Distributed Systems Administration Utilities User's Guide

HP Part Number: T2786-90327
Published: March 2009
Edition: 1.5

Table of Contents

List of Figures

List of Tables

About this Document

Distributed Systems Administration Utilities provide tools to simplify the management of groups of systems and of Serviceguard clusters. This document provides information on each component tool in separate chapters.

Intended Audience

This document is written for system administrators to assist them in learning about Distributed Systems Administration Utilities and how to use them.

Typographic Conventions

Table 1 Conventions

Book Title	Title of a book or other document.
`command`	Command name or qualified command phrase.
`user input`	Commands and other text that you type.
`computer output`	Text displayed by the computer.
Enter	The name of a keyboard key. Note that **Return** and **Enter** both refer to the same key. A sequence such as **Ctrl+A** indicates that you must hold down the key labeled **Ctrl** while pressing the **A** key.
`variable`	The name of an environment variable, for example `PATH` or `errno`.
value	A value that you replace in a command or function, or information in a display that represents several possible values.
find(1)	Manual page (manpage). In this example, “find” is the manpage name and “1” is the manpage section.

Related Information

The following documents will also be useful in extending your knowledge of Distributed Systems Administration Utilities (DSAU).

- DSAU manpages
- DSAU GUI online help
- DSAU Release Notes

Publishing History

Table 2 DSAU Publishing History

Manufacturing Part Number	DSAU Version	Document Edition	Publication Date
T2786-90327	2.4	1.5	March 2009
T2786-90291	2.2	1.4	September 2008
T2786-90265	2.0	1.3	March 2008
T2786-90137	1.5	1.2	September 2007
T2786-90090	1.2/1.3	1.1	February 2007
T2786-90003	1.2/1.3	1.0	September 2006

For specific versions of HP-UX , Serviceguard, and open source components, see the *Distributed Systems Administration Utilities V2.4 Release Notes for HP-UX 11i v3 March 2009* available on the HP Technical Documentation web site at http://www.docs.hp.com.

Product Support

For product support, contact your HP Support Representative, your HP Services Representative, or your authorized HP reseller. For more information about support services, see the HP Support web site at http://www.hp.com/go/support.

HP Encourages Your Comments

HP encourages your comments concerning this document. We are truly committed to providing documentation that meets your needs. Please submit comments to:

`http://docs.hp.com/assistance/feedback.html`

Please include the following information:

- Document title (*Distributed Systems Administration Utilities User's Guide*)
- Manufacturing part number (T2786-90327)
- Any comment, error found, or suggestion for improvement you have concerning this document.

1 Introduction

The Distributed Systems Administration Utilities provide several tools for simplifying the management of groups of systems and of Serviceguard clusters.

There are three utilities:

- Configuration Synchronization: - with this utility, based on the open source tool cfengine or "configuration engine," the administrator can centrally define management actions to be applied to a set of managed systems. cfengine is a client/server based tool. The central configuration master system hosts the configuration description file that defines the management actions to be performed on each managed client. The configuration master also hosts the "golden image" files, which are master copies of files that are distributed to the clients. The administrator can use cfengine to perform tasks such as:
  - Ensure that client systems are using a correct set of configuration files
  - Disable inappropriately configured files on the client
  - Check file permissions, ownership, and track checksum changes
  - Perform edits to files
  - Execute arbitrary shell commands on each client
  - Check for processes, signal processes

    A Configuration Synchronization Wizard is available to help the administrator quickly configure cfengine for managing a set of distributed systems or configuring it as a highly available service in a Serviceguard cluster. This wizard is described in Chapter 2: "Configuration Synchronization" (page 13). For additional information, see the cfengine and `csync_wizard` manpages.

- Consolidated Logging: standard UNIX `syslogd` offers UDP-based log forwarding to a central log consolidator today. The DSAU utilities provide the open source tool `syslog-ng` or "syslog next-generation." `syslog-ng` offers additional features that make it a powerful tool for log forwarding, log centralization and log consolidation.

  The Configuration Synchronization Wizard helps to configure `syslog-ng` on a log consolidation server and log forwarding clients. Centralized log consolidation offers the following benefits:
  - Easier log file analysis

    A centralized log provides a single location for the administrator to perform log file analysis. It offers a single view of events that impact multiple systems.

    The DSAU utilities are specifically designed to optimize this method for managing a Serviceguard cluster. Member syslogs and package logs can be centralized for simpler log file access and analysis. DSAU utilities also allow the cluster to offer a highly available consolidated logging service.
  - Increased security

    A security breach might compromise the local logs but not the centralized copy.
  - Simplified archiving of logs

    It is usually simpler to archive a set of centralized logs rather than per-system logs.

    This wizard is described in Chapter 3: "Consolidated Logging" (page 41). For additional information, refer to the `clog_wizard` and `syslog-ng` manpages.

- Command fanout is based on the open source tool Parallel Distributed Shell (`pdsh`). `pdsh` enables the administrator to execute shell commands in parallel across a set of systems. It can use `remsh` or `ssh` as the network transports. The `csshsetup` tool is provided to simplify the distribution of `ssh` keys. The companion utility Parallel Distributed Copy (`pdcp`) enables file and directory copies to be performed in parallel to a set of remote systems. The `dshbak` filter allows the output from multiple systems to be formatted and consolidated for better on-screen presentation.

The `cexec, ccp, ckill, cps,` and `cuptime` tools are wrappers around the `pdsh` and `pdcp` commands optimized for use in a Serviceguard cluster. They default to executing commands cluster-wide. These wrappers do the following:

— `cexec` - Like `pdsh` but with additional reporting and retry features
— `ccp` - Copies files cluster-wide
— `ckill` - Kills the named process cluster-wide or on the specified systems
— `cps` - Issues a `ps` command cluster-wide or on the specified systems
— `cuptime` - Runs the `uptime` command cluster-wide

These commands can also be used outside a cluster, but like `pdsh` and `pdcp`, the user must specify a list of target hosts. The `cexec` command operates like `pdsh` and adds reporting capabilities. Saved reports can be used to reissue previous commands and target only those systems where the command originally failed, originally succeeded, or both. Command fanout is more fully described in Chapter 4: “Command Fanout” (page 83).

IMPORTANT: On HP-UX 11i v3 Integrity systems, `pdsh` requires an additional software, LibcExt, to make use of the functions that are not shipped with the standard Library Routines, `libc` in HP-UX 11i v3. LibcExt contains `setegid`() and `seteuid`() POSIX APIs, which the `pdsh` tool requires to function properly.

LibcExt forms part of the Portability Package (Product # PortPkg) depot. You can download Portability Package from the HP Software Depot web site at www.software.hp.com

The next section describes the commands provided with each DSAU component.

1.1 Distributed Systems Administration Utilities Commands

Table 1-1 Configuration Synchronization Command

Command	What it Does	When to Use it
`csync_wizard`	Helps set up the cfengine environment.	When setting up the configuration master.

Table 1-2 Consolidated Logging Commands

Command	What it Does	When to Use it
`clog`	Displays log files.	To examine log files.
`clog_wizard`	Helps set up log consolidation servers and clients.	When setting up log consolidation.

Table 1-3 Command Fanout Commands

Command	What it Does	When to Use it
`ccp`	Copies files to multiple hosts in parallel. In a Serviceguard cluster, copies files cluster-wide.	To perform on-demand synchronization of files across a set of systems or a Serviceguard cluster.
`cexec`	Issues commands to multiple hosts in parallel. In a Serviceguard cluster, issues command cluster-wide.	To execute a non-interactive shell command across a set of systems or cluster. To consolidate identical output, pipe the output to `dshbak -c`.
`ckill`	Distributes a `kill` command to multiple hosts in parallel. In a Serviceguard cluster, issues command cluster-wide by default.	To send a signal to a named process across multiple systems or a cluster.

Table 1-3 Command Fanout Commands *(continued)*

Command	What it Does	When to Use it
`cps`	Distributes a `ps(1)` command to multiple hosts in parallel. In a Serviceguard cluster, issues command cluster-wide by default.	To collect process information from groups of systems simultaneously.
`cuptime`	Reports `uptime(1)` information for multiple systems. In a Serviceguard cluster, issues command cluster-wide by default.	To check uptime, users, and load averages.
`cwall`	Displays a `wall(1M)` broadcast message on multiple hosts. In a Serviceguard cluster, issues command cluster-wide by default.	To broadcast a message to all logged-in users across a group of systems.

Table 1-4 Utility Setup Command

Command	What it Does	When to Use it
`csshsetup`	For the current user, performs a secure shell (`ssh`) public key distribution to multiple systems.	To greatly simplify `ssh` key distribution. `pdsh` and the command fanout (cexec-related) commands all rely on a proper `ssh` key distribution. The `csync_wizard` requires `ssh` access to managed clients. For example, in a Serviceguard cluster, this allows `ssh` access from any member to any other member, so `pdsh` and `cexec` can be used from any cluster member.

1.2 Open Source Components

The open source components and their commands are described in the following table. These open source components used by DSAU are based on the high level cfengine language. For additional information on cfengine, see the cfengine manpage; for the individual commands, see their respective manpages and open source documentation at `/opt/dsau/doc`. For supported open source options, refer Appendix A (page 87) HP-Supported Open Source pdsh Options.

Table 1-5 Open Source cfengine Commands

Command	What it Does
`cfagent`	System configuration agent that performs the configuration actions defined in a configuration policy file.
`cfexecd`	A scheduling and report service. This is an optional component.
`cfkey`	Security key generation tool. `cfkey` is run once on every host to create a public/private key pair.
`cfrun`	Tool to activate a remote `cfagent`.
`cfservd`	A file server and remote activation service.

Table 1-6 Open Source pdsh Commands

Command	What it Does
`dshbak`	Formats output from `pdsh` commands; consolidates identical output from multiple hosts.
`pdcp`	Tool to make file and directory copies in parallel to a set of remote systems.
`pdsh`	Tool to execute shell commands in parallel across a set of systems.

Table 1-7 Open Source syslog-ng Command

Command	What it Does
`syslog-ng`	Tool that performs consolidated logging.

1.3 Distributed Systems Administration Utilities Manual Pages

In addition to the open source manual pages (`man` pages) for DSAU's open source components, DSAU also provides the following manual pages:

Table 1-8 DSAU Manual Page Sections

Manpage	Section
`ccp`	1
`cexec`	1
`ckill`	1
`clog`	
`clog_wizard`	1m
`cps`	1
`csshsetup`	1
`csync_wizard`	1m
`cuptime`	1
`cwall`	1m

2 Configuration Synchronization

Managing the configuration and configuration drift of a set of distributed systems is a constant challenge for system administrators. There are a variety of tools available to help manage various aspects of multi-system configuration management. For example, for account management, standard solutions include the Network Information System (NIS) and Lightweight Directory Access Protocol (LDAP). For file level synchronization, tools like `rdist` (see the *rdist*(1) manpage) and `rsync` are available. HP Systems Insight Manager helps to discover, monitor and manage groups of systems.

A new tool in this toolkit is Configuration Engine (cfengine). cfengine is a popular open source tool for configuration synchronization. It allows policy-based or goal-based configuration management that allows the administrator to define the management actions to be applied to groups of systems so those systems reach a desired state.

cfengine is a client/server based tool. A central configuration master system or policy server hosts a configuration policy file which defines the management actions to be performed on each managed client. The configuration master also hosts the "golden image" files, or reference copies of files that should be distributed to the clients. The administrator can use cfengine to perform tasks such as:

- Ensure that client systems are using a correct set of configuration files by copying over reference files or directories.
- Disable inappropriately configured files on the client.
- Check file permissions, ownership, and track checksum changes.
- Edit files.
- Execute specified shell commands on each client.
- Check for processes or signal processes.
- Check for specific filesystem mounts.

A Configuration Synchronization Wizard (`csync_wizard`) is available to help the administrator quickly configure cfengine for managing a set of distributed systems or configuring it as a highly available service in a Serviceguard cluster.

2.1 cfengine Overview

The administrator starts by defining a central system or Serviceguard cluster to act as the master configuration server or policy server. The Configuration Synchronization Wizard (`csync_wizard`) is a user-friendly front-end to the initial configuration process. This central system will house the master policy files (for example, `cfagent.conf`) which define the desired configuration policies, and also reference copies or master copies of files that should be distributed to the managed clients.

Each managed client copies down the master copies of the policy files from the central configuration server and evaluates its current state versus the desired state defined by the policy file. Any differences cause configurations rules to run in order to resynchronize the client. The administrator can initiate synchronization operations on the managed clients in two ways, using either a push or a pull operation.

- Using the `cfrun` command (see the *cfrun*(1) manpage for more information) from the master configuration server, the administrator can push changes. `cfrun` reads the file `cfrun.hosts` to determine the list of managed clients. It then invokes the `cfagent` command on each managed client to perform a synchronization run. Thus, push operations are really requests to the managed clients to perform an immediate pull.
- Pull operations are performed using cron or cfengine's own cron-like `cfexecd` daemon. Either technique invokes the `cfagent` command at fixed intervals in order to perform client-initiated configuration synchronization. The administrator defines what interval is

appropriate for each group of managed clients. For example, every five minutes, once an hour, or once a day. The administrator can also invoke `cfagent` directly for on-demand synchronization runs.

2.1.1 cfengine Daemons and Commands

cfengine employs several daemons and commands to perform configuration synchronization operations. The following list describes the primary cfengine components.

- `cfagent` -- the `cfagent` command is cfengine's workhorse. It runs on each managed client, and bootstraps itself using the file `update.conf`, which describes the set of files to transfer from the master server to the local managed client. The files transferred include the main policy file, `cfagent.conf`, and any related policy files. In the DSAU implementation, `cfagent.conf` imports the file `cf.main` which has examples of many cfengine features.

  After the configuration files are transferred, `cfagent` evaluates the configuration instructions in these files. If the client system's current configuration deviates from the desired configuration, `cfagent` executes the defined actions to return the client to the proper state.

- `cfservd` -- `cfservd` daemon has two roles:
  - `cfservd` runs on the master configuration server and is the clearinghouse for file transfer requests from the managed clients. `cfagent` on the managed clients contacts the master server's `cfservd` and requests copies of the master policy files and copies of any reference files that are needed as part of the defined configuration synchronization operations. The master `cfservd` is responsible for authenticating remote clients using a public/private key exchange mechanism and optionally encrypting the files that are transferred to the managed clients.
  - `cfservd` can optionally run on each managed client in order to process cfrun requests. cfrun allows the administrator to push changes to the managed clients instead of waiting for the clients to synchronize using some client-defined time interval. The `cfrun` command must be initiated from the master configuration server. It contacts each managed client listed in the `cfrun.hosts`files and connects to the managed client's cfservd asking it to invoke `cfagent` to perform the synchronization work.

    `cfservd` is configured using `cfservd.conf` and started using `/sbin/init.d/cfservd`.

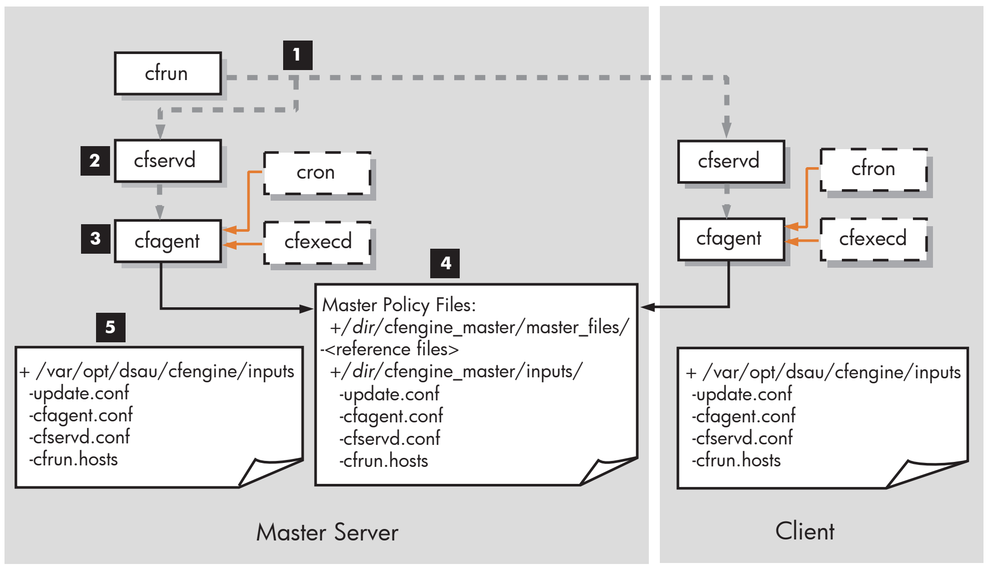
- `cfexecd` -- `cfexecd` is a scheduling and reporting tool. If the administrator uses cron to perform synchronization runs at fixed intervals, cfexecd is the command placed in the `crontab` file to wrap the invocation of `cfagent`. It stores the output of the `cfagent` run in the outputs directory (see `cfagent.conf` for details) and optionally sends email.

  `cfexecd` has it's own cron-like features based on cfengine's time classes. The administrator can choose to run `cfexecd` in daemon mode and use it to invoke `cfagent` at defined intervals instead of `cron`. The default is to invoke cfagent every hour. HP recommends adding an entry for `cfexecd` in the `crontab` file for the initial configuration.

