4` onto a local filesystem should improve response times.

Preventing Server Swamp

Generally, Perforce's performance depends on the number of files a user tries to manipulate in a single command invocation, not the size of the depot. That is, syncing a client view of 30 files from a 3,000,000-file depot should not be much slower than syncing a client view of 30 files from a 30-file depot.

The number of files affected by a single command is largely determined by:

- `p4` command line arguments (or selected folders in the case of GUI operations).

  Without arguments, most commands will operate on, or at least refer to, all files in the view.

- Client views, branch views, label views, and protections.

  Because commands without arguments operate on all files in the view, it follows that the use of unrestricted views and unlimited protections can result in commands operating on all files in the depot.

When the server answers a request, it locks down the database for the duration of the computation phase. For normal operations, this is a successful strategy, as it can "get in and out" quickly enough to avoid a backlog of requests. Abnormally large requests, however, can take seconds, sometimes even minutes. If frustrated users hit CTRL-C and retry, the problem gets even worse; the server consumes more memory and responds even more slowly.

At sites with very large depots, unrestricted views and unqualified commands will make a Perforce server work much harder than it needs to. Users and administrators can ease load on their servers by:

- Using "tight" views
- Assigning protections
- Limiting `maxresults`
- Writing efficient scripts
- Using compression efficiently

Using tight views

The following "loose" view is trivial to set up but could invite trouble on a very large depot:

```
//depot/...          //workspace/...
```

In the loose view, the entire depot was mapped into the client workspace; for most users, this can be "tightened" considerably. The following view, for example, is restricted to specific areas of the depot:

```
//depot/main/srv/devA/...          //workspace/main/srv/devA/...
//depot/main/drv/lport/...         //workspace/main/dvr/lport/...
//depot/rel2.0/srv/devA/bin/...    //workspace/rel2.0/srv/devA/bin/...
//depot/qa/s6test/dvr/...          //workspace/qa/s6test/dvr/...
```

Client views, in particular, but also branch views and label views, should also be set up to give users just enough scope to do the work they need to do.

Client, branch, and label views are set by a Perforce administrator or by individual users with the `p4 client`, `p4 branch`, and `p4 label` commands respectively.

Two of the techniques for script optimization (described in "Using branch views" on page 117 and "The temporary client trick" on page 118) rely on similar techniques. By limiting the size of the view available to a command, fewer commands need to be run, and when run, the commands require fewer resources.

Assigning protections

Protections (see "Administering Perforce: Protections" on page 71) are actually another type of Perforce view. Protections are set with the `p4 protect` command and control which depot files can be affected by commands run by users.

Unlike client, branch, and label views, however, the views used by protections can be set only by Perforce superusers. (Protections also control read and write permission to depot files, but the permission levels themselves have no impact on server performance.) By assigning protections in Perforce, a Perforce superuser can effectively limit the size of a user's view, even if the user is using "loose" client specifications.

Protections can be assigned to either users or groups. For example:

```
write     user      sam           *     //depot/admin/...
write     group     rocketdev     *     //depot/rocket/main/...
write     group     rocketrel2    *     //depot/rocket/rel2.0/...
```

Perforce groups are created by superusers with the `p4 group` command. Not only do they make it easier to assign protections, but they provide useful fail-safe mechanisms in the form of `maxresults` and `maxscanrows`, described in the next section.

Limiting database queries

Each Perforce group has an associated *maxresults* and *maxscanrows* value. The default for each is "`unlimited`", but a superuser can use `p4 group` to limit it for any given group.

Users in such groups are unable to run any commands which affect more database rows than the group's `maxresults` limit. (For most commands, the number of database rows affected is roughly equal to the number of files affected.)

Like `maxresults`, `maxscanrows` prevents certain user commands from placing excessive demands on the server. (For most commands, the number of rows that could be scanned is roughly equal to the number of files affected, multiplied by the average number of revisions per file in the depot.)

To set these limits, fill in the `Maxresults:` or `Maxscanrows:` field in the `p4 group` form. If a user is listed in multiple groups, the *highest* of the maxresults (or maxscanrows) *limits* (but *not* including the default "`unlimited`" setting) for those groups is taken as the user's `maxresults` (or `maxscanrows`) value.

Example: *Effect of setting* `maxresults` *and* `maxscanrows`*:*

As an administrator, you wish members of the group `rocketdev` *to be limited to operations of 20,000 files or less, and to scan no more than 100,000 revisions:*

```
Group:        rocketdev
Maxresults:   20000
Maxscanrows:  100000
Timeout:      43200
Subgroups:
Users:
        bill
        ruth
        sandy
```

Suppose that Ruth has an unrestricted ("loose") client view. When she types:

```
p4 sync
```

her `sync` *command is rejected if the depot contains more than 20,000 files. She can work around this limitation either by restricting her client view, or, if she needs all of the files in the view, by syncing smaller sets of files at a time, as follows:*

```
p4 sync //depot/projA/...
p4 sync //depot/projB/...
```

Either method enables her to get her files, but without tying up the server to process a single extremely large command.

If Ruth tries a command that scans every revision of every file, such as:

```
p4 filelog //depot/projA/...
```

and there are less than 20,000 files, but more than 100,000 revisions (perhaps the projA directory contains 8000 files, each of which has 20 revisions), the `maxresults` *limit does not apply, but the* `maxscanrows` *limit does.*

To remove any limits on the number of result lines processed (or database rows scanned) for a particular group, set the `Maxresults:` or `Maxscanrows:` value for that group to `unlimited`.

As these limitations can make life difficult for your users, do not use them unless you find that certain operations are slowing down your server. The `Maxresults:` value should never be less than 10,000, since certain operations performed by P4Win, the Perforce Windows Client, may require a `Maxresults:` value of between 5,000 and 8,000. Similarly, `Maxscanrows` should rarely need to be set below 50,000.

For more information, including a comparison of Perforce commands and the number of files they affect, type:

```
p4 help maxresults
p4 help maxscanrows
```

from the command line.

Maxresults and maxscanrows for users in multiple groups

As mentioned earlier, if a user is listed in multiple groups, the highest maxresults limit of all the groups a user belongs to is the limit that affects the user. The default value of "`unlimited`" is *not* a limit; if a user is in a group where maxresults is set to "`unlimited`", he or she is still limited by the highest maxresults (or maxscanrows) limit of the other groups of which he or she is a member. A user's commands are truly unlimited only when the user belongs to no groups, or when all of the groups of which the user is a member have their maxresults set to "unlimited"

A side effect of this is that you can't create a group that assigns "`unlimited`" maxresults values to superusers, because if any of the users in such a group were to belong to another group, the "`unlimited`" limit from the superuser group would also apply to them. You can get around this by assigning a very high maxresults limit to your superusers group.

For example:

```
Group:        superusers
Maxresults:   10000000
Maxscanrows:  100000000
```

(The largest possible `maxresults` or `maxscanrows` limit is platform-dependent; on most platforms, this is a 32-bit integer.)

Scripting efficiently

The Perforce Command-Line Client, `p4`, supports the scripting of any command that can be run interactively. The Perforce server can process commands far faster than users can issue them, so in an all-interactive environment, response time is excellent. However, `p4` commands issued by scripts -- triggers, review daemons, or command wrappers, for example -- can cause performance problems if you haven't paid attention to their efficiency. This is not because `p4` commands are inherently inefficient, but because the way one invokes `p4` as an interactive user isn't necessarily suitable for repeated iterations.