- `cfrun` -- the `cfrun` command contacts the managed clients asking each to perform an immediate synchronization run. Specifically, it connects to the optional `cfservd` on each managed client which in turn launches `cfagent`.

Figure 2-1: "cfengine Overview" illustrates the relationship of the cfengine commands and daemons, and shows an example of the administrator using `cfrun`. The dashed lines in the diagram indicate calling sequences (for example, A calls B). Solid lines indicate that data is being read from configuration files.

Figure 2-1 cfengine Overview



1. The administrator is logged into the master configuration synchronization server and makes a change to be propagated out to the managed clients, using the `cfrun` command. `cfrun` checks the file `cfrun.hosts` for the list of managed clients. Note that the master server can be a client of itself. In this diagram, there are two clients, the master server and a remote client.
2. `cfrun` contacts `cfservd` on each managed client, which in turn invokes `cfagent`.
3. `cfagent` first checks the master server for an updated copy of the`update.conf` file and transfers it to the client if needed.
4. If a standalone system is the master server, by default the master copy of `update.conf` is located in `/var/opt/dsau/cfengine_master/inputs/`. The master copies of other configuration files such as `cfagent.conf`, `cfservd.conf`, `cf.main`, and `cfrun.hosts` are also located here. If the master server is a Serviceguard cluster, the master configuration files are located in the mount point associated with the package. For example, if this mount point is named `csync`, the path would be `/csync/dsau/cfengine_master/inputs`.
5. When copying the configuration files to the local system, `cfagent` places them in `/var/opt/dsau/cfengine/inputs` for both standalone systems and clusters. `cfagent` first evaluates the contents of `update.conf` in order to update any changed cfengine binaries (if any) and gets the latest version of the policy files (`cfagent.conf` and related files).

   `cfagent` then evaluates `cfagent.conf` to determine if the client is in the desired state. If there are deltas, `cfagent` performs the defined actions to correct the client's configuration.

2.2 cfengine Master Server Deployment Models

The cfengine master server can be a standalone HP-UX system servicing groups of distributed clients. The clients can themselves be standalone systems or members of a Serviceguard cluster. If you are already using a Systems Insight Manager central management server, this can be an ideal system to use as a cfengine master server. Master servers can also act as clients and the configuration synchronization tasks can be performed on these systems as well as the remote clients.

If you are managing Serviceguard clusters, cfengine can be deployed strictly for intra-cluster use to synchronize the members of a single cluster. In this configuration, `cfservd` is configured as a package for high availability but the only cfengine clients are the cluster members themselves. The package's DNS name/IP address is the name for the cfengine master server.

In addition to providing configuration synchronization as an intra-cluster service, another Serviceguard configuration has the cluster providing the highly available configuration synchronization service to groups of remote client systems. Those clients can be standalone systems or Serviceguard clusters. The cluster providing the cfengine service can be a client of itself and also take advantage of cfengine's configuration synchronization features. A possible but somewhat unusual configuration is to have a fixed member of a Serviceguard cluster act as the master server but no package is configured so `cfservd` will not be highly available. This configuration is valid but not recommended.

2.3 Configuring cfengine

The following sections provide detailed instructions for setting up a configuration synchronization master server and its clients. The quickest way to get started is to use the Configuration Synchronization Wizard (`csync_wizard`), described in the next section. Completely manual configurations are also described.

Configuring Synchronization Master (csync master) Server in Cross-Subnet Cluster Environments

In a cluster environment, if all the nodes are within the same subnet, then you can configure a server within that cluster environment as the csync master server.

However, in a cross-subnet cluster environment, the csync master server must be an external system, preferably a quorum server, outside the cross-subnet cluster. A cross-subnet cluster can be configured only as client, with an external system acting as the cfengine master. After you configure an external system as the csync master, you can configure the cross-subnet cluster nodes as `cfengine` managed clients.

2.3.1 Using the Configuration Synchronization Wizard

The `csync_wizard` (see *csync_wizard*(1)) automates the task of setting a configuration synchronization master server and its managed clients. It supports setting up a standalone system or a Serviceguard cluster as the master server. The wizard configures all managed clients to run a `cfservd` so that `cfrun` (see *cfrun*(8)) can be used on the master server.

When you run the `csync_wizard` on a cross-subnet cluster, the system displays a message indicating that the csync master must be an external system outside the cross-subnet cluster. Depending on whether the csync master is already configured, one of the following is possible:

- If the csync master is already configured outside the cross-subnet cluster, the system displays the hostname or the IP address of the csync master.
- If the csync master is not configured outside the cross-subnet cluster, then you must configure an external system, preferably a quorum server, as the csync master server and later proceed to run the `csync_wizard` on the cross-subnet cluster.

With the `csync_wizard,` you perform the following tasks:

- Set up a master server
- Add a client
- Remove a client
- Manage keys for cfengine clients
- Display the current configuration

See the appropriate sections below for details. Table 2-1 lists the information you will need to gather before running the `csync_wizard` to set up the master server.

When running the wizard on a Serviceguard cluster, the default is to set up cfengine as a highly available service (Serviceguard package). The administrator must provision the storage environment for the package and the required package IP address and DNS name registration. The wizard supports LVM storage configurations. Non-LVM configurations must be completed manually. The package information that the wizard requires is given in Table 2-1.

Table 2-1 Configuration Data for csync_wizard

Configuration Data	Example	Your Value
LVM volume group	`/dev/vgcsync`	
Logical volume	`/dev/vcgsync/lvol1`	
Filesystem mount point	`/csync`	
Mount options	`-o rw, largefiles`	
Filesystem type	`vxfs`	
Package IP Address (a registered DNS name)	`192.10.25.12`	
Package subnet	`192.10.25.0`	

NOTE: If you have used the wizard previously to configure a cfengine master server and rerun it to reconfigure the master server, stop the currently running configuration first. For example, use the following command to stop the running cfservd: `/sbin/init.d/cfservd stop`

If you have `cfagent` in `cron` or are using `cfexed`, disable them so they do not run while the wizard reconfigures the system.

Configuring a single node in a Serviceguard cluster as a master server is not a highly available configuration and is not recommended. The default configuration to create for a cluster is to create a package for cfengine's `cfservd`. (To rerun the wizard in a Serviceguard cluster and change your configuration from one that is highly available to one that is not, halt the existing `csync` package (use `cmhaltpkg`) and delete it before running the wizard.)

2.3.1.1 Using the Wizard to Configure a Standalone Synchronization Server

To configure a synchronization server for a *standalone system*, run the csync_wizard(1) on the standalone system you wish to configure as the master synchronization server:

```
# /opt/dsau/sbin/csync_wizard
```

The wizard displays the following introductory screen:

```
Querying the system local_hostname for current status, one moment...

This Configuration Synchronization Wizard (csync_wizard) helps you set
up the Configuration Engine (cfengine) environment. Cfengine is a powerful
tool for performing policy-based management for groups of systems and
cluster environments.

csync_wizard is a client/server based utility. With csync_wizard, the
user can configure a standalone system or Serviceguard cluster as the
cfengine "master". The master contains the configuration description and
configuration files that will be used by all the clients. Clients copy the
configuration description from the master and apply it to themselves.
The configuration description supports a rich set of management actions
such as copying configuration files from the master to the client,
performing edits to files, checking file ownerships, permissions, and
checksums, executing shell commands, checking for processes, etc.

For a detailed description of the cfengine management actions,
please refer to the cfengine man page.

The csync wizard helps you set up this system as a cfengine master,
add or remove cfengine-managed clients, and perform the required
security setup.

Press "Enter" to continue...
```

Press Enter to continue; choose item 1 from the menu below to configure a master server:

```
 Configuration Synchronization Wizard Menu
 =========================================

 (1) Set up a cfengine master server

 (2) Add a client

 (3) Remove a client

 (4) Manage keys for cfengine clients

 (5) Display current configuration

(9) Exit

Enter choice: 1

The cfengine master server is being configured on:
```

local_hostname

The wizard then asks if you would like to additionally configure managed clients immediately after configuring the server. For this example, answer no. Managed clients will be added later.

```
You can optionally specify additional remote clients to manage at this
time. If you are running in an HA environment, you do not need to specify the
cluster members.

Would you like to manage clients? [N]: n
```

The wizard proceeds to configure the system as a master server:

```
******* WARNING!!!! ********

To protect against possible corruption of sensitive configuration files,
control-c has been disabled for the remainder of this configuration.

Configuration of the cfengine master server is starting.

Configuration files have been saved at

        /var/opt/dsau/cfengine/backups
cfengine keys are being created...

cfengine keys have been created, now distributing....

Verifying that the master has an entry in the /etc/hosts file
on each client...

Starting cfengine on the master server and any managed clients. This may
take a few minutes....
```

When the configuration is completed, the wizard displays the following summary screens which direct the administrator to the main policy file, `/var/opt/dsau/cfengine_master/inputs/cf.main`, and the recorded answer file for this run of the wizard.

```
The Configuration Synchronization Wizard has completed the
configuration of cfengine:

      - The master configuration description template is here:

            </csync/dsau/cfengine_master/inputs/cf.main>

        This default template has examples of typical configuration
        synchronization actions performed in a cluster. For example,
        synchronizing critical files such as /etc/hosts, package
        scripts, etc.

        All the actions in the template are disabled by default
        (commented out). Uncomment the lines corresponding to the desired
        synchronization actions for the cluster. See the cfengine
        reference documentation for a description of additional cfengine
        features: /opt/dsau/doc/cfengine/

Press "Enter" to continue...

The cfengine environment consists of:
Master server (policy host):
       local_hostname
Managed clients:
```

Note that when configuring a master server but not adding any managed clients during the server configuration, the members entry (list of managed clients), is empty, as shown in the above example.

```
A file containing the answers for this run of the Configuration
Synchronization Wizard is stored here...

        /var/opt/dsau/cfengine/tmpdir/csync_wizard_input.txt

This configuration can be reestablished by issuing the following command:

        /opt/dsau/sbin/csync_wizard \
                -f /var/opt/dsau/cfengine/tmpdir/csync_wizard_input.txt
```

2.3.1.2 Using the Wizard to Configure a Serviceguard Cluster Synchronization Server

To configure a synchronization server for a Serviceguard cluster, there are two configuration choices:

- Create a Serviceguard package for the configuration service to ensure high availability.
- Configure a single member of the cluster as if it is a standalone system. The configuration synchronization service will not be highly available, and this configuration will also not work properly with the Serviceguard automation features discussed in "Serviceguard Automation Features" (page 23) and is not recommended.

This section focuses on using the wizard to configure a highly available configuration synchronization service.

NOTE: Before starting the wizard, all the current cluster members should be up and running in the cluster. Make sure that this cluster's MAX_CONFIGURED_PACKAGES value can accommodate the additional package. For more information on this setting, refer to the *Managing Serviceguard* manual that is part of the Serviceguard documentation set.

Start by running the Configuration Synchronization Wizard, *csync_wizard*(1) by issuing the following command:

```
# /opt/dsau/sbin/csync_wizard

Querying the system local_hostname for current status, one moment...

This Configuration Synchronization Wizard (csync_wizard) helps you set
up the Configuration Engine (cfengine) environment. Cfengine is a powerful
tool used to perform policy-based management for groups of systems and
cluster environments.

csync_wizard is a client/server based utility. With csync_wizard, the
user can configure a standalone system or Serviceguard cluster as the
```

```
cfengine "master". The master contains the configuration description and
configuration files that will be used by all the clients. Clients copy the
configuration description from the master and apply it to themselves.
The configuration description supports a rich set of management actions
such as copying configuration files from the master to the client,
performing edits to files, checking file ownerships, permissions, and
checksums, executing shell commands, checking for processes, etc.

For a detailed description of the cfengine management actions,
please refer to the cfengine man page.

The csync_wizard helps you set up this system as a cfengine master,
add or remove cfengine-managed clients, and perform the required
security setup.
Press "Enter" to continue...
```

Press Enter to continue and choose item 1 from the menu below to configure a master server:

```
 Configuration Synchronization Wizard Menu
=========================================

(1) Set up a cfengine master server

(2) Add a client

(3) Remove a client

(4) Manage keys for cfengine clients

(5) Display current configuration

(9) Exit

Enter choice: 1
```

After you choose 1 and press Enter, the wizard displays the following text:

```
This system is a member of a Serviceguard cluster. The cfengine
configuration will be defined as a package for high availability
unless you answer no to the question below. If you answer no, for the
purposes of cfengine control, this machine will be treated as a single
machine without failover capability for cfengine.

If you accept the default answer of 'HA' to the question below,
cfengine will be configured as a highly available Serviceguard package.
This ensures that your cfengine master server is available as long
as one of the cluster members that can run the package is also available.

You will need a free IP address for this package and you must
configure storage for the package before proceeding. For details
on creating highly available file systems, please refer to the
Managing Serviceguard manual.

Will this master server be Highly Available (HA) [Y]:
```

The wizard names the package name "csync" for configuration synchronization. This specific package name is required. The LVM storage configuration and network configuration for the package must be set up before continuing or before running the wizard. All the cluster members should also be up and available. For details, refer to the *Managing Serviceguard* manual, under "Building an HA Cluster Configuration", "Creating a Storage Infrastructure with LVM."

NOTE: The wizard only supports creating packages based on LVM volume groups. When using CFS or VxVM, manual configuration is required. See the section on "Manually Configuring a Serviceguard Cluster Synchronization Server" (page 29) for details on manually configuring the `csync` package.

The wizard prompts for the following, all of which should have already been configured:

- LVM volume group name (for example, `/dev/vgcsync`)
- Logical volume in the volume group; must be the full path name of the logical volume (for example, `/dev/vgcsync/lvol1`)
- The filesystem mount point (for example, `/csync`)
- The filesystem mount options (for example, `-o rw,largefiles`). The mount options are used verbatim in the Service package control script's FS_MOUNT_OPT[0] field. Note that the mount options must agree with the filesystem you created on the logical volume. For example, if the filesystem was created with largefiles support, the largefiles mount option should be specified.
- The filesystem type (for example, vxfs)
- The package IP address. This should also be a registered DNS name so the configuration synchronization is easy to configure on client systems.
- The package subnet. (Use `netstat -i` to determine the correct subnet.)

Once the storage infrastructure is configured and the IP address obtained, press return to access the default answer of 'yes' and proceed with creating the package. The wizard now prompts for the package information:

```
Configuring the csync Serviceguard package for a
highly available cfengine master.

The cfengine master server is being configured as a
HA Serviceguard Package on this cluster.

Please provide the following information for the package:

Enter the Volume group [/dev/vgcsync]:

Enter the Logical Volume [/dev/vgcsync/lvol1]:

Enter the Filesystem (Mount Point) [/csync]:

Enter the Mount Options [-o rw, largefiles]:

Enter the Filesystem Type [vxfs]:

Enter the IP address [192.10.25.12]:

Enter the Subnet [192.10.25.0]:
```

The wizard now asks if you would like to manage additional remote clients, that is, systems outside the cluster. The wizard automatically configures the current members of the cluster. This is why all members must be up and accessible when running the wizard. In the example shown below, the administrator chose 'no' so only cluster members are configured as clients initially.

Additional remote clients can easily be added later using the wizard. When adding members to the cluster, it is not necessary to run the wizard to specify the new members as new client systems. They are automatically configured to participate in the current cfengine configuration. Refer to "Serviceguard Automation Features" (page 23) for details.

```
You can optionally specify additional remote clients to manage at this
time. If you are running in an HA environment, you do not need to
specify the cluster members.
```

```
Would you like to manage clients? [N]:
```

The wizard now has all the data it needs to configure the cluster and proceeds to do so:

```
******* WARNING!!!! ********

To protect against possible corruption of sensitive configuration files,
control-c has been disabled for the remainder of this configuration.

Configuring the "csync" Serviceguard package.

Applying the "csync" Serviceguard package configuration file.
This will take a moment.

Starting the "csync" Serviceguard package. This will take a few moments...

The "csync" Serviceguard package has been started on local_hostname.

Configuration of the cfengine master server is starting.

Configuration files have been saved at:
        /var/opt/dsau/cfengine/backups

cfengine keys are being created...

cfengine keys have been created, now distributing....

Verifying that the master has an entry in the /etc/hosts file
on each client...

Starting cfengine on the master server and any managed clients.
This may take a few minutes....
```

When the configuration is done, the wizard displays the following summary screens which direct the administrator to the main policy file, `/mount_point/cfengine_master/inputs/cf.main`, and the recorded answer file for this run of the wizard. The policy file is located on the newly configured filesystem associated with the package. In our example, the administrator chose to mount the filesystem for the package as `/csync`.