This section points out some common efficiency problems and solutions.

Iterating through files

Each Perforce command issued causes a connection thread to be created and a `p4d` subprocess to be started. Reducing the number of Perforce commands your script runs is the first step to making it more efficient.

To this end, scripts should never iterate through files running Perforce commands when they can accomplish the same thing by running one Perforce command on a list of files and iterating through the command results.

For example, try an approach like this:

```
for i in `p4 diff2 path1/... path2/...`
do
    [process diff output]
done
```

Instead of this:

```
for i in `p4 files path1/...`
do
    p4 diff2 path1/$i path2/$i
    [process diff output]
done
```

Using list input files

Any Perforce command that accepts a list of files as a command line argument can also read the same argument list from a file. Scripts can make use of the list input file feature by building up a list of files first, then passing the list file to `p4 -x`.

For example, if your script currently does something like:

```
for components in header1 header2 header3
do
    p4 edit ${component}.h
done
```

a more efficient alternative would be:

```
for components in header1 header2 header3
do
    echo ${component}.h >> LISTFILE
done
p4 -x LISTFILE edit
```

The `-x` flag instructs `p4` to read arguments, one per line, from the named file. If the file is specified as "`-`" (a dash), the standard input is read.

Using branch views

Branch views can be used with `p4 integrate` or `p4 diff2` to reduce the number of Perforce command invocations. For example, if you have a script that runs:

```
p4 diff2 pathA/src/...   pathB/src/...
p4 diff2 pathA/tests/... pathB/tests/...
p4 diff2 pathA/doc/...   pathB/doc/...
```

you can make it more efficient by creating a branch view that looks like this:

```
Branch:        pathA-pathB
View:
        pathA/src/...      pathB/src/...
        pathA/tests/...    pathB/tests/...
        pathA/doc/...      pathB/doc/...
```

and replacing the three commands with one:

```
p4 diff2 -b pathA-pathB
```

Limiting label references

Repeated references to large labels can be particularly costly. Commands that refer to files using labels as revisions will scan the whole label once for each file argument. To keep from hogging the Perforce server, your script should get the labeled files from the server, then scan the output for the files it needs.

For example, this:

```
p4 files path/...@label | egrep "path/f1.h|path/f2.h|path/f3.h"
```

will impose a lighter load on the Perforce server than either this:

```
p4 files path/f1.h@label path/f1.h@label path/f3.h@label
```

or this:

```
p4 files path/f1.h@label
p4 files path/f2.h@label
p4 files path/f3.h@label
```

The "temporary client" trick described below may also reduce the number of times you have to refer to files by label.

The temporary client trick

Most Perforce commands can process all the files in the current client view with a single command line argument. By making use of a temporary client view that contains the files on which you want to work, you may be able to reduce the number of commands you have to run, and/or to reduce the number of file arguments you need to give each command.

For instance, suppose your script runs these commands:

```
p4 sync pathA/src/...@label
p4 sync pathB/tests/...@label
p4 sync pathC/doc/...@label
```

You can combine the command invocations and reduce the three label scans to one by using a client spec that looks like:

```
Client:        XY-temp
View:
        pathA/src/...       //XY-temp/pathA/src/...
        pathB/tests/...     //XY-temp/pathB/tests/...
        pathC/doc/...       //XY-temp/pathC/doc/...
```

and running:

```
p4 -c XY-temp sync @label
```

Using compression efficiently

By default, revisions of files of type `binary` are compressed when stored on the Perforce server.

Some file formats (for example, .GIF and .JPG images, .MPG and .AVI media content, files compressed with `.gz` and `.ZIP` compression) include compression as part of the file format. Attempting to compress such files on the Perforce Server results in the consumption of server CPU resources with little or no savings in disk space.

To disable server storage compression for these file types, specify such files as type `binary+F` (binary, stored on the server in full, without compression) either from the command line or from the `p4 typemap` table.

For more about `p4 typemap`, including a sample typemap table, see “Defining filetypes with p4 typemap” on page 48.

Checkpoints for Database Tree Rebalancing

Perforce's internal database stores its data in structures called Bayer trees, more commonly referred to as B-trees. While B-trees are a very common way to structure data for rapid access, over time the process of adding and deleting elements to and from the trees can eventually lead to imbalances in the data structure.

Eventually, the tree may become sufficiently unbalanced that performance is negatively affected. The Perforce checkpoint and restore processes (see "Backup and Recovery Concepts" on page 25) re-create the trees in a balanced manner, and consequently, you may see some increase in server performance following a backup, a removal of the `db.*` files, and the re-creation of the `db.*` files from a checkpoint.

Rebalancing the trees is normally only useful if the database files have become more than about 10 times the size of the checkpoint. Given the length of time required for the trees to become unbalanced during normal Perforce use, we expect that the majority of sites will never need to restore the database from a checkpoint (that is, rebalance the trees) for performance reasons.

Chapter 8 Perforce and Windows

This chapter describes certain information of specific interest to administrators who set up and maintain Perforce servers on Windows.

Note Unless otherwise specified, the material presented here applies equally to Windows NT, Windows 2000, and Windows XP.

Using the Perforce installer

The Perforce installer program, `perforce.exe`, gives you the option to install either as a user (the Perforce client), a typical administrator (Perforce installed as a Windows service), a custom administrator (Perforce installed as a service with additional customization options), or to uninstall Perforce from your system.

If you have Administrator privileges, it is usually best to install Perforce as a service. If you don't, install it as a server.

Under Windows 2000 or higher, you need Administrator privileges to install Perforce as a service, and Power User privileges to install Perforce as a server.

Upgrade notes

The Perforce installer also automatically upgrades all types of Perforce servers (or services), even versions prior to 97.3. The upgrade process is extremely conservative; if anything fails at any step in the upgrade process, the installer stops the upgrade, and you are still able to use your old server (or service).

Installation options

When you invoke the installer, it presents an initial screen that lists the revisions of the Perforce software you're about to install. You are offered the choice between:

- a user install,
- a typical Administrator install,
- a customized Administrator install, or
- uninstalling Perforce.

User install

The "user install" installs only the Perforce Command-Line Client (`p4.exe`), Perforce Windows Client (P4Win), and (optionally) the third-party SCM plug-in. Under Windows 2000 or higher, this option requires Power User privileges.

You are prompted to specify the location of the client executables, the port (`P4PORT`) on which the client should attempt to contact the Perforce server, the default editor, and the default username.

When specifying the port for the client to use, remember to include the hostname in the form *`hostname:port`*. See "Telling Perforce client programs which port to connect to" on page 13 for more about how to set `P4PORT`.

If the installer detects older versions of Perforce client or server software on the machine, you are given the option to rename the old executables to prevent `PATH`-dependent conflicts.

Administrator typical

The "typical administrator install" installs both client and server software for Perforce. This option requires administrator privileges.

You are prompted to specify the directory for the client and server executables, the port on the local machine where the Perforce server or service will listen to client requests (`P4PORT`), the default editor, and the default username.

The installer selects default locations for the `P4LOG` error log file and the `journal` file. If an earlier version of Perforce was installed on the machine, these locations are based on those already in use.

If you have Administrator privileges, the installer installs Perforce and configures it to run as an auto-starting service. The service is set up and started after the installation is complete, and automatically restarts whenever the machine is rebooted. If you do not have Administrator privileges, a shortcut to run Perforce as a server is placed into your Start menu.

If the installer detects older versions of Perforce client or server software on the machine, you are given the option to rename the old executables to prevent `PATH`-dependent conflicts.

Administrator custom

The "custom administrator install" installs both client and server software for Perforce, with certain customizations. This option requires administrator privileges.

As with the typical administrator install, you are prompted to specify the location of client and server executables, the port on the local machine where the Perforce server or service will listen to client requests, the default editor, and the default username.

Unlike the typical administrator install, you are prompted to optionally specify separate directories for the client and server executables, as well as server root, server port, and whether to set up Perforce as an auto-starting (or non-auto-starting) service or server process. The locations of any existing `P4LOG` file and `journal` file are displayed for reference, and may be changed later using `p4 set`.

If you try to install a Perforce service while another Perforce server is running, the following error message is displayed:

```
Setup has determined that a Perforce Server could be running. Please
shut down all Perforce Servers before continuing the installation.
```

Failure to shut down the running Perforce server(s) will result in conflicts between the newly installed service and the existing server.

As with the other installation options, if the installer detects older versions of Perforce client or server software on the machine, you are given the option to rename the old executables to prevent `PATH`-dependent conflicts.

Uninstalling Perforce

To remove Perforce from a Windows machine, run `perforce.exe` and select the **Uninstall** option. This option requires administrator privileges.

The uninstall procedure removes everything *except* your server data; the Perforce server, service, and client executables, registry keys, and service entries are all deleted. The database and depot files in your server root, however, are always preserved.

Scripted deployment and unattended installation

The Perforce installer supports scripted installation, enabling you to accelerate a deployment of Perforce across a large number of desktops.

Scripted installations are controlled by a configuration file that comes with the scriptable version of the Perforce installer. You can edit this file to preconfigure Perforce environment variables (such as `P4PORT`) for your environment, to automatically select Perforce client programs in use at your site, and more.

To learn more about how to automate a deployment of Perforce, see Tech Note #68 at:

```
http://www.perforce.com/perforce/technotes/note068.html
```

Perforce technical support personnel are available to answer any questions or concerns you have about automating your Perforce deployment.

Windows services vs. Windows servers

To run any task as a Windows *server*, a user account must be logged in, as shortcuts in a user's `Startup` folder cannot be run until that user logs in. A Windows *service*, on the other hand, is invoked automatically at boot time, and runs regardless of whether or not a user is logged in to the machine.

Throughout most of the documentation set, the terms "Perforce server" or "`p4d`" are used to refer to "the process at the back end that manages the database and responds to requests from Perforce clients". Under Windows, this can lead to ambiguity; the back-end process can run as either a service (`p4s.exe`, which runs as a thread) or as a server (`p4d.exe`, which runs as a regular process). From a Windows administrator's point of view, these are important distinctions. Consequently, the terminology used in this chapter uses the more precise definitions.

The Perforce service (`p4s.exe`) and the Perforce server (`p4d.exe`) executables are copies of each other; they are identical apart from their filenames. When run, they use the first three characters of the name with which they were invoked (that is, either `p4s` or `p4d`) to determine their behavior. For example, invoking copies named `p4smyserver.exe` or `p4dmyservice.exe` invokes a service and a server, respectively.

Starting and stopping the Perforce service

If Perforce was installed as a service, a user with Administrator privileges can start and stop it using the **Services** applet under the **Control Panel**.

If you are running at Release 99.2 or above, you can also use the command:

```
p4 admin stop
```

to stop the Perforce service.

Starting and stopping the Perforce server

If Perforce was installed as a server, there should be a "Perforce Server" shortcut in your **Start** menu. To start the server, double-click on the shortcut. To stop the server, right-click on the "Perforce Server" button in the taskbar and select "**Close**".

You can also start the Perforce server manually from a command prompt. The server executable, `p4d.exe`, is normally found in your `P4ROOT` directory. To start the server, first make sure your current `P4ROOT`, `P4PORT`, `P4LOG`, and `P4JOURNAL` settings are correct, then run: `%P4ROOT%\p4d`

If you want to start a server using settings different than those set by `P4ROOT`, `P4PORT`, `P4LOG`, or `P4JOURNAL`, you can use `p4d` command line flags. For example:

```
c:\test\p4d -r c:\test -p 1999 -L c:\test\log -J c:\test\journal
```

starts a Perforce server process with a root directory of `c:\test`, listening to port `1999`, logging errors to `c:\test\log`, and with a journal file of `c:\test\journal`.

Note that `p4d` command line flags are case sensitive.

If you are running at Release 99.2 or above, use the following command:

```
p4 admin stop
```

to stop the Perforce server.

Note If you are running Release 99.1 or earlier, type Ctrl-C in the Command Prompt window, or simply **Close** the window.

Although this method of stopping a Perforce server works in all versions of Perforce, it is not necessarily "clean". With the availability of the `p4 admin stop` command in 99.2, this method is no longer recommended.

Installing the Perforce service on a network drive

By default, the Perforce service runs under the local `System` account. Because the `System` account has no network access, a real userid and password are required in order to make the Perforce service work if the metadata and depot files are stored on a network drive.

If you are installing your server root on a network drive, the Perforce installer (`perforce.exe`) requests a valid combination of userid and password at the time of installation. This user must have administrator privileges. (The service, when running, will run under this user name, rather than `System`)

Although the Perforce service runs reliably using a network drive as the server root, there is still a marked performance penalty due to increased network traffic and slower file access. Consequently, Perforce recommends that the depot files and Perforce database reside on a drive local to the machine on which the Perforce service is running.

Multiple Perforce services under Windows

By default, the Perforce installer for Windows installs a single Perforce server as a single service. If you want to host more than one Perforce installation on the same machine (for instance, one for production and one for testing), you can either manually start Perforce servers from the command line, or use the Perforce-supplied utility `svcinst.exe`, to configure additional Perforce services.

Note You must use Perforce 99.1/10994 or a later release in order to set up multiple Perforce services under Windows.

Warning Setting up multiple services to increase the number of users you support without purchasing more user licenses is a violation of the terms of your Perforce End User License Agreement.

Understanding the precedence of environment variables in determining Perforce configuration is useful when configuring multiple Perforce services on the same machine. Before you begin, read and understand "Windows configuration parameter precedence" on page 127.

To set up a second Perforce service:

1. Create a new directory for the Perforce service.
2. Copy the server executable, service executable, and your license file into this directory.
3. Create the new Perforce service using the `svcinst.exe` utility, as described in the example below. (The `svcinst.exe` utility comes with the Perforce installer, and can be found in your Perforce server root.)
4. Set up the environment variables and start the new service.

We recommend that you install your first Perforce service using the Perforce installer. This first service is called "`Perforce`" and its server root directory contains files that are required by any other Perforce services you create on the machine.