If the administrator had previously configured cfengine, before overwriting any existing configuration files, the wizard creates backups in the directory:

`/var/opt/dsau/cfengine/backups`

The top level files in this directory are the most recent backup files. Any configurations before that are saved in timestamped subdirectories named `v_timestamp`.

```
The Configuration Synchronization Wizard has completed the
configuration of cfengine:

 - The master configuration description template is here:

        </csync/dsau/cfengine_master/inputs/cf.main>

        This default template has examples of typical configuration
        synchronization actions performed in a cluster. For example,
        synchronizing critical files such as /etc/hosts, package
        scripts, etc.

        All the actions in the template are disabled by default
        (commented out).
        Uncomment the lines corresponding to the desired
        synchronization actions for this cluster. See the cfengine
        reference documentation for a description of additional cfengine
        features: /opt/dsau/doc/cfengine/
```

```
Press "Enter" to continue...

The cfengine environment consists of:
Master server (policy host): package_hostname
Master clients:

cluster_member_1, cluster_member_2, ...

A file containing the answers for this run of the Configuration
Synchronization Wizard is stored here:

        /var/opt/dsau/cfengine/tmpdir/csync_wizard_input.txt

This configuration can be reestablished by issuing the following command:

        /opt/dsau/sbin/csync_wizard \
                -f /var/opt/dsau/cfengine/tmpdir/csync_wizard_input.txt
```

2.3.1.3 Cluster Configuration Notes for cfengine

This section describes the details of a high availability configuration of cfengine in a Serviceguard cluster. For more information on the role of the various cfengine daemons and commands, refer to "cfengine Daemons and Commands" (page 14). The Serviceguard package ensures that cfengine's `cfservd` daemon remains highly available. The cfengine configuration files `update.conf` and `cfagent.conf` define the master configuration synchronization server to be the registered DNS name for the relocatable IP address of the package. When managed clients run `cfagent` (see *cfagent*(8)), `cfagent` connects to `cfservd` on the package's adoptive node. Thus the cluster members themselves are all managed clients. The member hosting the package additionally acts as the master server for the policy files.

When booting the cluster, each member will start a client `cfservd`. This is the `cfservd` that responds to `cfrun` requests. When the package starts on a member, that `cfservd` now has access to the filesystem of the package and becomes the master `cfservd` that serves the policy files to all managed clients. This `cfservd` is monitored by the package. If `cfservd` fails, the package will attempt to restart on another member. That member's `cfservd` will then become the master `cfservd`.

Halting the package does not stop the `cfservd` daemon on the adoptive member since the expectation is that the daemon is present to respond to future `cfrun` requests. Also, unlike some other high availability services, if the `csync` package is down or unavailable, remote clients are not adversely impacted. The clients continue to run with their currently defined configurations. The administrator would need to make sure the package is up and running in order to distribute any new configuration instructions to the managed clients.

The wizard automates cfengine key distribution to all cluster members. For a detailed description of key distribution steps performed, refer to "Security Notes" (page 36).

2.3.1.4 Serviceguard Automation Features

The Distributed Systems Administration Utilities require Serviceguard 11.17 or later. With Serviceguard 11.17 or later, when members are added to or deleted from the cluster, the configuration synchronization tools automatically take the appropriate configuration actions. Specifically:

- When adding a member to the cluster, the new member is automatically configured to participate in configuration synchronization. The following configuration actions occur automatically on the added member:
    1. `/etc/rc.config.d/cfservd` is changed to set CSYNC_CONFIGURED to 1.
    2. The appropriate cfengine public/private keys are created for the new member and placed in the member's `/var/opt/dsau/cfengine/ppkeys` directory. The new keys

for this member are also distributed to the `/var/opt/dsau/cfengine/ppkeys` directories on the other cluster members.

3. The new member's `/var/opt/dsau/cfengine/inputs` directory is populated.
4. `cfservd` is started on the new member.
5. The package files are copied to `/etc/cmcluster/csync/` on the new member.
6. A `cfagent` synchronization run is performed on the master to populate the master's `/var/opt/dsau/cfengine/inputs` directory.
7. A `cfagent` synchronization run is performed on the newly added member.

If there are any errors when performing these automated actions, messages are posted to `syslog` on the master server. Use `cmviewcl -p csync` to determine which member is currently the master server. Alternatively, if the cluster is using consolidated logging, check for messages in the consolidated `syslog`.

- When deleting a member from a cluster, the public key of the deleted member is deleted from the `/var/opt/dsau/cfengine/ppkeys` directory cluster-wide.
- The administrator can define cfengine groups or classes that enumerate all the members of a particular Serviceguard cluster. These class definitions are not updated automatically and the administrator must manually update the `cfagent.conf` and related files for cluster membership changes.

NOTE: When adding members to a cluster, consider the following:

- When adding a member to a cluster that is configured as a highly available master server, the `csync` package must be running when the member is added. The add member processing task copies the configuration data from the package's mounted filesystem to the new member's `/var/opt/dsau/cfengine` directories. If the package is not running, the filesystem will not be accessible and the new member will not be properly configured. In that case, the administrator can manually configure the new member as follows:
  1. Make sure that the `csync` package is running. If not, start it.
  2. Log in to the member running the package.
  3. Execute the following command exactly as shown:
     `/opt/dsau/bin/csync_dispatcher MEMBER_ADDED:` *member_hostname*

     For example, if the new member's unqualified hostname is *newhost,* use the following command:

     `/opt/dsau/bin/csync_dispatcher MEMBER_ADDED:` *newhost*

- When adding a member to the cluster that is configured as a highly available master server, the cfengine security key of the new member is distributed cluster-wide. This enables the new member to operate as an adoptive node. If the `csync` package fails over to the new member, the new member will correctly handle `cfagent` requests from all managed clients.

  However, a `cfrun` executed from the new member will fail when contacting the managed clients. For `cfrun` to work properly, each managed client must have a copy of each cluster member's key. (This is unlike `cfagent` on the managed client which needs only the key that corresponds to the IP address of the `csync` package.)

  For the new member to issue `cfrun` requests, its key must be manually created on each managed client. There are two ways to distribute the key:

  — Use the `csync_wizard` "Manage keys for cfengine clients" function, which regenerates keys for all systems. All managed clients must be reachable for the regeneration to complete.

  — Copy existing member keys to the new member. This approach takes advantage of the fact that the new member's key is identical to the keys for the other cluster members. On the managed client, any of the existing cluster member's keys can be copied to the proper name for the newly added member.

  For example,

```
# cd /var/opt/dsau/cfengine/ppkeys
# cp root-existing_member_IP_address.pub \
     root-new_member_IP_address.pub
```

2.3.1.5 Using the Wizard to Configure a Synchronization Client

You can use the Configuration Synchronization Wizard to add managed clients to an existing cfengine configuration. Run the wizard on the master server, *not* the client system. When a Serviceguard cluster is the master server, run the wizard on the adoptive node for the `csync` package. When a Serviceguard cluster is configured as a highly available master server, adding new members to the cluster does not require using the wizard to configure those new members. They will be configured automatically. For more information, see "Serviceguard Automation Features" (page 23).

If the client is not a cluster member, to distribute cfengine keys securely, the client must be configured for non-interactive `ssh` access by the root account of the master server. The `csshsetup` tool (see *csshsetup(1)*) makes it easy to configure `ssh` access to a remote system. The `csshsetup` tool is used in the examples below.

A remote Serviceguard cluster can be configured as a managed client. However, each member must be configured individually. Repeat the configuration tasks described below for each member of the cluster.

Start by logging in as root on the master server and configure `ssh` access to the remote system:

```
# csshsetup hostname_of_managed_client
```

`csshsetup` first tests `ssh` access to the remote system. If it is not configured, `ssh` prompts for the managed client's password.

Run the Configuration Synchronization Wizard and choose option 2 to add a new client:

```
 Configuration Synchronization Wizard Menu
 =========================================

 (1) Set up a cfengine master server

 (2) Add a client

 (3) Remove a client

 (4) Manage keys for cfengine clients

 (5) Display current configuration

 (9) Exit

Enter choice: 2
```

When prompted, enter the name of the client to add:

```
This option will configure additional clients to the cfengine domain.

Enter the name of the client to add: new_client
```

The wizard then proceeds to configure the client and report on its progress:

```
Verifying that the master has an entry in the /etc/hosts file on each client...

cfengine keys are being created...

cfengine keys have been created, now distributing....

The client new_client has been added to the cfengine domain
```

The wizard configures each new client to run cfservd so it can respond to `cfrun` requests and adds the client to the master's `cfrun.hosts` file.

2.3.2 Manual Configuration

The following sections describe the steps required to configure cfengine master configuration synchronization servers or managed clients manually. Note that it is typically easier to start by using the `csync_wizard` (see *csync_wizard*(1m)) and then modifying the resulting configuration instead of starting from scratch. This is especially true in a Serviceguard cluster where the wizard helps set up the package and takes care of propagating the correct configuration files to all members of the cluster.

When performing manual configurations, it is possible to create configurations that cannot subsequently be managed by the `csync_wizard`. Here are two examples:

- The wizard requires that all managed clients have `ssh` configured so that cfengine's security keys can be initially distributed or subsequently changed.
- The wizard places all managed clients in the `cfrun.hosts` file. This list of managed clients is used to identify systems for operations such as regenerating cfengine's keys on all machines. `cfrun.hosts` is an optional cfengine configuration file used by the `cfrun` command. Manual configurations need not use this file but the wizard requires it.

NOTE: You can use `csshsetup` to configure a trust relationship between the master server and the managed clients. This will allow you to use command fanout commands such as `cexec` and `ccp` (see *cexec*(1) and *ccp*(1)). Using these commands can simplify the configuration steps described below when files need to be distributed to managed clients.

2.3.2.1 Manually Configuring a Standalone Synchronization Server

Perform the following one-time steps to configure a standalone system as a cfengine master server:

1. Start by creating the master copies of the cfengine configuration files. These files are placed in a well known directory and are distributed to each managed client. The default directory is `/var/opt/dsau/cfengine_master/inputs`, referenced in the default templates. Start by creating the directory:

   ```
   # mkdir -p /var/opt/dsau/cfengine_master/inputs
   ```

2. Copy the default template files to the following directories:

   ```
   # cd /var/opt/dsau/cfengine_master/inputs
   # cp /opt/dsau/share/cfengine/templates/cf.main.template cf.main
   # cp /opt/dsau/share/cfengine/templates/update.conf.template update.conf
   # cp /opt/dsau/share/cfengine/templates/cfagent.conf.template cfagent.conf
   # cp /opt/dsau/share/cfengine/templates/cfrun.hosts.template cfrun.hosts
   # cp /opt/dsau/share/cfengine/templates/cfservd.conf.template cfservd.conf
   ```

3. Next, edit `update.conf`. This file has a format similar to cfengine's main configuration file `cfagent.conf`. It is used to transfer and update cfengine binaries and any updated configuration definitions files (for example, `cfagent.conf`) to the managed clients. It is critical to keep this file very simple and avoid errors. Errors in this file will require manually copying a new version to each managed client.

   The file contains tokens in the form <%*`token-name`*%> that are replaced by the `csync_wizard` with the administrator's answers to questions. Replace the tokens as follows:

   a. Replace the `<%POLICYHOST_NAME%>` token with the fully qualified domain name of the master server. Note that it is critical that this be a fully qualified domain name. This file is copied to and evaluated on the managed clients. If a managed client is in a different DNS domain from the master server, the client will be unable to communicate with the master server if the hostname is not fully qualified.

   b. Note that the cfengine domain variable is set as follows:

      ```
      domain = ( ExecResult(/bin/sh -c ${dblquote}nslookup `hostname`|
      awk ${quote}/Name:/ {print $2}${quote} | cut -d . -f
      2-${dblquote}) )
      ```

      The domain variable is used by cfagent's "resolve" action. The ExecResult command above assumes that the client's /etc/resolve.conf and /etc/nsswitch.conf are already appropriately configured. The command expects to get a fully qualified hostname when using nslookup of the client's own hostname. If this assumption is not appropriate for your environment, other techniques for setting the domain are possible. For example, the client's domain could be determined based on the client's IP address or subnet, as follows:

      ```
      classes:
          # host in these ip address ranges
          xyz_domain = ( IPRange(10.0.0.1-15) )
          abc_domain = ( IPRange(192.0.0.1-254) )
      control:
          xyz_domain::
              domain = ( "xyz.example.com" )
          abc_domain::
              domain = ( "abc.example.com")
      ```

Use the `cfagent -p` (or --parse-only) flag to verify the syntax of `update.conf`.

4. Distribute the master `update.conf` to each managed client. This step is described in "Configuring a Synchronization Managed Client" (page 35).
5. Create the master server's security keys. cfengine uses a public/private key exchange to authenticate remote clients. A public/private key pair is generated on the master server and all managed clients. The public key for each managed client is copied to the master server and from the master server to the managed clients. It is important to exchange keys securely using a tool like secure copy, (see *scp*(1)) or using tape or CD-ROM. Start by generating the keys for the master server:

   ```
   # /opt/dsau/sbin/cfkey
   ```

   ```
   # /var/opt/dsau/cfengine/ppkeys
   ```

   This creates the files `localhost.pub` and `localhost.priv`.

   Copy the public key to `root-`*`master_server_IP_address`*`.pub`. For example, assuming this system's IP address is `10.0.0.5`, use this command:

   ```
   # cp localhost.pub root-10.0.0.5.pub
   ```

   See "Configuring a Synchronization Managed Client" (page 35) for details on copying the client keys to this master server.
6. On the master server, configure the `cfservd` daemon to start at system startup. Edit `/etc/rc.config.d/cfservd` and change the line `CSYNC_CONFIGURED=0` to `CSYNC_CONFIGURED=1`. Optionally, if you want to be able to push changes out to the managed clients using `cfrun`, replicate this change on all of the managed clients.
7. `cfrun` requires that the managed clients be listed in the file `cfrun.hosts`. In the default configuration, this file is located in `/var/opt/dsau/cfengine_master/inputs`. Edit it and add the hostnames of each managed client, one per line. It is simplest to make sure that all the host names are fully qualified. When using fully qualified hostnames, the `"domain = "` line is not required and can be deleted. If using unqualified hostnames, find the line `"domain = "` *variables* and replace the token with the DNS domain of the master system. This restricts all of the unqualified clients to be members of that single domain.
8. The file `/var/opt/dsau/cfengine_master/inputs/cfagent.conf` is the master policy file. The default `cfagent.conf` includes the default `cf.main` template file with examples of common synchronization actions for both standalone systems and Serviceguard clusters. `cf.main` contains the `POLICY HOST_NAME` and `"domain = "` *variables*. Perform the same edits described in Step 3 above.

   Note that this default `cf.main` file performs no management actions. All the action lines are commented out. This is a starting point for creating a custom set of cfengine policies and actions for your managed clients. The cfengine reference manual that documents the syntax and all the management actions defined in this file is located in `/opt/dsau/doc/cfengine`. Other example cfengine configuration files that are included with the open source cfengine distribution are located in `/opt/dsau/share/cfengine/examples`.

9. The file `/var/opt/dsau/cfengine_master/inputs/cfservd.conf` controls which managed clients have access to the files served by `cfservd` on the master. Make the following edits to `cfservd.conf`:

   - Replace the `"<%CFSERVD_DOMAIN_LISTS%>"`token with a comma-separated list of wildcard DNS domains or hostnames for the systems that are allowed to access this server. For example:

     ```
     domain_list       = ( "*.abc.xyz.com,*.cde.xyz.com" )
     ```

     This statement allows all hosts in the abc.xyz.com and cde.xyz.com domains to access the master server.

     IMPORTANT: No spaces are allowed in this comma-separated list.

     Prefix each domain name with the **"*."** wildcard.

     NOTE: The csync_wizard only supports specifying wildcard domain names in cfservd.conf. If you manually edit cfservd.conf and include a combination of specific hostnames or IP address and wildcard domains, then subsequent runs of csync_wizard will replace this line with a list of wildcard domains based on the list of hosts present in cfrun.hosts.

10. On the master server, start `cfservd`:

    ```
    # /sbin/init.d/cfservd start
    ```

    Repeat this for each managed client.

NOTE: cfservd.conf must be present in **`/var/opt/dsau/cfengine/inputs`** before executing this command.

11. Test the configuration by performing the following steps:

    a. On a managed client, use the command:

       ```
       # cfagent --no-lock --verbose --no-splay
       ```

       The verbose output will display the client checking for updated copies of the master policy files, copying them down to `/var/opt/cfengine/inputs` if needed, and then executing the contents of `cfagent.conf/cf.main`.

    b. On the master server, test the `cfrun` command:

       ```
       # cfrun -- --inform
       ```

       The `--inform` syntax instructs the remote `cfagent` to use the `--inform` flag which will produce messages for all changes cfengine performs on the system. For additional information, the `--verbose` can also be helpful:

       ```
       # cfrun -v -- --verbose
       ```

       The `-v` instructs `cfrun` itself to be more verbose and the `--verbose` is passed on to the remote `cfagent`.

    For additional troubleshooting information, refer to "cfengine Troubleshooting" (page 39).

2.3.2.2 Manually Configuring a Serviceguard Cluster Synchronization Server

Configuring cfengine for high availability in a Serviceguard cluster is similar to configuring it for a standalone machine, which is described in the section "Using the Wizard to Configure a Standalone Synchronization Server" (page 17). The primary differences are the creation of the

Serviceguard package and the mechanism used to distribute cfengine's security keys. Follow all the steps described below.

- **Initial Serviceguard Package Preparation**
  1. Start by obtaining an IP address for the package. This address is typically registered in DNS to simplify management of remote clients. If you are using cfengine for intra-cluster use only, it is sufficient to make sure the address is added to each member's `/etc/hosts` file.
  2. Next, create the storage infrastructure required for a new package. The instructions for doing this are documented in the *Managing Serviceguard* manual, under "Building an HA Cluster Configuration", "Creating a Storage Infrastructure." For example, if using an LVM storage infrastructure, that would include the following steps:
     a. Create the LVM volume group (VG) and logical volumes (LV) (for example, `/dev/vgcsync/lvol1`).
     b. Exporting/importing the volume group cluster-wide.
     c. Setting up a filesystem on the logical volumes.
     d. Creating the filesystem's mount point (for example, `/csync`) cluster-wide.

     The default templates assume you are using LVM-based storage. To use VxVM or other cluster-wide storage and filesystems, make the appropriate changes to the package templates described below. Also note that the Disks and Filesystems Tool (`fsweb`), available from the System Management Homepage, can help simplify volume group and filesystem setup.
  3. Make sure the filesystem for the package is mounted on the current member. For example, if using LVM do the following:

     ```
     # vgchange -a e /dev/vgcsync
     # mount -o rw,largefiles /dev/vgcsync/lvol1 /csync
     ```

- **Initial Policy File Customization**
  1. Create a subdirectory for the master policy files and reference files. For example:

     ```
     # mkdir -p /csync/dsau/cfengine_master/master_files
     ```

     These example directories are those used by the csync_wizard.
  2. Copy the default templates into the master inputs directory:

     ```
     # cd /csync/dsau/cfengine_master/inputs
     # cp /opt/dsau/share/cfengine/templates/cf.main.template cf.main
     # cp /opt/dsau/share/cfengine/templates/update.conf.template update.conf
     # cp /opt/dsau/share/cfengine/templates/cfagent.conf.template cfagent.conf
     # cp /opt/dsau/share/cfengine/templates/cfrun.hosts.template cfrun.hosts
     # cp /opt/dsau/share/cfengine/templates/cfservd.conf.template cfservd.conf
     ```
  3. Edit `update.conf`. This file has a format similar to cfengine's main configuration file `cfagent.conf`. It is used to transfer and update cfengine binaries and any updated configuration definitions files (for example, `cfagent.conf`) to the managed clients.

It is critical to keep this file very simple and avoid errors. Errors in this file will require manually copying a new version to each managed client.

The file contains tokens in the form <%*token-name*%> which are replaced by the csync_wizard with the administrator's answers to questions. Replace the tokens as follows:

— Replace the <%POLICYHOST_NAME%> token with the fully qualified domain name of the Serviceguard csync package. For example:

  policyhost = ("csync.abc.xyz.com")

— Refer to "Manually Configuring a Standalone Synchronization Server" (page 27) for a discussion on setting the cfagent domain variable, which is used by cfagent's resolve action.

- **List Managed Clients in cfrun.hosts**

  cfrun requires that all managed clients be listed in the file cfrun.hosts. Since each cluster member is considered a client, make sure each member is listed in /csync/dsau/cfengine_master/inputs/cfrun.hosts.

  Edit it and add the hostnames of each member, one per line. It is simplest to make sure that all the host names are fully qualified. When using fully qualified hostnames, the "domain =" line is not required and can be deleted. This domain specification is concatenated on any unqualified hostnames. If using unqualified hostnames, replace the "<%DEFAULT_CLIENT_DNS_DOMAIN%>" token with the simple domain name. For example:

  ```
  domain = xyz.abc.com
  ```

  Note that the csync_wizard will always write fully qualified hostnames when adding managed clients to this file.

- **Edit the Master Policy File**

  The file /var/opt/dsau/cfengine_master/inputs/cfagent.conf is the master policy file. The default cfagent.conf includes the default template cf.main which is a commented template file with examples of common synchronization actions for both standalone systems and Serviceguard clusters. Edit cf.main to replace the <%POLICYHOST_NAME%> token as described in a previous list bullet "Initial Policy File Customization." The "domain =" declaration used by the resolve action is also discussed in the same section.

  Note that this default template performs no management actions. All the action lines are commented out. It does contain many examples specific to synchronizing files in a Serviceguard cluster. This is a starting point for creating a custom set of cfengine policies and actions for your cluster and other managed clients.

  The cfengine reference manual which documents the syntax and all the possible management actions defined in this file is located in /opt/dsau/doc/cfengine/.

  Other example cfengine configuration files which are included with the open source cfengine distribution are located in /opt/dsau/share/cfengine/examples.

- **Edit the cfservd.conf File**

  The file `/var/opt/dsau/cfengine_master/inputs/cfservd.conf` controls which managed clients have access to the files served by `cfservd` on the master. Make the following edits to `cfservd.conf`:

  — Replace the `"<%CFSERVD_DOMAIN_LIST%>"` token with a comma-separated list of wildcard DNS domains or hostnames for the systems that are allowed to access this server. For example:

  ```
  domain_list        = ( "*.abc.xyz.com,*.cde.xyz.com" )
  ```

  This statement allows all hosts in the abc.xyz.com and cde.xyz.com domains to access the master server. No spaces are allowed in this comma-separated list. Each domain must be prefixed with the **`"*."`** wildcard.

  NOTE: The csync_wizard only supports specifying wildcard domain names in cfservd.conf. If you manually edit cfservd.conf and include a combination of specific hostnames or IP address and wildcard domains, then subsequent runs of csync_wizard will replace this line with a list of wildcard domains based on the list of hosts present in cfrun.hosts.

  This example allows all hosts in the listed domains to access files on the master server.

  You can also specify lists of specific host, IP address ranges, and so on. Refer to the cfengine reference manual for additional information.

- **Distribute the Master `update.conf` to Each Cluster Member**

  Use the following commands:

  ```
  # cd /var/opt/dsau/cfengine_master/inputs
  # ccp update.conf /var/opt/dsau/cfengine/inputs/
  ```

  cfengine itself will take care of distributing the remaining files both cluster-wide and to all managed clients.

- **Distribute the cfengine Security Keys**

  Since cfengine uses a public/private key exchange model to validate the authenticity of managed clients, a key must be configured that is associated with the relocatable IP address of the package. That address is the one that remote clients see as the master server. Since any cluster member can become the adoptive node, this key must be identical across all cluster members. cfengine's cfkey generates a public/private key pair for the current system. `cfkey` creates the files `localhost.priv` and `localhost.pub`.

  cfengine expects keys to be named using the following convention:

  `username-IP_address``.pub`

  For example,

  `root-10.0.0.3.pub`

  The administrator copies the localhost.pub key to the correct name based on the system's IP address. For the case of a cluster, the keys for the current member are used to generate the keys cluster-wide using the following steps:

  1. Use `cfkey` to create the public and private key pair for this cluster member:

     ```
     # /opt/dsau/sbin/cfkey
     ```

This will create keys named localhost.priv and localhost.pub in the directory `/var/opt/dsau/cfengine/ppkeys`.

2. The public key, `localhost.pub` is then copied to `root-`*`package IP address`*`.pub`. For example,

   ```
   # cp localhost.pub root-192.10.25.12.pub
   ```

   where 192.10.25.12 is the relocatable IP address of the `csync` package.

3. This member's `localhost.pub` is then used to create the member-specific keys for each member:

   ```
   # cp localhost.pub root-member1 IP address.pub
   # cp localhost.pub root-member2 IP address.pub
   # cp localhost.pub root-member3 IP address.pub
   …
   # cp localhost.pub root-memberN IP address.pub
   ```

4. Finally, all the keys are copied to each member.

   ```
   # ccp * /var/opt/dsau/cfengine/ppkeys
   ```

NOTE: `ccp`, a command-fanout command, performs a cluster copy, copying a command to all cluster members.

- **Configure and start cfservd**
  1. Configure the `cfservd` daemon to start at system startup. Edit `/etc/rc.config.d/cfservd` and change the line `CSYNC_CONFIGURED=0` to `CSYNC_CONFIGURED=1`.
  2. Propagate this change cluster-wide:

     ```
     # ccp /etc/rc.config.d/cfservd /etc/rc.config.d/cfservd
     ```

  3. On the master server, start cfservd:

     ```
     # /sbin/init.d/cfservd start
     ```

  4. Repeat for the remaining cluster members. If you have configured the cluster for use with the DSAU command fanout tools, use the following command to start the daemons cluster-wide:

     ```
     # cexec /sbin/init.d/cfservd start
     ```

- **Create the csync Package**

  To create the configuration synchronization package, modify the default package template files as appropriate for your Serviceguard environment. Note that the package must be called `csync`. Failure to do so will cause the Serviceguard automated operations to fail. For more information, refer to the section "Serviceguard Automation Features" (page 23).

  Start by making the following changes:

  1. Create the package directory cluster-wide:

     ```
     # cexec mkdir /etc/cmcluster/csync
     ```

  2. Copy the template package ASCII file and package control script to the `/etc/cmcluster/csync` directory on the current member:

     ```
     # cd /etc/cmcluster/csync
     # cp /opt/dsau/share/serviceguard/templates/csync.conf.template
     csync.conf
     # cp /dsau/share/serviceguard/templates/csync.script.template
     csync
     # chmod +x csync
     ```

3. Edit the `csync.conf` package ASCII configuration file to replace the placeholder tokens with the appropriate values. The tokens are in the form <%*token-name*%>. Find the line

   ```
   "SUBNET <%SG_PKG_SUBNET%>"
   ```

   and replace the token with the subnet for the `csync` package. Use `netstat -i` to help identify the subnet.
4. Edit the package control script, and substitute appropriate values for the placeholder tokens.

   NOTE: The default script template assumes you are using an LVM-based storage configuration. If you are using VxVM or CFS, refer to the *Managing Serviceguard* documentation for more information on configuring packages using those technologies. You will have to comment out the LVM parts of the template described below and substitute the appropriate VxVM or CFS stanzas.

   a. Find the line `"VG[0]="<%SG_PKG_VOL_GRP%>""` and replace the token with the name of the LVM volume group for the package. For example, `VG[0]="/dev/vgcsync".`
   b. Find the line `"LV[0]="<%SG_PKG_LOG_VOL%>""` and replace the token with the full name of the logical volume. For example, `LV[0]="/dev/vgcsync/lvol1".`
   c. Find the line `"FS[0]="<%SG_PKG_FS%>""` and replace the token with the name of the filesystem mount point created for this package. For example, `FS[0]="/csync".`

      Note that this mount point should have been created on each cluster member as part of the storage configuration described above.
   d. Find the line `"FS_MOUNT_OPT[0]="<%SG_PKG_MNT_OPT%>""` and replace the token with the filesystem's mount options. For example, `FS_MOUNT_OPT[0]="-o rw,largefiles".`
   e. Find the line `"FS_TYPE[0]="<%SG_PKG_FS_TYPE%>""` and replace the token with the filesystem type. For example, `FS_TYPE[0]="vxfs".`
   f. Find the line `"FS_UMOUNT_OPT[0]="<%SG_PKG_FS_UMOUNT_OPT%>""` and replace the token with any filesystem `umount` options. The token can be removed and this option left blank if there are no special `umount` options. For example, `FS_UMOUNT_OPT[0]="".`
   g. Find the line `"FS_FSCK_OPT[0]="<%SG_PKG_FS_FSCK_OPT%>""` and replace the token with any filesystem specific `fsck` options. As above, the token can be deleted and this option left blank. For example, `FS_FSCK_OPT[0]="".`
   h. Find the line `IP[0]="<%SG_PKG_IP%>"` and replace the token with the IP address of the `csync` package. For example, `IP[0]= 123.456.789.3.`
   i. Find the line `"SUBNET[0]="<%SG_PKG_SUBNET%>""` and replace the token with the subnet for the package's IP address. Use `netstat -i` to help determine the subnet. For example, `SUBNET[0]= 123.456.789.0.`
5. Distribute the package control script and package ASCII configuration files cluster-wide:

   ```
   # ccp csync csync.conf /etc/cmcluster/csync/
   ```
6. Apply the package and start it:

   ```
   # cmapplyconf -P csync.conf
   # cmmodpkg -e csync
   ```

- **Test the csync Package Configuration**

  Test the configuration by performing the following steps:

1. On a managed client, use the command:

   ```
   # cfagent --no-lock --verbose --no-splay
   ```

   The verbose output will display the client, checking for updated copies of the master policy files, copying them into `/var/opt/dsau/cfengine/inputs` if needed, and then executing the contents of `cfagent.conf/cf.main`.

2. On the master server, test the `cfrun` command:

   ```
   # cfrun -- --inform
   ```

   `--inform` instructs the remote `cfagent` to use the `--inform` flag which will produce messages for all changes cfengine performs on the system. For additional information, the `--verbose` command can also be helpful:

   ```
   # cfrun -v -- --verbose
   ```

   The `-v` instructs cfrun itself to be more verbose and the `--verbose` is passed on to the remote `cfagent`.

   For additional troubleshooting information, refer to "cfengine Troubleshooting" (page 39).

2.3.2.3 Configuring a Synchronization Managed Client

When manually configuring managed clients, the basic steps are:

- Exchanging security keys. This establishes the trust relationship between the managed client and master server.
- Copying `update.conf` from the master server to the managed client.
- Setting a schedule for which `cfagent` will perform synchronization operations.

For a Serviceguard cluster, each member must be individually configured as a cfengine client. After configuring each member, if you add new members to the cluster, you must manually configure each new member as well. Repeat the configuration tasks described below on each cluster member.

For all other newly managed clients, start by configuring the trust relationship between the client and the master server. The master and client systems exchange security keys to authenticate each other. The master server's public key needs to be copied to the client and the client's public key is copied to the master server:

1. As root, use cfkey to create the public and private key pair for this cluster member:

   ```
   # /opt/dsau/sbin/cfkey
   ```

   This creates keys named localhost.priv and localhost.pub in the directory `/var/opt/dsau/cfengine/ppkeys`.

2. Copy this client's key to the master server. The master server uses the following naming convention for the client keys: *`username-client_IP_address`*`.pub`.

   Using this naming convention, push the client's public key to the master server's `ppkeys` directory using the following naming convention:

   ```
   # scp localhost.pub master_server:\
     /var/opt/cfengine/ppkeys/root-client_IP_address.pub
   ```

   It is important to use a utility such as secure copy (see *scp*(1)) when transferring the key in order to protect its integrity.

3. Finally, copy the master server's key to this managed client:

   ```
   # scp master_server:/var/opt/cfengine_master/ppkeys/localhost.pub
     root-master_IP_address.pub
   ```

4. Next, copy the master server update.conf to the managed client:

```
# mkdir -p /var/opt/dsau/cfengine/inputs
# cd /var/opt/dsau/cfengine/inputs
# scp master_server:/var/opt/dsau/cfengine/inputs/update.conf
./update.conf
```

To allow this client to accept `cfrun` requests, do the following:

1. Edit `/etc/rc.config.d/cfservd` and set the `CSYNC_CONFIGURED` variable to `"1"` -- this will start cfservd at system boot time.
2. Start `cfservd`:

   ```
   # /sbin/init.d/cfservd start
   ```

3. Test the configuration with `cfagent` (see *cfagent*(8)):

   ```
   # cfagent --no-lock --verbose --no-splay
   ```

   The verbose output will display the client, checking for updated copies of the master policy files, copying them down to `/var/opt/cfengine/inputs` if needed, and then executing the contents of `cfagent.conf/cf.main`.

For additional troubleshooting information, refer to the section "cfengine Troubleshooting" (page 39).

2.3.2.4 Choosing a Synchronization Invocation Method

As the administrator, you can push changes out to managed clients by using the `cfrun` command (see *cfrun*(8)). `cfrun` contacts the `cfservd` daemon on each managed client and `cfservd` invokes `cfagent` which does the actual synchronization work. You can also choose to have `cfagent` run at intervals on the client. There are two approaches:

- Run `cfagent` from a cron job.

  When running `cfagent` from `cron`, invoke it using `cfexecd -F`. An example `crontab` entry is shown below:

  ```
  0 * * * * /var/opt/dsau/cfengine/bin/cfexecd -F
  ```

  This `crontab` entry will cause `cfagent` to be run every hour.

  In this example, `cfexecd` (see *cfexecd*(8)) acts a wrapper for `cfagent` and collects any output and places it in `/var/opt/dsau/cfengine/outputs`. `cfexecd` can also cause mail to be sent to the administrator if specified in the `cfagent.conf` file. For details, refer to the cfengine reference manual in `/opt/dsau/doc/cfengine`.

  Note that the default `cf.main` has an example for automatically adding the above line to the `crontab` file of each managed client.

- Run `cfexecd` in daemon mode.

  `cfexecd` has `cron`-like features based on cfengine's time classes and can be used instead of `cron` to run `cfagent`. `cfexecd` defaults to running cfengine every hour. When first getting started with cfengine, it is probably easiest to use `cron` for scheduling client side synchronization. For details on using `cfexecd` in daemon-mode, refer to the cfengine tutorial located in `/opt/dsau/doc/cfengine/`.