Example: *Adding a second Perforce service.*

You want to create a second Perforce service with a root in `C:\p4root2` *and a service name of "*`Perforce2`*". You are running Release 99.1/10994 or greater, and the* `svcinst` *executable is in the server root of the first Perforce installation you installed in* `C:\perforce`*.*

Verify that your `p4d.exe` *executable is at Release 99.1/10994 or greater:*

```
p4d -V
```

(If you are running an older release, you must first download a more recent release from `http://www.perforce.com` *and upgrade your server before continuing.)*

Create a `P4ROOT` *directory for the new service:*

```
mkdir c:\p4root2
```

Copy the server executables - both `p4d.exe` *(the server) and* `p4s.exe` *(the service) - and your license file into the new directory:*

```
copy c:\perforce\p4d.exe c:\p4root2
copy c:\perforce\p4d.exe c:\p4root2\p4s.exe
copy c:\perforce\license c:\p4root2\license
```

Use Perforce's `svcinst.exe` *(the service installer) to create the "*`Perforce2`*" service:*

```
svcinst create -n Perforce2 -e c:\p4root2\p4s.exe -a
```

After creating the "`Perforce2`*" service, set the service parameters for the "*`Perforce2`*" service:*

```
p4 set -S Perforce2 P4ROOT=c:\p4root2
p4 set -S Perforce2 P4PORT=1667
p4 set -S Perforce2 P4LOG=log2
p4 set -S Perforce2 P4JOURNAL=journal2
```

Finally, use the Perforce service installer to start the "`Perforce2`*" service:*

```
svcinst start -n Perforce2.
```

The second service is now running, and both services will start automatically the next time you reboot.

Windows configuration parameter precedence

Under Windows, Perforce configuration parameters can be set in many different ways. When a Perforce client program (such as `p4` or P4Win), or a Perforce server program (`p4d`) starts up, it reads its configuration parameters according to the following precedence:

1. The program's command line flags have the highest precedence.
2. The `P4CONFIG` file, if `P4CONFIG` is set.
3. User environment variables.
4. System environment variables.
5. The Perforce user registry (set by `p4 set`).
6. The Perforce system registry (set by `p4 set -s`).

As of Release 99.1 / 10994, when a Perforce service (`p4s`) starts up, it reads its configuration parameters from the environment according to the following precedence:

1. Windows service parameters (set by `p4 set -S` *`servicename`*) have the highest precedence.
2. System environment variables.
3. The Perforce system registry (set by `p4 set -s`).

User environment variables can be set with any of the following:

- The MS-DOS `set` command.
- The `AUTOEXEC.BAT` file.
- The **User Variables** tab under the **System Properties** dialog in the Control Panel.

System environment variables can be set with:

- The **System Variables** tab under the **System Properties** dialog in the Control Panel.

Resolving Windows-related instabilities

There are many large sites running Perforce on Windows without incident. There are also sites in which Perforce service or server installation appears to be unstable; the server dies mysteriously, the service can't be started, and in extreme cases the system crashes. In most of these cases, this is an indication of recent changes to the machine or a corrupted operating system.

While not all Perforce failures are caused by OS-level problems, a number of symptoms may indicate the OS is at fault. Examples include: the system crashing, the Perforce server exiting without any error in its log and without Windows indicating that the server crashed, or the Perforce service not starting properly.

Perforce is supported on Windows NT 4.0 sp6a and higher, including Windows 2000 Intel x86, Windows XP Intel x86, and Windows Server 2003.

In some cases, installing third-party software *after* installing a Service Pack can overwrite critical files installed by the service pack; reinstalling your most-recently installed service pack can often correct these problems. If you've installed another application after your last service pack, and server stability appears affected since the installation, consider reinstalling the service pack.

As a last resort, it may pay to install Perforce on another system to see if the same failures occur, or even to reinstall the OS and Perforce on the faulty system.

Users having trouble with P4EDITOR or P4DIFF

Your Windows users may experience difficulties using the Perforce Command-Line Client (`p4.exe`) if they use the `P4EDITOR` or `P4DIFF` environment variables.

The reason for this is that Perforce clients sometimes use the DOS shell (`cmd.exe`) to start programs such as user-specified editors or diff utilities. Unfortunately, the DOS shell knows that when a Windows command is run (such as a GUI-based editor like `notepad.exe`), the shell doesn't have to wait for the command to complete before terminating. When this happens, the Perforce client then mistakenly believes that the command has finished, and attempts to continue processing, often deleting the temporary files that the editor or diff utility had been using, leading to error messages about temporary files not being found, or other strange behavior.

You can get around this problem in two ways:

- Unset the environment variable `SHELL`. Perforce clients under Windows only use `cmd.exe` when `SHELL` is set, otherwise they call `spawn()` and wait for the Windows programs to complete.

- Set the `P4EDITOR` or `P4DIFF` variable to the name of a batch file whose contents are the command:

  ```
  start /wait program %1 %2
  ```

  where *`program`* is the name of the editor or diff utility you wish to invoke. The `/wait` flag instructs the system to wait for the editor or diff utility to terminate, enabling the Perforce client program to behave properly.

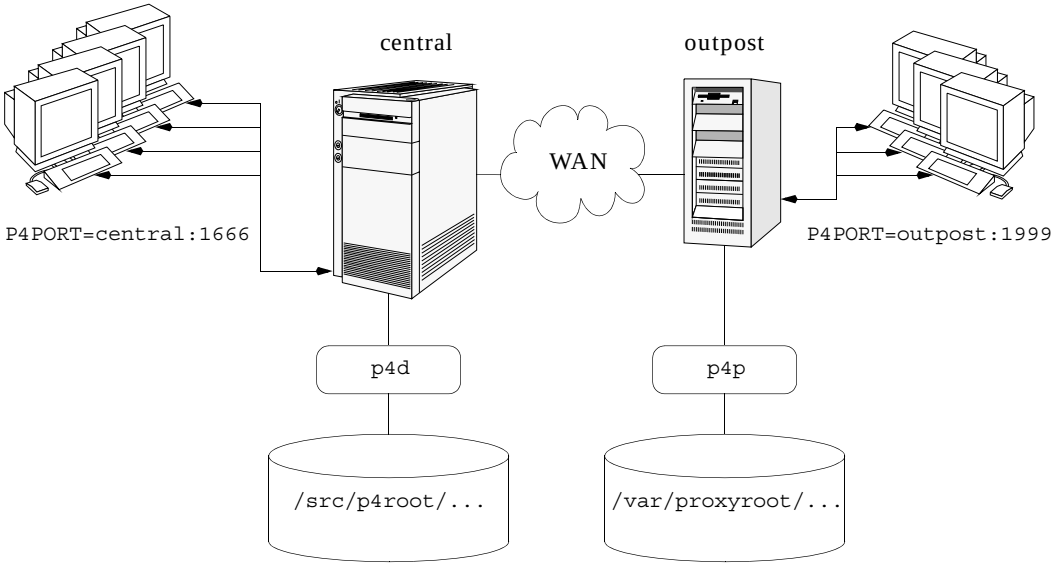
  Some Windows editors (most notably, Wordpad) do not exhibit proper behavior, even when instructed to wait. There is presently no workaround for such programs.

Chapter 9 Perforce Proxy

Perforce is built to handle distributed development in a wide range of network topologies. Where bandwidth to remote sites is limited, P4P, the Perforce Proxy, improves performance by mediating between Perforce clients and servers to cache frequently transmitted file revisions. By intercepting requests for cached file revisions, P4P reduces demand on the Perforce server and network.

To improve performance obtained by multiple Perforce clients accessing a central Perforce server across a WAN, configure P4P on the side of the network close to the clients and configure the clients to access P4P, and then configure P4P to access the central Perforce server. (On a LAN, you can also obtain performance improvements by setting up proxies to divert workload from the central server's CPU and disks.)

The following diagram illustrates a typical P4P configuration:



In this configuration, file revisions requested by users at a remote development site are fetched first from a central Perforce server (`p4d` running on `central`) and transferred over a relatively slow WAN. Subsequent requests for that same revision, however, are delivered from the Perforce Proxy, (`p4p` running on `outpost`), over the remote development site's LAN, reducing both network traffic across the WAN and CPU load on the central server.

System Requirements

To use Perforce Proxy, you must have:

- A Perforce server at Release 2002.2 or higher
- Sufficient disk space on the proxy host to store a cache of file revisions

Installing P4P

UNIX

To install P4P on UNIX, do the following:

1. Download the `p4p` executable to the machine on which you wish to run the proxy.
2. Select a directory on this machine (`P4PCACHE`) in which to cache file revisions.
3. Select a port (`P4PORT`) on which `p4p` will listen for requests from Perforce client programs.
4. Select the target Perforce server (`P4TARGET`) for which this proxy will cache.

Windows

Install P4P from the Windows installer's custom / administrator installation dialog.

Running P4P

To run P4P, invoke the `p4p` executable, configuring it with environment variables or command-line flags. Flags you specify on the command line override environment variable settings.

For example, the following command line starts a proxy that communicates with a central Perforce server located on a host named `central`, listening on port 1666.

```
p4p -p 1999 -t central:1666 -r /var/proxyroot
```

To use the proxy, Perforce client programs connect to P4P on port 1999 on the machine where the proxy runs. P4P file revisions are stored under a directory named `/var/proxyroot`.

Running as a Windows service

To run P4P as a Windows service, install P4P from the Windows installer, or specify the `-s` flag when you invoke `p4p.exe`, or rename the P4P executable to `p4ps.exe`.

P4P flags

The following command-line flags specific to the proxy are supported.

Flag	Meaning
`-d`	Run as daemon - fork first, then run (UNIX only)
`-f`	Do not fork - run as a single-threaded server (UNIX only)
`-i`	Run for `inetd` (socket on `stdin`/`stdout` - UNIX only)
`-q`	Run quietly; suppress startup messages
`-s`	Run as an NT service (Windows only)
	Running `p4p.exe -s` is equivalent to invoking `p4ps.exe`
`-c`	Do not compress files transmitted from the Perforce server to P4P
	(This option reduces CPU load on the central server at the expense of slightly higher bandwidth consumption)

The following general options are supported.

Flag	Meaning
`-h` or `-?`	Display a help message
`-p` *port*	Specify the port on which P4P will listen for requests from Perforce client programs.
	Default is `P4PORT`, or 1666 if `P4PORT` is not set.
`-r` *root*	Specify the directory where revisions are cached.
	Default is `P4PCACHE`, or the directory from which `p4p` is started if `P4PCACHE` is not set.
`-t` *port*	Specify the port of the target Perforce server (that is, the Perforce server for which P4P acts as a proxy).
	Default is `P4TARGET` or `perforce:1666` if `P4TARGET` is not set.
`-v` *level*	Specifies server trace level. Debug messages are stored in the proxy server's log file. Debug messages from `p4p` are not passed through to `p4d`, and debug messages from `p4d` are not through to instances of `p4p`.
	Default is `P4DEBUG`, or none if `P4DEBUG` is not set.
`-L` *logfile*	Specify the location of the log file.
	Default is `P4LOG`, or the directory from which `p4p` is started if `P4LOG` is not set.
`-V`	Display the version of the Perforce Proxy.

Administering P4P

No backups required

You never need to back up the P4P cache directory.

If necessary, P4P reconstructs the cache based on Perforce server metadata.

Stopping P4P

P4P is effectively stateless; to stop P4P under UNIX, `kill` the `p4p` process with `SIGTERM` or `SIGKILL`. Under Windows, select **End Process** under the **Task Manager**.

Managing disk space consumption

P4P caches file revisions in its cache directory. These revisions accumulate until you delete them. P4P does not delete its cached files or otherwise manage its consumption of disk space.

Warning! If you do not delete cached files, you will eventually run out of disk space.

To recover disk space, remove files under the proxy's root. It is safe to delete the proxy's cached files while the proxy is running.

Determining if your Perforce client is using the proxy

If your Perforce client program is using the proxy, the proxy's version information appears in the output of `p4 info`.

For example, if a Perforce server is running on `central:1666` and you direct your Perforce client to a Perforce Proxy running on `outpost:1999`, the output of `p4 info` resembles the following:

```
$ export P4PORT=outpost:1999
$ p4 info
User name: p4adm
Client name: admin-temp
Client host: remotesite22
Client root: /home/p4adm/tmp
Current directory: /home/p4adm/tmp
Client address: 192.168.0.123:55768
Server address: central:1666
Server root: /src/p4root
Server date: 2002/10/14 15:03:05 -0700 PDT
Server version: P4D/FREEBSD4/main/36609 (2002/09/30)
Proxy version: P4P/SOLARIS26/main/36884 (2002/10/14)
Server license: P4 Admin <p4adm> 20 users (expires 2003/02/01)
```

P4P and protections

To apply the IP address of a Perforce Proxy user's workstation against the protections table, prepend the string `proxy-` to the workstation's IP address.

For instance, consider an organization with a remote development site with workstations on a subnet of `192.168.10.0/24`. The organization also has a central office where local development takes place; the central office exists on the `10.0.0.0/8` subnet. A Perforce Server resides on the `10.0.0.0/8` subnet, and a Perforce Proxy resides on the `192.168.10.0/24` subnet. Users at the remote site belong to the group `remotedev`, and may occasionally visit the central office.

To ensure that members of the `remotedev` group use the proxy while working at the remote site, but do not use the proxy when visiting the local site, add the following lines to your protections table:

```
list    group    remotedev     192.168.10.*          -//...
write   group    remotedev     proxy-192.168.10.*     //...
list    group    remotedev     proxy-10*             -//...
write   group    remotedev     10.*                   //...
```

The first line denies `list` access to all users in the `remotedev` group if they attempt to access Perforce without using the proxy from their workstations in the `192.168.10.*` subnet. The second line grants write access all users in `remotedev` if they are using a Perforce Proxy server and are working from the `192.168.10.*` subnet. Users of workstations at the remote site must use the proxy.

Similarly, the third and fourth lines deny list access to `remotedev` users when they attempt to use the proxy from workstations on the central office's subnet (`10.0.0.0/8`), but grant write access to `remotedev` users who access the Perforce server directly from workstations on the central office's subnet. When visiting the local site, users from the `remotedev` group must access the Perforce server directly.

Determining if specific files are being delivered from the proxy

Use the `-Zproxyverbose` flag with `p4` to display messages indicating whether file revisions are coming from the proxy (`p4p`) or the central server (`p4d`).