2.4 Security Notes

cfengine has many security features that range from parameters that control denial-of-service attacks to access control lists that prevent managed clients from accessing reference file directories on the server. For details on cfengine security features, refer to the reference manual located in `/opt/dsau/doc/cfengine/`. The security topics discussed below include:

- Key exchange
- Network port usage

- Encryption
- Checksum alerts

2.4.1 Key Exchange

All the key exchange examples shown thus far have used `scp` to securely transfer the master server public key to the managed client and the managed client's public key to the master server. This scheme provides the highest level of security but can be inconvenient in certain situations. Other key distribution alternatives include the following:

- When connecting to a new client, `cfrun` has an interactive mode similar to `ssh`, where the administrator is prompted to accept the remote system's key. For example:

  ```
  cfrun(0): ......... [ Hailing remote-host.abc.xyz.com ] .........
  WARNING - You do not have a public key from host remote-host.abc.xyz.com =
  192.10.25.12
  Do you want to accept one on trust? (yes/no)
  -> yes
  cfrun:master-server-name: Trusting server identity and willing to accept key
  from remote-host.abc.xyz.com=192.10.25.12
  ```

- For large numbers of new clients, interactive mode can be inefficient. `cfrun` supports a `-T` option which tells cfengine to trust all new keys from the hosts listed in `cfrun.hosts`.
- `cfservd.conf` supports a TrustKeysFrom control clause. For example:

  ```
  control:
  TrustKeysFrom = ( 128.39.89.76 ) # A trusted host
  TrustKeysFrom = ( 128.39.89.76/24 ) # A trusted subnet
  ```

  The enumerated host or subnet addresses will be implicitly trusted and their keys automatically accepted.

All of these key exchange alternatives should be used with extreme caution and only in a secure environment where the LAN is trusted and the remote hosts are trusted. Once a public key is accepted it will not be updated unless it is deleted by hand from the master server's `/var/opt/dsau/cfengine/ppkeys` directory, manually replaced with a new key, or the csync wizard is run to update it.

2.4.2 csync Network Port Usage

`cfservd` uses TCP port 5308 by default. You can instruct `cfagent` to connect to `cfservd` using a different port by specifying a port in the `cfrun.hosts` file. For example:

```
host1.abc.xyz.com # Use standard port
host2.abc.xyz.com # Use standard port
host3.abc.xyz.com:4444  # Use port 4444
```

Also, cfengine will honor a cfengine tcp port defined in `/etc/services`. There are corresponding changes in `/etc/services`.

2.4.3 Encryption

In general, file transfer traffic between the master server and a managed client is not encrypted. For many system management related configuration files this is acceptable. For certain files, an encrypted file transfer is desirable. The copy action in `cfagent.conf` has an `"encrypt = true"` option to encrypt the specified file. For additional encryption options, refer to the cfengine reference manual located in `/opt/dsau/doc/cfengine`.

2.4.4 Checksum Alerts

cfengine has a checksum alert feature. To monitor changes to a file's checksum, do the following:

- Add the following stanza to `/var/opt/dsau/cfengine_master/inputs/cfagent.conf`:

  ```
  ChecksumUpdates = ( "on" )
  ```

- In `cfagent.conf`'s `"files"` actionsequence, add `checksum = md5` or `checksum = sha` options for the files to monitor. For example,

  ```
  files:
  class::
  /etc/example
  mode = 644
  checksum = md5
  ```

  Note that this checksum option is different from the `checksum = true` option used in the copy actionsequence. That option tells cfengine to use checksums instead of timestamps when deciding if files need to be copied.

`cfagent` creates the checksum database on the client if it does not already exist. When ChecksumUpdates is set to `"on"` or `"true"`, then the current checksum for the monitored files is added to or updated in the checksum database. After this initial run to populate the checksum database, change ChecksumUpdates to `"off"`. At this point, any changes to a checksum of a monitored file causes a security warning. For example:

```
host1: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
host1: SECURITY ALERT: Checksum for /etc/example changed!
host1: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

2.5 Disabling Use of cfengine

The `csync_wizard` does not have an unconfigure option to stop a system from being a master server. To disable a master server, simply stop `cfservd`:

```
# /sbin/init.d/cfservd stop
```

To prevent `cfservd` from starting at system startup, edit `/etc/rc.config.d/cfservd` and change CSYNC_CONFIGURED to `"0"`.

If the `csync_wizard` was used to create the cfengine configuration and add managed clients, it can be used to remove managed clients. Run the wizard on the master server and select the `"Remove a client"` option. The wizard requires that non-interactive `ssh` access to the managed client has been configured as described in the section "Using the Wizard to Configure a Synchronization Client" (page 25). The specified client will be deleted from `cfrun.hosts`, its public key deleted from the master `ppkeys` directory, and the master's key deleted from the client's `ppkeys` directory.

2.6 Logging Options

cfengine is intentionally silent about most configuration changes but there are several configuration options to increase the verbosity of cfengine output, as follows:

- Most `cfagent.conf` actions such as `"copy,"` `"editfiles,"` and `"processes,"` support a `syslog = true` option to cause the specific action to be logged to `syslog`.
- Similarly, most actions support an `"inform = true"` option to cause `cfagent` to report any changes.
- `cfagent.conf`'s control section supports global `"inform = (true)"` and `"syslog = true"` options.
- `cfagent` (see *cfagent*(8)) supports the `--inform` switch on the command line. For more information, refer to the cfengine reference manual in `/opt/dsau/doc/cfengine` or the `cfagent`manpage.

2.7 cfengine Troubleshooting

The following are some troubleshooting hints for working with cfengine.

1. Run `cfservd` on the master server using the --no-fork (`-F`) and the --verbose (`-v`) options. This will provide useful information for any troubleshooting efforts.
2. You may see authentication errors. When performing a `"cfagent -K"` operation, the following messages are displayed:

   ```
   cfengine:: BAD: key could not be accepted on trust
   cfengine:: Authentication dialogue with master-server.
   abc.xyz.com failed
   cfengine:client:/var/opt/dsau/cfengine/inputs/update.conf:194: Warning:
   actionsequence is empty
   cfengine:client:/var/opt/dsau/cfengine/inputs/update.conf:194: Warning: perhaps
   cfagent.conf/update.conf have not yet been set up?
   ```

   This problem is most likely due to the cfengine security setup. To resolve the problem, you will need to exchange cfengine public keys between the managed client and master server. The `csync_wizard` (see *csync_wizard*(8)) automates this process when adding clients. See the section "Configuring a Synchronization Managed Client" (page 35) for instructions on manually distributing keys to managed clients.

3. "Warning: actionsequence is empty" errors

   Use the `cfagent -v` option to get more information. One possible cause of this message is that `update.conf` has not been added to the client's `/var/opt/dsau/cfengine/inputs` directory.

4. Syntax error due to missing or superfluous spaces

   ```
   #cfagent -K
   ```

   ```
   cfengine::/var/opt/dsau/cfengine/inputs/update.conf:39: syntax error
   cfengine::/var/opt/dsau/cfengine/inputs/update.conf:
   Execution terminated after parsing due to errors in program
   ```

   In the first line of the example above, cfengine is reporting a **syntax error** on line 39 of the file `update.conf`. The error reported may be caused by a space in line 38, the previous line in the file `update.conf`.

   Check for extra spaces in the configuration files. As a general rule, using spaces can improve readability. One common problem is missing spaces within parentheses. For example, a function should have no space between the function name and its leading parenthesis but the function itself requires leading and trailing spaces within its enclosing parentheses. For example, the following snippet shows the use of required leading and trailing spaces for the function ExecResult.

   ```
   control:
   my_variable = ( ExecResult(/bin/ls -l) )
   ```

5. Unable to connect to a cfengine client or master.

   ```
   # cfrun
   ```

   ```
   cfrun(0): .......... [ Hailing host1 ] ..........
   cfrun(0): .......... [ Hailing host2 ] ..........
   cfrun:host2: Couldn't open a socket
   cfrun:host2: socket: Connection refused
   ```

   Check that the `cfservd` daemon on `host2` is configured and running.

   Use `/sbin/init.d/cfservd start` to start `cfservd` if it is not running.

6. "Can't stat" messages

   When running using either `cfrun` or `cfagent`, you might get "can't stat" errors. For example,

   ```
   host1: Can't stat
   /var/opt/dsau/cfengine_master/master_files/etc/test in copy
   ```

Check your master file repository and ensure that the file in question is available and has the right permissions.

7. "Couldn't open a socket " or "unable to establish connection:" errors

   `cfagent` and `cfrun` can display errors such as:

   ```
   cfengine:: Couldn't open a socket
   cfengine:: Unable to establish connection with host1 (failover)
   host2: Couldn't open a socket
   ```

   If the master server `cfservd` is running, this error could indicate that a there is a firewall or port issue such that the client cannot reach port TCP 5308 on the master server. When using `cfrun`, the master server must also be able to reach TCP port 5308 on the remote client. Ensure that any firewall rules allow access to these ports.

8. cfengine command line arguments are case-sensitive. For example, `cfagent` supports both the `-k` and `-K` options which have different meanings:
   - `-k` instructs `cfagent` to ignore the copy actionsequence
   - `-K` instructs `cfagent` to ignore locks when running

9. How do I make cfengine more verbose?

   Most cfengine tools and daemons accept a verbose `(-v)` option and several debugging `(-d)` options. For example:

   ```
   cfagent -d, -d1, -d2, or -d3
   cfservd -v
   cfrun -v
   ```

3 Consolidated Logging

Distributed Systems Administration Utilities offers consolidated logging features, including the standard logging features offered by `syslogd`, and `syslog` Next Generation (`syslog-ng`) features in standalone and cluster log consolidation environments.

The next sections of this document describe their use.

3.1 Introduction to syslog

`syslogd` is a ubiquitous component of UNIX systems that performs system logging activities. `syslogd` reads from a set of log sources such as `/dev/log` and `/dev/klog` and processes the log messages as instructed in `/etc/syslog.conf`. Applications log messages to `syslog` using the `syslog` call (see *syslog*(3C)).

For more information on `syslogd`, see *syslogd*(1M).

3.1.1 syslog Message Format

A `syslog` message has a standard format that includes an optional priority level and facility. The priority level indicates the urgency of the message. The facility indicates the subsystem that posted the message. Table 3-1 lists the priority level and facilities defined in `/usr/include/syslog.h`.

Table 3-1 syslog Priority Levels

Message	Description
LOG_ALERT	Take action immediately,
LOG_CRIT	Critical conditions have occurred.
LOG_DEBUG	Debug-level message.
LOG_EMERG	System is unusable.
LOG_ERR	Error conditions.
LOG_INFO	Informational message.
LOG_NOTICE	Normal but significant conditions that warrant attention.
LOG_WARNING	Warning conditions.

Table 3-2 describes `syslog` Facilities Messages.

Table 3-2 syslog Facilities Messages

Message	Description
LOG_AUTH	Security and authorization messages (DEPRECATED; use LOG_AUTHPRIV instead).
LOG_AUTHPRIV	Security and authorization messages (private).
LOG_CRON	Clock daemon (cron and at).
LOG_DAEMON	System daemons without separate facility values.
LOG_FTP	Ftp daemon.
LOG_KERN	Kernel messages.
LOG_LOCAL0 through LOC_LOCAL7	Reserved for local use.
LOG_LPR	Line printer subsystem.

Table 3-2 syslog Facilities Messages *(continued)*

Message	Description
LOG_MAIL	Mail subsystem.
LOG_NEWS	USENET news subsystem.
LOG_SYSLOG	Messages generated internally by `syslogd`.
LOG_USER (default)	Generic user-level messages.
LOG_UUCP	UUCP subsystem.

3.1.2 Message Filtering

Using `/etc/syslog.conf`, messages can be filtered based on their priority level and facility. Messages can be directed to:

- Specific log files
- The console
- A specified user. The message is sent to the user's terminal if the user is logged in.
- All logged-in users
- Forwarded to remote systems. For more information, see the "Log Consolidation Overview" (page 42).

For more information on configuring message filters, see the *syslogd*(8) manpage.

3.2 Log Consolidation Overview

Log forwarding is a feature of the standard UNIX `syslogd`. In addition to logging messages to the local host's log files, `syslogd` can forward log messages to one or more remote systems. These systems are referred to as log sinks or log consolidation servers.

Log consolidation offers benefits such as the following:

- Easier log file analysis - The centralized log provides a single location for the administrator to perform log file analysis. It offers single view of events that impact multiple systems.
- Increased security - A security breach might compromise the local logs but not the centralized copy. The log consolidation system can be hardened in ways that are likely to be inappropriate for log forwarding clients.
- Simplified archiving of logs - It is sometimes simpler to archive a set of centralized logs rather than per-system logs.

There are several disadvantages of using the standard `syslogd` on a log consolidation server:

- `syslogd` supports forwarding using UDP only. The Universal Datagram Protocol (UDP) is a "connectionless" protocol and does not offer flow control or guaranteed delivery of messages. As such, it is possible for forwarded log messages to be lost.
- The filtering features of `syslogd` are quite simple: you can filter only on a message's facility and priority.
- A log consolidation system represents a single point of failure. If the system is unavailable, the messages forwarded from clients are lost. Note that the messages still exist on the individual client systems. They are lost only from the consolidated log.

3.2.1 Improved Log Consolidation

The Distributed Systems Administration Utilities (DSAU) use `syslog-ng`, or `syslog` "Next Generation," to address the weaknesses of the traditional `syslogd` mentioned above.

`syslog-ng` is an open source `syslogd` replacement. It performs all the functions of the standard `syslogd` in addition to providing features such as the following:

- Improved filtering functionality. In addition to `syslog`'s facility/priority level filtering, `syslog-ng` can perform regular expression filtering against the program name, hostname, text of the message itself, the sender's IP address, and so on.
- TCP transport - In addition to `syslogd`'s UDP transport, `syslog-ng` supports a TCP transport which offers better delivery guarantees.

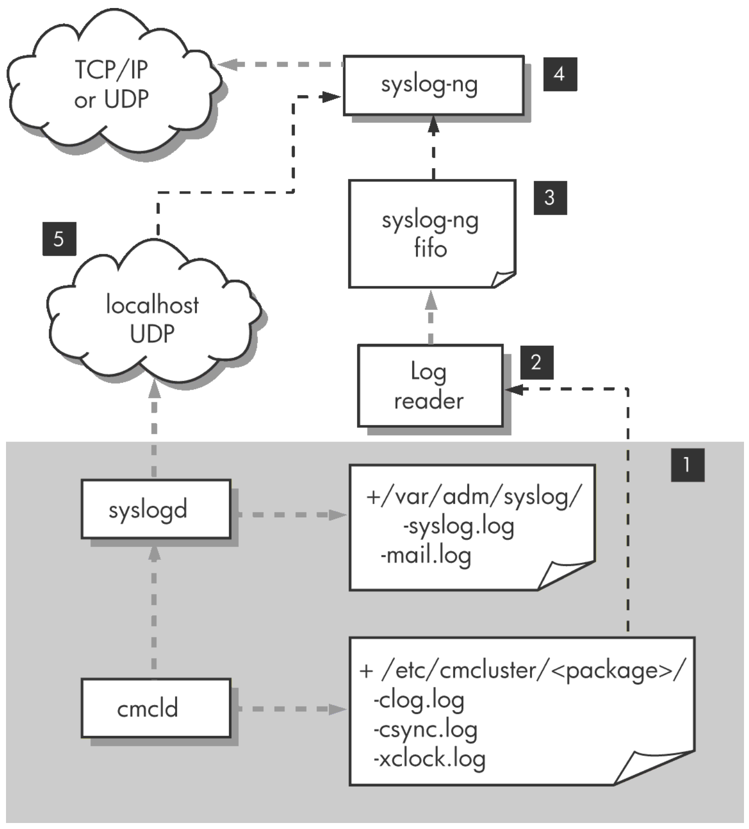
NOTE: `syslog-ng`'s support for a TCP transport does not imply that it safeguards against all message loss. For example, if the log consolidation server is down, the remote forwarding clients will indeed experience packet loss once their buffers are exceeded (the client-side buffer size is configurable with `syslog-ng`). TCP can offer better reliability in general, however, and can offer increased security. For example, TCP-based log traffic can be encrypted using `ssh`.

- Log rotation based on output filenames - Log output filenames can be based on templates names which support macro expansion. For example, if the output filename template contains the month macro, a new filename will created each month.
- Launching programs - A message can trigger a program to be launched, sending the message to its standard input.
- Log forwarding for arbitrary text-based logs - In conjunction with DSAU's `clog_tail` tool, `syslog-ng` can be used to forward and consolidate arbitrary text-based application log files such as Serviceguard's package log files.

3.2.2 syslog Co-existence

The Distributed Systems Administration Utilities configures `syslog-ng` to co-exist and work alongside the standard `syslogd`. `syslogd` continues to handle all the local logging for the system. `syslog-ng` is used when forwarding messages to a log consolidation system and is used on the log consolidator to receive and filter messages. The following diagrams illustrate the relationship between `syslogd` and `syslog-ng`. Figure 3-1 depicts the configuration on a `syslog-ng` client system that is forwarding logs to a remote log consolidation server.

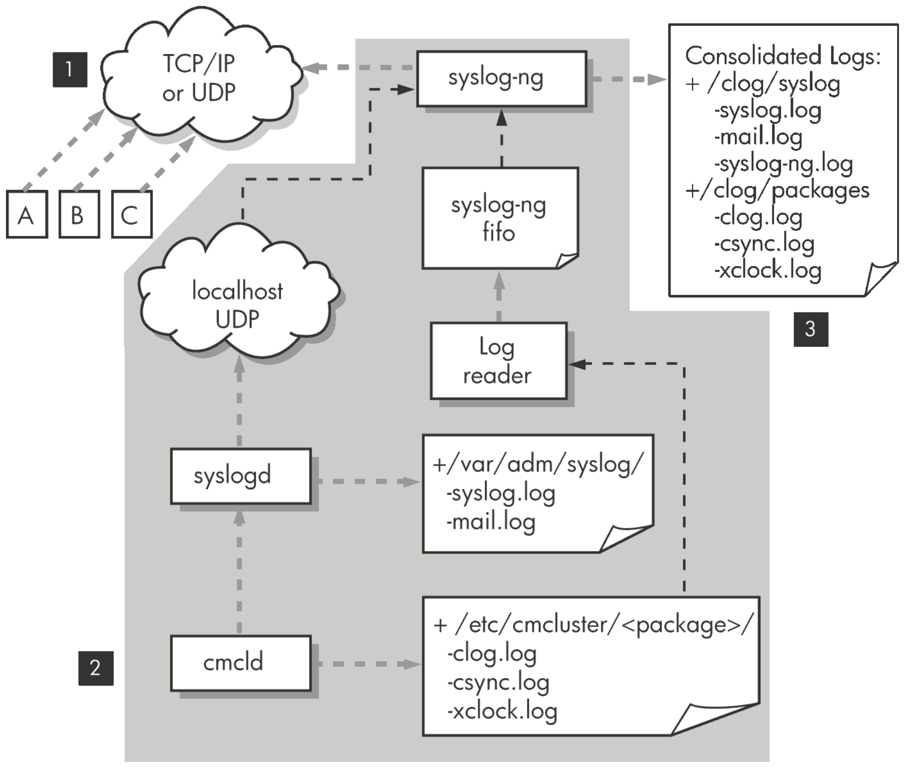
Figure 3-1 syslog-ng Log-Forwarding Configuration



1. The grey area represents standard `syslogd` operation. Applications such as Serviceguard's `cmcld` daemon call `syslog` (see *syslog*(3C)) to send messages to `syslogd`. `syslog` writes messages to the local system's `/var/adm/syslog/syslog.log` and related files. Applications also frequently have application-specific log files. In this example, Serviceguard maintains a log of package operations in `/etc/cmcluster/`*`package-name`*`/`*`package-name`*`.log`.
2. The `clog_tail` daemon of DSAU, labeled "Log reader" in the diagram, monitors text-based logs and sends new log lines to `syslog-ng` for processing. In a Serviceguard cluster, `clog_tail` defaults to monitoring all the package logs.
3. The `log_reader` sends all new log messages to a named pipe (`log_consolidation_fifo`), which is one of the log sources for `syslog-ng`.
4. The `syslog-ng` reads any new data from the named pipe and forwards it to the log consolidation server.
5. The local `syslogd`, in addition to writing log messages to the local `/var/adm/syslog/syslog.log`, is configured to additionally forward all messages to the local instance of `syslog-ng`. `syslog-ng` in turn, forwards these messages to the log consolidator. The administrator can choose to use UDP, TCP, or TCP with `ssh` when forwarding messages.

Figure 3-2 illustrates the configuration on the log consolidation server.

Figure 3-2 syslog-ng Log Consolidator Configuration



1. The `syslog-ng` server reads the incoming log data from the UDP or TCP connected clients. Note: gray arrows indicate a read operation; black arrows, a write.
2. The grey area is identical to the client configuration in Figure 3-1: "syslog-ng Log-Forwarding Configuration". In terms of the local system, `syslog-ng` acts as a client and processes locally forwarded `syslog` messages and `clog_tail` messages.
3. The `syslog-ng` server processes all messages and filters them into the appropriate consolidated log files. In this specific example, the administrator has created a filesystem named "`/clog`" to house the consolidated logs. `/clog/syslog/` would contain the consolidated `syslog`-related file. `/clog/packages` would contain consolidated package logs for a Serviceguard cluster.

3.3 Log Consolidation Configuration

The following sections describe how to configure log consolidation servers and log forwarding clients. Configuring a consolidation server is a multi-step process. The `clog_wizard` tool vastly simplifies the configuration process. If you choose not to use the wizard, the manual configuration steps are also described below.

Configuring Log Consolidation Server in Cross-Subnet Cluster Environments

In a cluster environment, if all the nodes are within the same subnet, then you can configure a server within that cluster environment as the log consolidation server.

However, in a cross-subnet cluster environment, the log consolidation server must be an external system, preferably a quorum server, outside the cross-subnet cluster. You can configure a cross-subnet cluster only as a log forwarding client, with an external system acting as the log consolidation master server. After you configure an external system as the log consolidation master server, the cross-subnet cluster nodes can be configured as log forwarding clients.

3.3.1 Using the Log Consolidation Wizard

The Log Consolidation Wizard is installed as `/opt/dsau/sbin/clog_wizard`. The wizard supports creating the following configurations:

- a standalone log consolidation server
- a highly-available log consolidation server for use within a single Serviceguard cluster (intra-cluster use only)
- a highly-available log consolidation server for use by the local Serviceguard cluster and remote systems, including Serviceguard cluster clients
- a standalone system forwarding logs to a remote log consolidation server
- a Serviceguard cluster forwarding logs to a remote log consolidation server

Choose the appropriate configuration option.

The wizard detects whether you are running on a standalone system or a Serviceguard cluster.

IMPORTANT: When you run the `clog_wizard` on a cross-subnet cluster, the system prompts you to respond to the following question:

```
Do you want to configure log consolidation? (y/n) [y]:
```

If you respond with **`y`**, the system displays a message indicating that the log consolidation master server must be an external system outside the cross-subnet cluster, and prompts you to enter the hostname or the IP address of the log consolidation server.

If the log consolidation server is not configured outside the cross-subnet cluster, then you must configure an external system, preferably a quorum server, as the log consolidation master server and later proceed to run the `clog_wizard` on the cross-subnet cluster node.

When running the wizard on a Serviceguard cluster, the default is to set up `clog` as a highly available service (Serviceguard package). The administrator must provision the storage environment for the package and the required package IP address and DNS name registration. The wizard supports LVM storage configurations. Non-LVM configurations must be done manually. The required package information that the wizard requires is listed in the following table.

Table 3-3 Configuration Data for clog_wizard

Configuration Data	Example	Your Value
LVM volume group	`/dev/vgclog`	
Logical volume	`/dev/vgclog/lvol1`	
Filesystem mount point	`/clog`	
Mount options	`-o rw, largefiles`	
Filesystem type	`vxfs`	
Package IP Address (a registered DNS name)	`192.10.25.12`	
Package subnet	`192.10.25.0`	
Free ports for tcp and ssh	`1775`	

3.3.1.1 Configuring a Log Consolidation Standalone Server with clog_wizard

To start the log consolidation wizard, issue the following command:

```
/opt/dsau/sbin/clog_wizard
```

For a standalone system, the wizard first displays introductory paragraphs explaining log consolidation and then asks:

```
Do you want to configure log consolidation? (y/n) [y]:
```

Answer yes (y) or press **Enter**. The next question is:

```
You can configure this system hostname as either a:
        - Consolidation server
        - Client that forwards logs to a remote consolidation server
Do you want to configure hostname as a Consolidation
Server? (y/n) [y]:
```

Answer yes (y). The wizard then prompts:

```
Enter the fully qualified directory where the consolidated
logs should be stored []:
```

It is typically best to select a dedicated filesystem for the consolidated logs. Since consolidated logs like `syslog` can grow rapidly, HP also recommends that the filesystem be configured for "largefiles." For this example, a filesystem named "`/clog`" is used.

Next, the wizard prompts for the client's transport:

```
You can choose to have the clients forward logs to this
consolidation server using either the UDP protocol or the TCP protocol (recommended).
Do you want to use the TCP protocol? (y/n) [y]:
```

Selecting TCP does not necessarily preclude the use of UDP forwarded log messages by clients. Whether the log consolidator allows TCP log messages exclusively, depends on whether the system is consolidating its own local `syslog` file. See below for details.

```
You need to choose a free port on this system for receiving logs. The port chosen
should be free on all cluster nodes.
Note: When configuring log consolidation on the clients,
this port will need to be specified.
Enter the TCP port to be used for receiving logs [1776]:
```

There is no reserved port for the TCP transport of `syslog-ng`. Any port that is not in use can be chosen. HP recommends that the administrator choose a port from the reserved range, that is, ports below 1024. Only privileged processes on a remote system can connect to privileged ports. This provides only a weak security guarantee because it implies that the administrator trusts the remote system. See the `ssh` section in the log forwarding client section for establishing stronger security guarantees "Manually Configuring a Standalone Log Forwarding Client" (page 66).

The `/etc/services` file documents the well-known reserved ports. When choosing a reserved port, the wizard will check both `/etc/services` and use "`netstat -an`" to check that the port is not in use.

Note that `syslogd` uses UDP port 514. TCP port 514 is reserved for use by `remsh`. `remsh` is not a secure protocol and is disabled at many sites. If `remsh` has been disabled on the consolidator, you could use TCP port 514. This has the advantage that it is a privileged port and it is the same as the UDP port number so it is easy to remember and manage. However, if the administrator changes the system to re-enable the use of `remsh`, `syslog-ng` would have to be reconfigured to use a new port and all the client systems that forward to this system would have to be updated.

Unlike UDP, TCP is a connection-oriented protocol. Each log forwarding client using TCP will have a connection to the log consolidation server. In order to avoid denial of service attacks, the default number of TCP connections accepted by `syslog-ng` is limited to 10 connections. For larger numbers of clients, edit the consolidation server's `/etc/syslog-ng.conf.server` file. Find the TCP source line in the file:

```
source s_syslog_tcp { tcp(port(tcp_port) keep-alive(yes));};
```

and add a `max-connections` attribute as follows:

```
source s_syslog_tcp { tcp(port(tcp_port) keep-alive(yes)
max-connections(N)); };
```

where *N* is the expected number of clients.

Next, the wizard prompts for which local logs should be consolidated:

```
Log files that reside on this system can be consolidated.
Would you like to consolidate this system's syslogs? (y/n) [y]:
```

Answering yes places this log consolidation system's own local `syslog` data in the consolidated log along with the client system's `syslog` data. To preserve the priority and facility of `syslog` entries, UDP local loopback is used, and `syslog` is configured to also forward entries to its local UDP port 514. `syslog-ng` is configured to read from this port. Thus, consolidating this system's `syslogs` allows clients to also connect to this log consolidation server via UDP port 514, even if TCP transport is specified earlier. If you choose not to consolidate this system's `syslogs`, then choosing a TCP transport earlier will require that all log forwarding clients be configured to use the TCP transport. The wizard displays a summary of all the configuration choices made by the administrator:

```
Summary of Log Consolidation Configuration:

       You have chosen to configure hostname as a Log
       Consolidation Server.
       Logs will be forwarded from the remote consolidation
       clients to local port 1776 using the TCP protocol.

       The consolidated logs will be stored under directory:
                /clog

       The following logs from the local system will be
       consolidated:
               Syslog
```

If these choices are correct, continue:

```
Do you want to continue? (y/n) [y]: y
```

The wizard displays its progress by describing which files are being modified and warns that Ctrl/C is disabled until configuration is done. For a complete description of the modified files, refer to "Manually Configuring Log Consolidation" (page 56).

```
Copying files that will be modified by the wizard to
/var/opt/dsau/root_tmp/clog. These files will be used to
restore the system to its current log consolidation
configuration, in the event of a failure.

Configuring hostname as a log consolidation server.

Creating the /etc/syslog-ng.conf.server configuration
file.

Creating a symbolic link from /etc/syslog-ng.conf to the
/etc/syslog-ng.conf.server configuration file.
Creating /etc/rc.config.d/syslog-ng, the log
consolidation configuration file.

Updating the syslog configuration:
       Updating the /etc/rc.config.d/syslogd file to add
        -N SYSLOGD_OPTS. This stops syslogd from
       listening to UDP port 514.

       Updating the /etc/syslog.conf file for UDP local
       loopback.

       Starting syslogd for the configuration changes to
       take effect.

Registering the log consolidation ports in the
/etc/services file.
```

```
Starting syslog-ng.

Successfully configured hostname as a log consolidation
server.
```

3.3.1.2 Configuring a Serviceguard Cluster as a Log Consolidation Server with clog_wizard

When running the `clog_wizard` (see *clog_wizard*(1M)) in a cluster, first make sure that all the cluster members are up and available. The wizard needs to perform configuration operations on each member. It only needs to be run once, from any member of the cluster. If you run the wizard more than once, additional prompts may appear.

The wizard will set up and create a Serviceguard package for the consolidated logging service. Make sure that this cluster's MAX_CONFIGURED_PACKAGES value can accommodate the additional package. For more information on this setting, please refer to the *Managing Serviceguard* manual which is part of the Serviceguard documentation set.

The wizard first displays introductory paragraphs explaining log consolidation (wizard output may wrap differently from what is shown here):

```
Consolidated logging (clog) lets you combine the log entries from multiple
remote systems into a single file. This feature is used to
consolidate syslog data from several systems. Each remote system
continues to write entries to its local syslog.log and additionally
forwards the entries to the consolidating host. The systems forwarding
log entries are consolidation clients. The system to which they send
entries is the consolidation server. In addition to syslog data,
clog can also consolidate arbitrary text log files.

In a Serviceguard cluster, clog can help you automate package log
file consolidation. Log consolidation is especially useful in a
Serviceguard cluster, because it enables you to look at a single
consolidated file instead of the per-member logs. The clog wizard needs
to be run only once in the cluster and not on each cluster member.
All cluster members should be up when running this wizard.

clog_wizard will prompt you for information to configure log file
consolidation. Some questions display a default answer in square
brackets. If you press <Return/Enter>, the clog_wizard uses the
default answer.

Press "Enter" to continue...

Press Enter.

Querying the system cluster_member for current status, one moment...
```

The next prompt is:

```
You can configure this cluster clustername as either a:
        - Consolidation server
        - Client that forwards logs to a remote consolidation server

Do you want to configure cluster_member as a Consolidation
Server?  (y/n) [y]:

To configure this cluster as a log consolidation server, the wizard
will create a Serviceguard package called "clog". The package
requires the following:
   - Dedicated storage for failover between cluster members. The
     consolidated logs will be stored here. This includes an LVM
     volume group, LVM logical volume, a filesystem, filesystem
     mount point, and the desired mount options. this storage
     infrastructure needs to be configured cluster-wide before
     proceeding.
   - An IP address and subnet address pair for the package. IPv4
     or IPv6 addresses can be used. The IP address should be registered
     in DNS, if this cluster will consolidate logs from remote clients.
This should be appropriately configured on each cluster member before
proceeding with the consolidation server configuration.
```

Answer yes (y).

In a cluster, the wizard configures `syslog-ng` to be highly available using a Serviceguard package. For consolidated logging, the package name is `clog`. The LVM storage configuration and network configuration for the package must be set up before continuing or before running the wizard. For additional details, refer to the section "Creating a Storage Infrastructure with LVM" in the chapter "Building an HA Cluster Configuration," in the *Managing Serviceguard* manual.

NOTE: The wizard only supports creating packages based on LVM volume groups. When using CFS or VxVM, manual configuration is required. See the section "Manually Configuring Log Consolidation" (page 56) for details.

The wizard prompts for the following, all of which should have already been configured:

1. LVM volume group name (for example, `/dev/vgclog`).
2. Logical volume in the volume group (for example, `/dev/vgclog/lvol1`).
3. The filesystem's mount point (for example, `/clog`).
4. The filesystem's mount options (for example, `-o rw,largefiles`). The mount options are used verbatim in the Service package control script's `FS_MOUNT_OPT[0]` field. Note that the mount options must agree with the filesystem you created on the logical volume. For example, if the filesystem was created with largefiles support, the largefiles mount option should be specified. Since consolidated logs tend to be large, it is recommended to configure VxFS filesystems with the largefiles option.
5. The filesystem type (for example, `vxfs`).
6. The package IP address. This should also be a registered DNS name so the log forwarding is easy to configure on client systems.
7. The package subnet. (Use the `netstat -i` command to determine the proper subnet.)

Next, the wizard prompts for the clients' transport.

```
You can choose to have the clients forward logs to this consolidation
server using either the UDP or the TCP protocol (recommended).

Do you want to use the TCP protocol? (y/n) [y]: y

You need to choose a free port on this cluster for receiving logs. The
port chosen should be free on all cluster nodes.

Note: When configuring log consolidation on the clients, this port
will need to be specified.

Enter the TCP port to be used for receiving logs []: 1776
```

Note that selecting TCP does not necessarily preclude the use of UDP forwarded log messages by clients. Whether the log consolidator allows TCP log messages exclusively depends on whether the system is consolidating its own local `syslog` file. See below for details.

When answering Yes to TCP, you must select a free TCP port. This port must be free on all cluster members. See the section "Configuring a Log Forwarding Client Using clog_wizard" (page 54) using the `clog_wizard` for details on choosing a TCP port.

Next the wizard prompts for which local logs should be consolidated:

```
Log files that reside on this cluster can be consolidated.
```

```
Would you like to consolidate this cluster's syslogs? (y/n) [y]:

Would you like to consolidate this cluster's package logs? (y/n) [y]:
```

In a Serviceguard cluster, you can consolidate all the member-specific `syslog` files into a single consolidated `syslog` containing `syslog.log`, `mail.log` and `syslog-ng.log`. Each member-specific package log can also be consolidated.

Note that if you choose to consolidate the cluster's `syslogs`, the remote clients can also forward UDP `syslog` messages to the cluster, regardless of the answer to the "Do you want to use the TCP protocol" question. If you choose not to consolidate this cluster's `syslogs`, then choosing a TCP transport earlier requires that all log forwarding clients be configured to use the TCP transport.

The consolidated logs are placed in the filesystem associated with the package. Using the example above, the consolidated `syslog.log` would be located here:

`/clog/syslog/syslog.log,mail.log,syslog-ng.log`

The consolidated package logs would be located here:

`/clog/package/`*`package1`*`.log,`*`package2`*`.log, ...,`*`packageN`*`.log`

The wizard now has all the data it needs to configure the consolidated logging package. It displays a summary confirmation screen and then performs the configuration:

```
Summary of Log Consolidation Configuration:
       You have chosen to configure clustername as a Log Consolidation Server.
       Logs will be forwarded from the remote consolidation clients
       to local port port_number using the TCP protocol.