For instance:

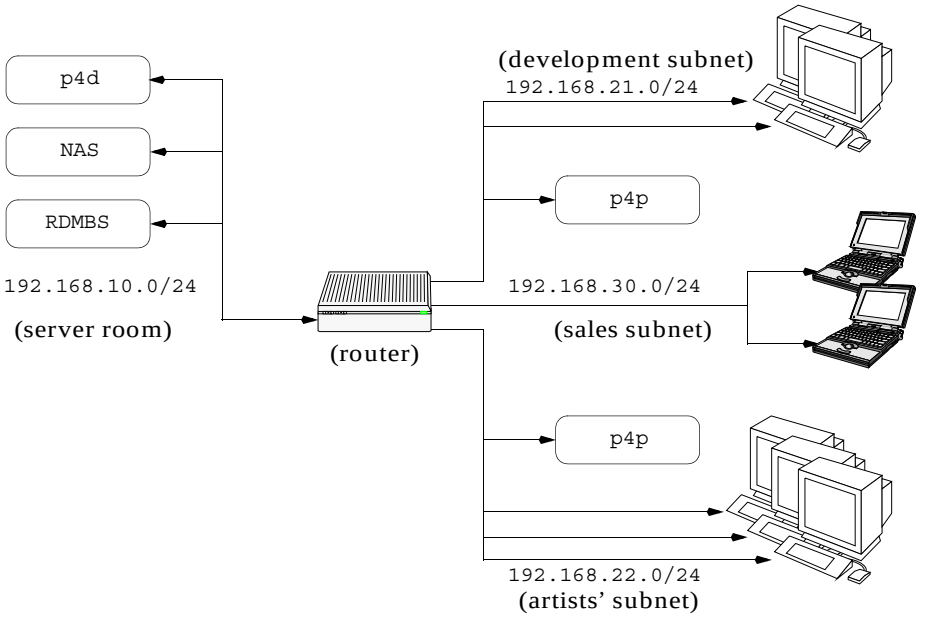
```
$ p4 -Zproxyverbose sync noncached.txt
//depot/main/noncached.txt - refreshing /home/p4adm/tmp/noncached.txt

$ p4 -Zproxyverbose sync cached.txt
//depot/main/cached.txt - refreshing /home/p4adm/tmp/cached.txt
File /home/p4adm/tmp/cached.txt delivered from proxy server
```

Maximizing performance improvement

Network topologies versus P4P

If network bandwidth on the same subnet as the central Perforce server is nearly saturated, deploying proxy servers on the same subnet will not likely result in a performance improvement. Instead, deploy the proxy servers on the other side of a router so that the traffic from the clients to the proxy server is isolated to a subnet separate from the subnet containing the central Perforce server.

For example:



Deploying an additional proxy server on a subnet when network bandwidth on the subnet is nearly saturated will not likely result in a performance improvement. Instead, split the subnet into multiple subnets and deploy a proxy server in each resulting subnet.

In the illustrated configuration, a server room houses a company's Perforce server (`p4d`), a network storage device (NAS), and a database server (RDBMS). The server room's network segment is saturated due heavy loads placed on it by a sales force constantly querying a database for live updates, and the developers and graphic artists frequently accessing large files through the Perforce server.

By deploying two instances of Perforce Proxy, one on the developers' subnet, and one on the graphic artists' subnet, all three groups benefit from improved performance due to decreased use on the server room's network segment.

Pre-loading the cache directory for optimal initial performance

P4P stores file revisions only when one of its clients requests them. That is, file revisions are not "prefetched". The performance gains from P4P only occur after file revisions are cached.

After starting P4P, you can effectively prefetch the cache directory by creating a client workspace and syncing it to the head revision. All other clients that subsequently connect to the proxy immediately obtain the performance improvements provided by P4P.

For instance, a development site located in Asia with a P4P server targeting a Perforce server in North America can preload its cache directory by using an automated job that runs a `p4 sync` against the entire Perforce depot after most work at the North American site had been completed, but before its own developers arrived for work.

Distributing disk space consumption

P4P stores revisions as if there is only one depot tree. If this approach stores too much file data onto one filesystem, you can use symbolic links to spread the revisions across multiple filesystems.

For instance, if the P4P cache root is `/disk1/proxy` and the Perforce server it supports has two depots named `//depot` and `//released`, you can split data across disks, storing `//depot` on `disk1` and `//released` on `disk2` as follows:

```
mkdir /disk2/proxy/released
cd /disk1/proxy
ln -s /disk2/proxy/released released
```

The symbolic link means that when P4P attempts to cache files in the `//released` depot to `/disk1/proxy/released`, the files are stored on `/disk2/proxy/released`.

Reducing server CPU usage by disabling file compression

By default, P4P compresses communication with the central Perforce server, imposing additional overhead on the server.

To disable compression, specify the `-c` option when you invoke `p4p`. This option is particularly effective if you have excess network and disk capacity and are storing large numbers of binary file revisions in the depot, because the proxy (rather than the server) will decompress the binary files from its cache before sending them to Perforce clients.

Appendix A Perforce Server (p4d) Reference

Synopsis

Invoke the Perforce server or perform checkpoint/journaling (system administration) tasks.

Syntax

```
p4d [ options ]
p4d.exe [ options ]
p4s.exe [ options ]
p4d -j [ -z ] [ args ... ]
```

Description

The first three forms of the command invoke the Perforce background process ("Perforce server"). The fourth form of the command is used for system administration tasks.

On UNIX and MacOS X, the executable is `p4d`.

On Windows, the executable is `p4d.exe` (running as a server) or `p4s.exe` (running as a service).

Exit Status

After successful startup, `p4d` does not normally exit. It merely outputs the startup message

```
Perforce server starting...
```

and runs in the background.

On failed startup, `p4d` returns a nonzero error code.

Also, if invoked with any of the `-j` checkpointing and/or journaling flags, `p4d` exits with a nonzero error code if any error occurs.

Options

Flag	Meaning
`-c` *command*	Lock database tables, run *command*, unlock the tables, and exit.
`-d`	Run as a daemon (in the background)
`-f`	Run as a single-threaded (non-forking) process
`-i`	Run from `inetd` on UNIX

Flag	Meaning
`-q`	Run quietly (no startup messages)
`-s`	Run `p4d.exe` as an NT service (equivalent to running `p4s.exe`)
`-xu`	Run database upgrades and exit.
`-xi`	Irreversibly reconfigure the Perforce server (and its metadata) to operate in unicode mode. Do not use this flag unless you know you require unicode mode. See the *Release Notes* for details.
`-jc [ prefix ]`	Journal-create; checkpoint and save / truncate journal.
`-jd [ file ]`	Journal-checkpoint; create checkpoint without saving / truncating journal.
`-jj [ prefix ]`	Journal-only; save and truncate journal without checkpointing.
`-jr file`	Journal-restore; restore metadata from a checkpoint and / or journal file.
`-z`	Compress (in `gzip` format) checkpoints and journals.
`-h, -?`	Print help message.
`-V`	Print server version.
`-J journal`	Specify a journal file. Overrides `P4JOURNAL` setting. Default is `journal`.
`-L log`	Specify a log file. Overrides `P4LOG` setting. Default is stderr.
`-p port`	Specify a port to listen to. Overrides `P4PORT`. Default `1666`.
`-r root`	Specify the server root directory. Overrides `P4ROOT`. Default is current working directory.
`-v debuglevel`	Set server trace flags. Overrides value `P4DEBUG` setting. Default is null.

Usage Notes

- On all systems, journaling is enabled by default. If `P4JOURNAL` is unset when a server starts, the default location for the journal is `$P4ROOT/journal`. If you wish to manually disable journaling, you must explicitly set `P4JOURNAL` to `off`.
- Take checkpoints and truncate the journal often, preferably as part of your nightly backup process.
- Checkpointing and journaling preserve only your Perforce metadata (data *about* your stored files). The stored files themselves (the files containing your source code) reside under `P4ROOT` and must be also be backed up as part of your regular backup procedure.

- If your users are using triggers, don't use the `-f` (non-forking mode) flag; the Perforce server needs to be able to spawn copies of itself ("fork") in order to run trigger scripts.
- After a hardware failure, the flags required for restoring your metadata from your checkpoint and journal files may vary, depending on whether or not data was corrupted.
- Because restorations from backups involving loss of files under `P4ROOT` often require the journal file, we strongly recommend that the journal file reside on a separate filesystem from `P4ROOT`. This way, in the event of corruption the filesystem containing `P4ROOT`, the journal is likely to remain accessible.
- The database upgrade flag (`-xu`) is may require considerable disk space. See the *Release Notes* and the section "Important notes for 2001.1 and later" on page 16 if upgrading to 2001.1 or later from a 2000.2 or earlier server.

Related Commands

To start the server, listening to port `1999`, with journaling enabled and written to `journalfile`.	`p4d -d -p 1999 -J /opt/p4d/journalfile`

To checkpoint a server with a non-default journal file, the `-J` argument (or the environment variable `P4JOURNAL`) must match the journal file specified when the server was started.	Checkpoint with:
	`p4d -J /p4d/jfile -jc`
	or
	`P4JOURNAL=/p4d/jfile ; export P4JOURNAL`
	`p4d -jc`

To create a compressed checkpoint from a server with files in directory `P4ROOT`	`p4d -r $P4ROOT -z -jc`
To create a compressed checkpoint with a user-specified prefix of "`ckp`" from a server with files in directory `P4ROOT`	`p4d -r $P4ROOT -z -jc ckp`
To restore metadata from a checkpoint named `checkpoint.3` for a server with root directory `P4ROOT`	`p4d -r $P4ROOT -jr checkpoint.3`
To restore metadata from a compressed checkpoint named `checkpoint.3.gz` for a server with root directory `P4ROOT`	`p4d -r $P4ROOT -z -jr checkpoint.3.gz`

Index

A

access level
    and protections 72
access levels 72
`admin` access level 39, 73
administrator
    force flag 50
    privilege required 125
administrators
    and job specifications 81
allocating disk space 20
AppleSingle 30
.asp files 49
automated checkpoints 27
automating Perforce 43
.avi files 49

B

backing up 31
backup
    procedures 31
    recovery procedures 33
backups
    and Perforce Proxy 134
.bmp files 49
branches
    namespace 65
.btr files 49
buffering
    of input/output in scripts 106

C

can 124
case-sensitivity
    and cross-platform development 23
    UNIX and Windows 23, 56
change review 103
changelist numbers
    highest possible 105
    pending vs. submitted changelists 106
changelist submission triggers 93
changelist triggers 95
changelists
    deleting 47
    editing 47
checkpoint
    as part of backup script 31
    creating 26
    creation of, automating 27
    defined 26
    ensuring completion of 32
    failed 27
    introduced 25
    managing disk space 20
    when to call support 27
checkpoints
    creating with `p4 admin` 27, 31
client
    and port 13
clients
    namespace 65
.cnf files 49
commands
    forcing 50
`content`
    trigger type 95, 97
counter
    limits 105
CPU
    and performance 109
CR/LF conversion 63
creating checkpoints 26
creating users 43
creation of users
    preventing 43
cross-platform development
    and case sensitivity 23
.css files 49

D

daemon

change review 103
daemons 91
changelist numbers 106
creating 104
database files 61
defined 25
where stored 25
db.* files 25
debugging
with server tracing 60
defect tracking
integrating with Perforce 90
deleting
changelists 47
depots 65
files, permanently 45
user groups 77
deleting users 45
depot
and Mac file formats 30
and server root 64
depot files
see *versioned files* 30
depots
defined 25
defining 64
deleting 65
listing 65
local 64
mapping field 68
multiple 64
namespace 65
remote 64, 69
remote, defining 68
disabling journaling 30
disk
performance 108
sizing 108
disk space
allocating 20
and server trace flags 60
freeing up 45
required for upgrade 16
distributed development 66
DNS
and performance 110, 111
.doc files 49
.dot files 49
drives
and db.*and journal file 19
E
editing
changelists 47
editor
Wordpad, limitation 129
environment variables
P4PCACHE 132, 133
P4PORT 132
P4TARGET 132, 133
error logging 22
error messages
and p4 verify 47
example
specifying journal files 29
exclusionary mappings
and protections 75
.exp files 49
F
fields
of job template 82
file formats
AppleSingle 30
file names
mapping to file types 48
file specification
and protections 72
file types 49
mapping to file names 48
files
access to, limiting 75
.asp 49
.avi 49
.bmp 49
.btr 49
.cnf 49
.css 49

database 25
.doc 49
.dot 49
.exp 49
.gif 49
.htm 49
.html 49
.ico 49
.inc 49
.ini 49
.jpg 49
.js 49
left open by users, reverting 45
.lib 49
.log 49
matching Perforce file types to file names 48
.mpg 49
.pdf 49
.pdm 49
permanent deletion of 45
.ppt 49
subscribing to 104
verification of 47
versioned 25
.xls 49
.zip 49
filesystems
and performance 108
large 21
NFS-mounted, caveats 21, 108
firewall
defined 52
running Perforce through 52
flags
and Perforce Proxy 133
`-f` to force 50
server, listed 139
forms
triggers 98
G
.gif files 49
groups
and protections 72, 76
and subgroups 76
deleting 77
editing 76
of users 76
H
hostname
changing your server's 63
hosts
and protections 72
`hosts` file
on Windows and UNIX 111
.htm files 49
.html files 49
I
`-i`
and `inetd` 55
automating job submissions 90
automating user creation 43
.ico files 49
`in`
trigger type 100
.inc files 49
`inetd` 55, 139
.ini files 49
installation
Windows 14
installing
license file 18
on network drives 22
on NFS filesystems 21, 108
on UNIX 11
on Windows 14
on Windows network drives 125
Perforce Proxy 132
IP address
changing your server's 63
servers and `P4PORT` 55
IP forwarding
and `ssh` 53
J
job fields
data types 85

job specification 81–??
    and administrators 81
    and comments 86
    default format 81
    defining fields 83
    extended example 88
    warnings 87
job template
    default 81
    fields of 82
    viewing 82
jobs
    comments in 86
    other defect tracking systems 90
journal
    defined 28
    introduced 25
    managing size of 20
    where to store 20
journal file
    specifying 140
    store on separate drive 19
journaling
    disabling 30
.jpg files 49
.js files 49
L
label
    namespace 65
.lib files 49
license 18
licensing information 18
limitations
    Wordpad 129
`list` access level 72
listing
    depot names 65
local depots 64
localhost 55
log file
    specifying 140
.log files 49
M
Mac
    and file formats 30
Macintosh
    OS X 11
mappings
    and depots 68
maxresults
    and multiple groups 115
    and P4Win 115
    and performance 114
    use of 114
maxscanresults
    and performance 114
    use of 114
maxscanrows
    and multiple groups 115
    and P4Win 115
MD5 signatures 47
memory
    and performance 107
    requirements 107
metadata
    see database files 25, 61
monitoring server activity 58
moving servers 61
    across architectures 62
    between Windows and UNIX 63
    new hostname 63
    new IP address 63
    same architecture 61
.mpg files 49
multiple depots 64
N
naming
    depots 65
network
    and performance 109, 110
    Perforce Proxy configuration 131
    problems, diagnosing 110
network drives
    and triggers 102
    and Windows 22

network interface
    directing server to listen to specific 55
NFS
    and installation 21, 108
non-forking 139
O
obliterating files 45
`open` access level 73
operating systems
    and large filesystem support 21
OS X
    and UNIX 11
`out`
    trigger type 99
P
`p4 admin`
    and Windows 16, 124
    creating checkpoints 27, 31
    stopping server with 14, 34, 35
`p4 jobspec`
    warnings 87
`p4 monitor` 58
`p4 set -s`
    setting variables for Windows services 127
`p4 triggers`
    form 92
`p4 typemap` 48
`p4 verify` 47
    use of 31
`p4d`
    flags, listed 139
    security 22, 102
    specifying journal file 140
    specifying log file 140
    specifying port 140
    specifying server root 140
    specifying trace flags 140
`p4d.exe` 15
`P4DEBUG` 140
    and proxy server 133
`P4JOURNAL` 140
`P4LOG` 140
    and proxy server 133
P4P
    and remote development 66
    see Perforce Proxy 131, 132
`P4PCACHE` `132`, 133
`P4PORT`
    and client 13
    and proxy server 133
    and server 13, 140
    IP addresses and your server 55
    Perforce Proxy 132
`P4ROOT` 12, 140
    and depot files 64
`p4s.exe` 15
`P4TARGET` `132`, 133
passwords
    setting 19, 43
PDF files
    and `p4 typemap` 48
.pdf files 49
.pdm files 49
Perforce
    uninstalling 123
Perforce clients
    and `P4PORT` 13
Perforce file types 49
Perforce Proxy 66, 131
    backups 134
    diskspace usage 134
    installation 132
    options 133
    protections 135
    startup 132
    stopping 134
    troubleshooting 134
    tuning 136
Perforce server
    and `P4PORT` 13
    and triggers 94
    and Windows network drives 22
    installing under NFS 21, 108
    monitoring 58
    moving to another machine 61

running from `inetd` 55
UNIX `UPGRADE` 17
upgrading 16
upgrading under Windows 18
verifying 47
vs. service 15
Perforce service
vs. server 15
`perforce.exe` 14
performance
and memory 107
and scripts 116
and wildcards under Windows 111
CPU 109
monitoring 58
network 109, 131
preventing server swamp 112
slow, diagnosing 110
performance tuning
and Perforce Proxy 136
permissions
see protections 74
port
for client 13
for server 13
specifying 140
ports
running out of TCP/IP 109
.ppt files 49
privileges
administrator 125
protections 71–78
algorithm for applying 77
and commands 78
and groups 76
and Perforce Proxy 135
and performance 113
and superusers 71
commands affected by 78
default 74
exclusionary 75
multiple 74
schemes for defining 73
securing remote depots 69
protections table 71
proxy 131
and remote development 66
python 103

R

RAM
and performance 107
`read` access level 72
recovery
procedures 33
remote depots 64
and virtual users 69
defining 68
securing 69
resetting passwords 43
`review` access level 73
review daemon 103
revision range
and `obliterate` 46
rich text
and `p4 typemap` 48
`root`
must not run `p4d` 22, 102

S

`save`
trigger type 98
scripting
buffering standard in/output 106
guidelines for efficient 116
with `-i` 43
scripting Perforce ??–104
secure shell 53
security
and passwords 19
`p4d` must have minimal privileges 22, 102
preventing user impersonation 19
restrict remote access 69
server
and triggers 94
backing up 31
license file 18
licensing 18

migrating 61
monitoring 58
port 13
proxy 131
recovery 33
root, specifying 140
running from `inetd` 55
running in background 139
running single-threaded 139
specifying journal file 140
specifying log file 140
specifying port 140
stopping on Windows 124
stopping with `p4 admin` 14, 34, 35
trace flags 60
upgrading 16
verifying 47
vs. service 15
Windows 15
server flags
listed 139
server root
and depots 64
and `P4ROOT` 12
creating 12
defined 12
specifying 140
server upgrade
UNIX 17
Windows 18
setting passwords 19, 43
single-threaded 139
specification triggers 93, 98, 99, 100
specifications
triggers 98
`ssh` 53
standard input/output
buffering 106
stopping server
on Windows 124
with `p4 admin` 14, 34, 35
subgroups
and groups 76
`super` access level 39, 73
superuser
and triggers 92
force flag 50
Perforce, defining 19
superusers
and protections 71
`svcinst.exe` 125
symbolic links
and disk space 20

T

TCP/IP
and port number 13
running out of ports 109
technical support
when to call 27
template
job, default 81
trace flags
specifying 140
triggers 91, 91–??
and Windows 102
content 95, 97
fields 93
firing order 101
form 92
input 100
multiple 101
naming 93
on changelists 95
output 99
passing arguments to 94
portability 102
save 98
script, specifying arguments to 94
security and `p4d` 22, 102
specification triggers 98
submit`submit`
trigger type 95
types of 93
warnings 99
troubleshooting

Perforce Proxy 134, 135
slow response times 110
type mapping 48
U
`umask(1)` 12
unicode 140
uninstalling Perforce 123
UNIX
`/etc/hosts` file 111
and case-sensitivity 57
upgrading a server 17
upgrading
server 16
users
access control by groups 76
and protections 72
creating 43
deleting 45
files, limiting access to 75
nonexistent 45
preventing creation of 43
preventing impersonation of 19
resetting passwords 43
virtual, and remote depots 69
V
variables
in trigger scripts 94
setting for a Windows service 127
verifying server integrity 47
version information
and Perforce Proxy 133
clients and servers 19
versioned files 61
defined 25
format and location of 30
introduced 25
where stored 25
view
scope of, and performance 112
W
warnings
and job specifications 87
database changes on upgrade 16, 17
disk space and Perforce Proxy 134
disk space and upgrade 16
obliterating files 46
recursive triggers 99
security 69
security and `p4d` 22, 102
wildcards
and protections 72
and Windows performance 111
Windows
and case-sensitivity 23, 57
and `p4 admin` 16
and server upgrade 18
`hosts` file 111
installer 14
installing on 14
installing on network drive 22, 125
server 15
service, setting variables in 127
stopping server 124
triggers and network drives 102
Wordpad
limitation 129
`write` access level 73
X
.xls files 49
Z
.zip files 49