       For high availability the Serviceguard package "clog" will be
       configured with the following attributes:
             Volume Group:     /dev/vgclog
             Logical Volume:   /dev/vgclog/lvol1
             Filesystem:       /clog
             Mount Options:    -o rw,largefiles
             Filesystem Type:  vxfs
             IP Address:       192.10.25.12
             Subnet:           192.10.25.0

       The following logs on this cluster will be consolidated:
             Syslog
             Serviceguard package logs

Do you want to continue? (y/n) [y]:

******* WARNING!!!! ********
To protect against possible corruption of sensitive configuration files,
control-c has been disabled for the remainder of this configuration.

Copying files that will be modified by the wizard
to /var/opt/dsau/root_tmp/clog on each cluster node.
These files will be used to restore the cluster to its
current log consolidation configuration, in the event
of a failure.

Configuring cluster_member as a log consolidation server.

The configuration will be done on all cluster nodes.
It will take a few minutes....

Creating the /etc/syslog-ng.conf.server configuration file.

Creating the /etc/syslog-ng.conf.client configuration file.

Creating a symbolic link from /etc/syslog-ng.conf to the
/etc/syslog-ng.conf.client configuration file.

[Halting the "clog" Serviceguard package if it is up.]
```

```
Creating /etc/rc.config.d/syslog-ng, the log consolidation
configuration file.
Updating the syslog configuration:
    Updating the /etc/rc.config.d/syslogd file to add -N to
   SYSLOGD_OPTS. This stops syslogd from listening to UDP port
   514.

     Updating the /etc/syslog.conf file for UDP local loopback.

     Starting syslogd for the configuration changes to take effect.
Registering the log consolidation ports in the /etc/services file.

Starting syslog-ng.

Setting up the log consolidation server to be highly available.

Configuring the "clog" Serviceguard package.

Applying the "clog" Serviceguard package configuration file.
This will take a moment.

Starting the "clog" Serviceguard package. This will take a few moments...

The "clog" Serviceguard package has been started on cluster_member.

Successfully created the "clog" Serviceguard package.

Successfully configured cluster_member as a log consolidation server.
```

3.3.1.3 Cluster Configuration Notes for clog

In a Serviceguard cluster, the adoptive node for the `clog` package performs the log consolidation functions. All the other cluster members participate as log forwarding clients and send log messages to the relocatable IP address of the `clog` package.

DSAU maintains two configuration files that control whether the instance of `syslog-ng` on a particular cluster member operates as a consolidation server or a log forwarding client: `/etc/syslog-ng.conf.server` and `/etc/syslog-ng.conf.client`. The symbolic link `/etc/syslog-ng.conf` points to one of the configuration files. When the cluster is booted, all the members start as log forwarding clients with `syslog-ng` running on each member. The `/sbin/init.d/syslog-ng` startup script sets the symbolic link `/etc/syslog-ng.conf` to point to `/etc/syslog-ng.conf.client`.

When the `clog` package starts, the adoptive node restarts that instance of `syslog-ng` as a log consolidation server instance. The package script resets the `/etc/syslog-ng.conf` symbolic link to point to `/etc/syslog-ng.conf.server`. If the `clog` package is halted, the symlink is changed to point to `/etc/syslog-ng.conf.client` and the `syslog-ng` instance on that member restarted. Note that when a cluster is a log consolidation server, and the package is down, no log consolidation occurs and forwarded log messages are lost.

Cluster members can forward log messages to the consolidator using either UDP or TCP. Within a Serviceguard cluster, `ssh` port forwarding is not used. `ssh` port forwarding can be used to secure the log traffic forwarded by remote clients outside the cluster. For additional information, refer to "ssh Port Forwarding" (page 78).

3.3.1.4 Serviceguard Automation Features

The Distributed Systems Administration Utilities require Serviceguard 11.17 or later. With Serviceguard 11.17 or later, when members are added to or deleted from cluster or packages are added and deleted, the DSAU consolidated logging tools will automatically take the appropriate configuration actions. Specifically:

- When adding a member to the cluster, the new member is automatically configured to participate in log consolidation according to the cluster's configuration. The following files are automatically configured on the added member:
  - `/etc/rc.config.d/syslog-ng`
  - `/etc/rc.config.d/syslogd`
  - `/etc/syslog.conf`
  - `/etc/syslog-ng.conf.client`, `/etc/syslog-ng.conf.server`, and the `/etc/syslog-ng.conf` symbolic link
  - `/etc/services`
- When deleting a member from a cluster:
  - The member is still configured as a log-forwarding client and will continue to forward `syslog` messages to the cluster if that option had been chosen during the initial run of the `clog_wizard`. If the system should no longer forward log messages to the cluster, rerun the wizard to configure the system to forward to a different consolidator, or disable log consolidation entirely. Refer to "Disabling Log Consolidation" (page 75) for additional information.
  - The package logs on the deleted member are still monitored until a reboot. Since this member is no longer part of the cluster, the package logs will not be active.
- When adding or deleting a package, the following automated actions occur:
  - The package is added to or deleted from `/etc/syslog-ng.conf.server` cluster-wide. There is a reserved section of these files dedicated for use by the DSAU tools. The configuration stanzas added in this section direct `syslog-ng` to filter package log messages into the appropriate consolidated package logs.
  - The `clog_tail` log monitor adds or deletes the package log file from its list of files to monitor.

3.3.1.5 Minimizing Message Loss During Failover

When there is a failure on the adoptive node, it takes a finite amount of time for the clog package to fail over to another cluster member. The longer this failover time, the more likely that messages could be lost from the consolidated log. Use the following guidelines to minimize message loss during failover.

- Configure clients to use the TCP transport instead of the UDP transport. UDP messages will be lost unconditionally when the package is down. The TCP protocol contains retry mechanisms, congestion control, and so on, that help minimize message loss.
- `syslog-ng` can buffer TCP messages on the client side. The number of messages buffered is controlled by the `syslog-ng log_fifo_size` setting. This sets an upper limit on the number of messages that can be buffered. The default`/etc/syslog-ng.conf` file sets `log_fifo_size` to 10000.
- `syslog-ng` has a `time_reopen()` option to configure the time to wait before a dead connection is reestablished. The `/etc/syslog-ng.conf` file has `time_reopen()` set to 10 seconds.
- Serviceguard offers various configuration options to improve failover times such as HEARTBEAT_INTERVAL and NODE_TIMEOUT. Serviceguard Extension for Faster Failover (SGeFF) is also available to optimize failover times for two-node clusters. Since `syslog-ng` itself starts quickly, SGeFF is an ideal candidate for improving failover times and minimizing message loss.

3.3.1.6 Configuring a Log Forwarding Client Using clog_wizard

There are two ways to configure a log forwarding client: as a standalone machine or as a Serviceguard cluster. When configuring a cluster as a log forwarding client, all the members of the cluster will be configured identically as clients. The wizard asks the same questions and performs the same configuration actions for single systems and for clusters. The examples below show use of the clog wizard on a Serviceguard cluster. After starting `clog_wizard`, answer "yes" to the following question:

```
Do you want to configure log consolidation? (y/n) [y]:
```

or press **Enter**. The next question is:

```
You can configure this cluster cluster_member as either a:
   - Consolidation server
   - Client that forwards logs to a remote consolidation server

Do you want to configure cluster_member as a Consolidation Server?  (y/n) [y]: n
```

Answer "No" here. At this point you are configuring a log forwarding client. The wizard displays the following:

```
You now need to specify which system will be the
consolidator. If the consolidator is a Serviceguard
cluster, specify the IP address of the "clog"
Serviceguard package for this question. The "clog"
package makes log consolidation highly
available on the consolidator.

The consolidation server must already be configured.

Enter the hostname or IP address of the consolidator
[]: clog.usa.xyz.com
```

After entering the hostname or IP address of the log consolidation server, the wizard asks if you want to use the TCP transport when forwarding log messages:

```
You can choose to forward logs to the consolidator using either
the UDP protocol or the TCP protocol (recommended).

Do you want to use the TCP protocol? (y/n) [y]:
```

Standard `syslogd` forwards messages using the UDP protocol. UDP is a high-performance, broadcast-oriented protocol with no flow control or message delivery verification. `syslog-ng` supports `syslogd's` UDP protocol and a TCP protocol. The TCP transport offers both flow control and message delivery checks. However, since TCP is a connection-oriented protocol, it requires additional resources on the log consolidation server. The consolidation server's `max-connections` attribute must be set according to the maximum number of expected clients. Refer to the section "Configuring a Log Consolidation Standalone Server with clog_wizard" (page 46) for a discussion of the `max-connections` setting.

If you answer "yes" to using TCP, the next question asks for the TCP port to forward messages to:

```
Ask the administrator of the consolidation server which TCP
port was configured for receiving logs.

Enter the TCP port configured on the CONSOLIDATOR for
receiving logs []: 1776
```

You must use the TCP port selected by the system administrator of the log consolidation server. If the `clog_wizard` was used to configure the server, the port number is saved in `/etc/rc.config.d/syslog-ng` as the variable CLOG_TCP_PORT. In this example, TCP port 1776 was used. If you answer "yes" to the TCP question, the following question is displayed:

```
The TCP protocol can be used together with Secure
Shell port forwarding to enhance security. Each member
of this cluster must already have non interactive Secure
```

```
Shell Authentication set up with the consolidator. You
can use the tool /opt/dsau/bin/csshsetup to configure
non interactive Secure Shell Authentication.

Do you want to configure Secure Shell port forwarding? (y/n) [y]:
```

Choose yes in order to use `ssh` port forwarding. This will encrypt all the traffic sent from this local log forwarding client to the log consolidator.

NOTE: A special `ssh` security configuration is required on the server when a Serviceguard cluster is the log consolidation server. For details, refer to "ssh Port Forwarding" (page 78).

`ssh` port forwarding requires an additional free TCP port on the local client system:

You need to choose a free port on this cluster for `ssh` port forwarding. The port chosen should be free on all cluster nodes.

```
Enter the ssh port to be used for port forwarding []: 1775
```

The same guidelines for choosing a free `syslog-ng` TCP port apply to this port. For details, refer to "Configuring a Log Consolidation Standalone Server with clog_wizard" (page 46). In this example, the local port 1775 was used. For a Serviceguard cluster log forwarding client, the cluster's `syslogs` and package logs can be forwarded to the log consolidation server. For a standalone system, the wizard asks only about forwarding `syslog` messages:

```
Log files that reside on this cluster can be forwarded to the
consolidator.

Would you like to forward this cluster's syslogs? (y/n) [y]:

Would you like to forward this cluster's package logs? (y/n) [y]:
```

When forwarding a cluster's package logs, manual configuration is required on the consolidation server in order to add the `syslog-ng` filtering lines to cause these package logs to be consolidated into their own unique files. See "Manually Configuring a Serviceguard Cluster as a Log Forwarding Client" (page 68) for details.

After all the questions have been answered, the `clog_wizard` displays the following summary screen:

```
Summary of Log Consolidation Configuration:

       You have chosen to configure clustername as a Log Consolidation Client.
       Logs will be forwarded to the remote consolidation server
       clog.usa.xyz.com on port 1776 using the TCP protocol.

       The TCP protocol will be used together with Secure Shell
       Port Forwarding using port 1775, for added security.

       The following logs will be forwarded for consolidation:
            Syslog
            Serviceguard package logs

Do you want to continue? (y/n) [y]:
```

Confirm your answers with a "yes" response and the wizard summarizes the configuration steps that it performs:

```
Copying files that will be modified by the wizard to /var/opt/dsau/root_tmp/clog
on each cluster node.
These files will be used to restore the cluster to its current log consolidation
configuration, in the event of a failure.

Configuring clustername as a log consolidation client.

The configuration will be done on all cluster nodes.
It will take a few minutes....

Creating the /etc/syslog-ng.conf.client configuration file.
Creating a symbolic link from /etc/syslog-ng.conf to the
/etc/syslog-ng.conf.client configuration file.
Creating /etc/rc.config.d/syslog-ng, the log consolidation configuration file.
       Updating the syslog configuration:
       Updating the /etc/rc.config.d/syslogd file to add -N to SYSLOGD_OPTS.
       This stops syslogd from listening to UDP port 514.

       Updating the /etc/syslog.conf file for UDP local loopback.

       Starting syslogd for the configuration changes to take effect.
Registering the log consolidation ports in the /etc/services file.

Starting syslog-ng.

Successfully configured clustername as a log consolidation client.
```

For additional information on the configuration actions performed by the `clog_wizard`, refer to "Manually Configuring a Serviceguard Cluster as a Log Consolidation Server" (page 59).

3.3.2 Manually Configuring Log Consolidation

If you choose not to use the Consolidated Logging Wizard, use the following sections for the manual steps required to configure a log consolidation server and log forwarding clients. Because there are many steps required to set up clients and servers, HP recommends using the `clog_wizard`.

Manual configuration is required for the following cases:

- When a cluster is a log forwarding client and forwarding package logs, manual configuration is required on the consolidation server (standalone or cluster) to filter the package logs appropriately.
- When configuring a Serviceguard Cluster as a log consolidator and you require:
  - Special customization of the clog package
  - Use of VxVM instead of LVM
  - Use of the Cluster File System (CFS)

It is often simplest to run the wizard and let it complete the basic configuration and then customize, starting from that point.

The following sections describe the steps required to configure log consolidation systems manually. The systems you can configure manually are:

- Standalone log consolidation server
- Serviceguard cluster log consolidation server

3.3.2.1 Manually Configuring a Standalone Log Consolidation Server

Start by configuring the standard `syslogd` to co-exist with a `syslog-ng` consolidator. By default, `syslogd` listens for incoming log messages on UDP port 514. If you want to accept UDP `syslog` messages from remote clients or consolidate this server's local `syslogs`, `syslog-ng` must listen on UDP port 514. Edit `/etc/rc.config.d/syslogd` and change `SYSLOGD_OPTS` to add the `-N` switch, which prevents `syslogd` from listening on port 514. For example:

```
SYSLOGD_OPTS="-D -N"
```

If you want the local `syslog` messages from the log consolidation server itself to be part of the consolidated `syslog`, edit the consolidator's `/etc/syslog.conf` file to forward log messages to port 514 on the local host where they will be read by `syslog-ng`. Using the HP-UX default `/etc/syslog.conf` as an example, add the following lines:

```
mail.debug                @log-consolidation-server
*.info;mail.none          @log-consolidation-server
```

where `log-consolidation-server` is the fully qualified domain name of the consolidation server. The name must be fully qualified or `syslogd` will not forward the messages properly.

NOTE: There must be a <tab> before each @ sign.

If you have customized `syslog.conf`, make sure to add the forwarding lines for your customizations as well.

`syslogd` must be stopped and restarted for these changes to take effect, using the following commands:

```
# /sbin/init.d/syslogd stop
# /sbin/init.d/syslogd start
```

With `syslogd` appropriately configured, now configure `syslog-ng`.

Start with the same `syslog-ng.conf` templates used by the `clog_wizard`. Copy `/opt/dsau/share/clog/templates/syslog-ng.conf.server.template` to `/etc/syslog-ng.conf.server`. This file has tokens named <%*token-name*%> that are replaced by the wizard based on the administrator's answers to the wizard's questions.

Replace the tokens as follows:

- When using the TCP protocol and configuring the consolidation server to consolidate its own `syslogs`, replace the `<%UDP_LOOPBACK_SOURCE%>` token with:

  ```
  source s_syslog_udp { udp(port(514)); };
  ```

  Replace the `<%UDP_LOOPBACK_LOG%>` token with:

  ```
  log { source(s_syslog_udp); destination(d_syslog_tcp); };
  ```

  This causes the `syslog-ng` consolidator to read the local `syslogd`'s UDP messages and send them to `syslog-ng` on the local TCP port. Optionally, the destination could be set to be the local consolidation file directly, (`destination(d_syslog)` in this default template), but this configures the consolidation server client components in the same manner as a remote client. In other words, when the consolidator is a client of itself, it's configured identically to remote clients.

  If using the UDP protocol or not consolidating the local `syslogs` of this server, delete the`<%UDP_LOOPBACK_SOURCE%>` and `<%UDP_LOOPBACK_LOG%>` tokens.

- Replace the `<%TYPE%>` tokens with either udp or tcp depending on the desired log transport to support. Note that even when using TCP clients, UDP clients are also supported if the consolidation of the server's local `syslogs` is configured. There are multiple lines with the `<%TYPE%>` token and all must be edited appropriately.
- For the "`source s_syslog_<%TYPE%>`" line, replace the `<%PORT%>` and`<%KEEP_ALIVE%>` tokens with appropriate values, as follows:

  ```
  source s_syslog_<%TYPE%> { <%TYPE%>(port(<%PORT%>) <%KEEP_ALIVE%>); };
  ```

  For TCP, the port needs to be an available TCP port. See section "Configuring a Log Consolidation Standalone Server with clog_wizard" (page 46) for a discussion of selecting an available port. For UDP, use port 514.

  `<%KEEP_ALIVE%>` applies only when selecting TCP as the log transport. Replace this token with "`keep-alive(yes)` " which instructs `syslog-ng` to keep connections open when it is rereading its configuration file. If using UDP, delete this token.

- For the "`destination d_syslog_<%TYPE%>`" line, replace the `<%IP%>` and`<%PORT%>` tokens:

  ```
  destination d_syslog_<%TYPE%> { <%TYPE%>("<%IP%>" port(<%PORT%>)); };
  ```

  For example, for TCP:

  ```
  destination d_syslog_tcp { tcp("local_hostname" port(1776)); };
  ```

where the `<%IP%>` is replaced by the server's IP address or local hostname and the `<%PORT%>` is replaced by the selected TCP port number.

For UDP:

```
destination d_syslog_udp { udp("local_hostname" port(514)); }
```

where `<%IP%>` is replaced by the server's IP address or local hostname and the `<%PORT%>` token is replaced by 514, the standard `syslog` UDP port.

- Replace the`<%FS%>` token with the filesystem or directory where the consolidated logs will be kept. For example,

  ```
  destination d_syslog { file("<%FS%>/syslog/syslog.log"); };
  ```

  becomes:

  ```
  destination d_syslog { file("/clog/syslog/syslog.log"); };
  ```

  Make sure that this directory exists or the appropriate filesystem is mounted. Since consolidated logs can grow quite large, HP recommends that this filesystem use the largefiles option and that there is sufficient room for growth.

- When using TCP, record the port number you choose above in the `/etc/services` file. For example, add the line:

  ```
  clog_tcp  1776/tcp   # Consolidated logging with syslog-ng
  ```

- Create the following symbolic link:

  ```
  ln -sf /etc/syslog-ng.conf.server /etc/syslog-ng.conf
  ```

- The `syslog-ng` startup procedure, `/sbin/init.d/syslog-ng`, relies on several configuration variables. Edit `/etc/rc.config.d/syslog-ng` as follows:
  - Change the `CLOG_CONFIGURED` line to:

    ```
    CLOG_CONFIGURED=1
    ```

  - Add the following lines:

    ```
    CLOG_CONSOLIDATOR=1
    CLOG_FS=directory where the consolidated logs will be stored
    ```

    If using the TCP protocol, add:

    ```
    CLOG_TCP=1
    CLOG_TCP_PORT=tcp port chosen for log consolidation
    ```

    otherwise, if using the UDP protocol, add:

    ```
    CLOG_TCP=0
    ```

    If consolidating the local `syslogs`, add:

    ```
    CLOG_SYSLOG=1
    ```

    otherwise add:

    ```
    CLOG_SYSLOG=0
    ```

    For a standalone consolidator, add the following:

    ```
    CLOG_SYSTEM_LOG_CONSOLIDATION_DIR=<consolidated log directory/syslog>
    CLOG_SERVICEGUARD_PACKAGE_LOG_CONSOLIDATION_DIR=<consolidated log directory/packages>
    ```

  - Add the following two values that are used by the System and Consolidated Log Viewer:

    ```
    CLOG_LAYOUTS_DIR=/var/opt/dsau/layouts
    CLOG_ADDITIONAL_LOG_DIRS[0]=/var/adm/syslog
    ```

- Test the configuration by performing the following steps:

1. Run /opt/dsau/sbin/syslog-ng with the -s or --syntax-only option to verify the syntax of the /etc/syslog-ng.conf file. This should be a symbolic link to /etc/syslog-ng.conf.server as described previously.
2. Start syslog-ng using /sbin/init.d/syslog-ng start.
3. If consolidating the local syslogs, use logger *test-message* and make sure this message is in the consolidated syslog.log. If you are not consolidating the local logs, use the logger command from a log forwarding client. Note that the logger messages are first sent to the local syslog which forwards them to syslog-ng. syslogd by default suppresses duplicate messages. If you issue multiple logger test messages, make sure each is unique.

3.3.2.2 Manually Configuring a Serviceguard Cluster as a Log Consolidation Server

Configuring a Serviceguard cluster as a log consolidation server is similar to the steps for a single system. All cluster members must be up and accessible before proceeding.

Create the configuration files described below on every cluster member. The simplest approach is to configure one member completely and then copy each configuration file cluster-wide. The cexec and ccp tools can simplify replicating changes cluster-wide.

For a cluster configuration, syslog-ng is configured as a package so the log consolidation service is highly available. The package must be named clog and the package configuration files require the following information:

- Registered IP address and DNS name for the clog package
- The subnet associated with that IP address
- Cluster-wide storage configuration using LVM or VxVM
- A filesystem configured on the cluster-wide storage, that can be VxFS or CFS. Since consolidated logs grow rapidly, HP recommends that the filesystem be configured using the largefiles option and that there is room for growth.

Complete IP address registration and storage/filesystem configuration before continuing. For additional information on creating the Serviceguard storage/filesystem configuration for a package, refer to the *Managing Serviceguard* manual.

For an overview of how to configure consolidated logging in a cluster, see the section “Cluster Configuration Notes for clog” (page 52).

1. If you want the local `syslog` messages for the cluster itself to be part of the consolidated `syslog`, complete the following tasks:
   a. Start by configuring the standard `syslogd` to co-exist with a `syslog-ng` consolidator. By default, `syslogd` listens for incoming log messages on UDP port 514. To use the UDP protocol or consolidate this server's local `syslogs`, `syslog-ng` must listen on UDP port 514. Edit `/etc/rc.config.d/syslogd` and change `SYSLOGD_OPTS` to add the `-N` switch to prevent `syslogd` from listening on port 514. For example:

      ```
      SYSLOGD_OPTS="-D -N"
      ```

   b. Edit the `/etc/syslog.conf` file to forward log messages to UDP port 514 on the local host where they will be read by `syslog-ng`. Using the HP-UX default `/etc/syslog.conf` as the example, add the following lines:

      ```
      mail.debug              @log-consolidation-server
      *.info;mail.none        @log-consolidation-server
      ```

      where *`log-consolidation-server`* is the fully qualified domain name of the local cluster member. The name must be fully qualified or `syslogd` will not forward messages properly.

      If you have customized `syslog.conf`, make sure to add the forwarding lines for your customizations as well.

   c. Since `/etc/rc.config.d/syslogd` is generic, it can be distributed cluster-wide using `ccp`, as follows:

      ```
      # cpp /etc/rc.config.d/syslogd /etc/rc.config.d/
      ```

   d. The `/etc/syslog.conf` is specific to each member and the edits described previously must be performed on each cluster member.
   e. Once you have made the above changes on each cluster member, `syslogd` must be restarted for these changes to take effect. Use `cexec` to do this on all members of the cluster:

      ```
      # cexec "/sbin/init.d/syslogd stop;/sbin/init.d/syslogd start"
      ```

2. To configure `syslog-ng`, start with the same `syslog-ng.conf` templates used by the `clog_wizard`. On one cluster member, copy

   ```
   /opt/dsau/share/clog/templates/syslog-ng.conf.server.template
   ```

   to `/etc/syslog-ng.conf.server`. Then copy an

   ```
   /opt/dsau/share/clog/templates/syslog-ng.conf.client.template
   ```

   to `/etc/syslog-ng.conf.client`. Both files have tokens named `<%`*`token-name`*`%>` that are replaced by the wizard based on the administrator's answers to the wizard's questions.

   Manually replace the tokens in `/etc/syslog-ng.conf.server` as follows:

a. When using the TCP protocol and configuring the consolidation server to consolidate its own `syslogs`, replace the `<%UDP_LOOPBACK_SOURCE%>` token with:

```
source s_syslog_udp { udp(port(514)); };
```

Replace the `<%UDP_LOOPBACK_LOG%>` token with:

```
log { source(s_syslog_udp); destination(d_syslog_tcp); };
```

This causes the `syslog-ng` consolidator to read the local `syslogd`'s UDP messages and send them to `syslog-ng` on the local TCP port. Optionally, the destination could be set to be the local consolidation file directly (`destination(d_syslog)` in this default template), but the above configuration sets the consolidation server client components in the same manner as a remote client. In other words, when the consolidator is a client of itself, it is configured identically to remote clients.

If using the UDP protocol or not consolidating the local `syslogs` of this cluster, delete the `<%UDP_LOOPBACK_SOURCE%>` and `<%UDP_LOOPBACK_LOG%>` tokens.

b. Replace the `<%TYPE%>` tokens with either `udp` or `tcp` depending on the desired log transport to support. Note that even when using TCP clients, UDP clients are also supported, if the consolidation of the cluster's local `syslogs` is configured. There are multiple lines with the `<%TYPE%>` token and all must be edited appropriately.

c. For the "`source s_syslog_<%TYPE%>`" line, replace the `<%PORT%>` and `<%KEEP_ALIVE%>` tokens with appropriate values:

```
source s_syslog_<%TYPE%> {<%TYPE%>(port(<%PORT%>)<%KEEP_ALIVE%>); };
```

For TCP, the port needs to be an available TCP port on all cluster members. See the section "Configuring a Log Consolidation Standalone Server with clog_wizard" (page 46) for a discussion of selecting an available port. For UDP, use port 514.

`<%KEEP_ALIVE%>` applies only when selecting TCP as the log transport. Replace this token with "`keep-alive(yes)`" which instructs `syslog-ng` to keep connections open when it is rereading its configuration file. If using UDP, delete this token.

d. For the `destination d_syslog_<%TYPE%>` line, replace the `<%IP%>` and `<%PORT%>` tokens:

```
destination d_syslog_<%TYPE%> { <%TYPE%>("<%IP%>" port(<%PORT%>)); };
```

For example, for TCP:

```
destination d_syslog_tcp { tcp("package IP" port(1776)); };
```

where the `<%IP%>` is replaced by the `clog` package IP address or hostname and the `<%PORT%>` is replaced by the selected TCP port number.

For UDP:

```
destination d_syslog_udp { udp("package IP" port(514)); };
```

where `<%IP%>` is replaced by the clog package IP address or hostname and the `<%PORT%>` token is replaced by 514, the standard `syslog` UDP port.

e. Replace the `<%FS%>` token with the filesystem or directory where the consolidated logs will be kept. This filesystem/directory is the one managed by the Serviceguard package. For example:

   ```
   destination d_syslog { file("<%FS%>/syslog/syslog.log"); };
   ```

   becomes:

   ```
   destination d_syslog { file("/clog/syslog/syslog.log"); };
   ```

   Make sure that this filesystem mount point exists cluster-wide and that the storage fails over correctly cluster-wide. Since consolidated logs can grow quite large, HP recommends that this filesystem use the largefiles option and that there is sufficient room for growth.

   For additional information on creating the Serviceguard storage/filesystem configuration for a package, refer to the *Managing Serviceguard* manual.

3. Manually replace the tokens in `/etc/syslog-ng.conf.client` as follows:
   a. If configuring the cluster to consolidate its own `syslogs`, replace the `<%UDP_LOOPBACK_SOURCE%>` token with:

      ```
      source s_syslog_udp { udp(port(514)); };
      ```

      Replace the `<%UDP_LOOPBACK_LOG%>` token with:

      ```
      log { source(s_syslog_udp); destination(d_syslog_<type>); };
      ```

      where `<type>` is either `tcp` or `udp` depending on the desired log transport. This causes `syslog-ng` to read the local `syslogd`'s UDP messages and send them to the log consolidation server.

      If you do not want to consolidate the local `syslogs` of this cluster, delete the `<%UDP_LOOPBACK_SOURCE%>` and `<%UDP_LOOPBACK_LOG%>` tokens.
   b. Replace all the `<%TYPE%>` tokens with either `tcp` or `udp` depending on the desired log transport.
   c. Find the line: "`destination d_syslog_<%TYPE%>{ <%TYPE%>("<%IP%>"port(<%PORT>%>)); };.`"

      Replace `<%IP%>` with the IP address of the `clog` package. For TCP, replace `<%PORT%>` with the TCP port used for log forwarding (selected above). For UDP, replace `<%PORT%>` with 514, the standard UDP port.

4. The `syslog-ng` startup procedure, `/sbin/init.d/syslog-ng`, relies on several configuration variables. Edit `/etc/rc.config.d/syslog-ng` as follows:
   a. Change the `CLOG_CONFIGURED` line to:
      ```
      CLOG_CONFIGURED=1
      ```
   b. Add the following lines:
      ```
      CLOG_CONSOLIDATOR=1
      ```
      If using the TCP protocol, add:
      ```
      CLOG_TCP=1
      CLOG_TCP_PORT=tcp port chosen for log consolidation
      ```
      otherwise, if using the UDP protocol, add:
      ```
      CLOG_TCP=0
      ```
      If consolidating the local `syslogs`, add:
      ```
      CLOG_SYSLOG=1
      ```
      otherwise, add:
      ```
      CLOG_SYSLOG=0
      ```
      If consolidating package logs of this cluster, add:
      ```
      CLOG_PACKAGE=1
      ```
      otherwise
      ```
      CLOG_PACKAGE=0
      ```
   c. Add the following two values which are used by the System and Consolidated Log Viewer:
      ```
      CLOG_LAYOUTS_DIR=/var/opt/dsau/layouts
      CLOG_ADDITIONAL_LOG_DIRS[0]=/var/adm/syslog
      ```
5. All the files edited thus far need to be distributed cluster-wide:
   ```
   # ccp /etc/syslog-ng.conf.server /etc/
   # ccp /etc/syslog-ng.conf.client /etc/
   # ccp /etc/rc.config.d/syslog-ng /etc/rc.config.d/
   ```
6. When using TCP, record the port number you chose above in the `/etc/services` file. For example, add the line:
   ```
   clog_tcp  1776/tcp   # Consolidated logging with syslog-ng
   ```
   Add this line to `/etc/services` for each member of the cluster.

3.3.2.2.1 Creating the clog Package

To create the consolidated logging or `clog` package, start by copying the package templates:

```
# mkdir /etc/cmcluster/clog
# cd /etc/cmcluster/clog
# cp /opt/dsau/share/serviceguard/templates/clog.conf.template clog.conf
# cp /opt/dsau/share/serviceguard/templates/clog.script.template clog
# chmod +x clog
```

Both the `clog.conf` package configuration file and the `clog` package control script need to be edited to replace marker tokens with the correct values.

For `clog.conf`, there is only one token to replace, `<%SG_PKG_SUBNET%>`. This identifies the package's subnet. It is the same as the subnet value in the package control script. Use `netstat -i` to help identify the proper subnet for the package's IP address.

For the package control script, `clog`, make the changes described below.

The default script template assumes you are using an LVM-based storage configuration. Replace the volume group/filesystem related tokens as appropriate for the package's storage configuration as follows:

1. Find the line "`VG[0]="<%SG_PKG_VOL_GRP%>"`" and replace the token with the name of the VM volume group for the package. For example:

   ```
   VG[0]="vgclog"
   ```

   If using VxVM, comment out the LVM Volume Group line `VG[0]="<%SG_PKG_VOL_GRP%>"`. Uncomment the line "`VXVM_DG[0]=`" and put in the VxVM Disk Group.

2. Find the line "`LV[0]="<%SG_PKG_LOG_VOL%>"`" and replace the token with the full name of the logical volume. For example:

   ```
   LV[0]="/dev/vgclog/lvol1"
   ```

3. Find the line "`FS[0]="<%SG_PKG_FS%>"`" and replace the token with the name of the filesystem created for this package. For example:

   ```
   FS[0]="/clog"
   ```

   All the consolidated logs will reside on this filesystem. The specific location for the consolidated package logs and the consolidated `syslogs` is specified in the `/etc/syslog-ng.conf.server` file. Using `/clog` as the example, the default locations based on the template `/etc/syslog-ng.conf.server` file are:

   ```
   /clog/syslog/syslog.log
   /clog/packages/package name.log
   ```

4. Find the line "`FS_MOUNT_OPT[0]="<%SG_PKG_MNT_OPT%>":`" and replace the token with the filesystem's mount options. For example:

   ```
   FS_MOUNT_OPT[0]=-o rw,largefiles
   ```

5. Find the line "`FS_TYPE[0]="<%SG_PKG_FS_TYPE%>"`" and replace the token with the filesystem type. For example:

   ```
   FS_TYPE[0]=vxfs
   ```

6. Find the line "`FS_UMOUNT_OPT[0]="<%SG_PKG_FS_UMOUNT_OPT%>"`" and replace the token with any filesystem `umount` options. The token can be removed and this option left blank if there are no special `umount` options. For example:

   ```
   FS_UMOUNT_OPT[0]=""
   ```

7. Find the line "`FS_FSCK_OPT[0]="<%SG_PKG_FS_FSCK_OPT%>"`" and replace the token with any filesystem specific fsck options. The token can be deleted and this option left blank. For example:

   ```
   FS_FSCK_OPT[0]=
   ```

8. Find the line "`IP[0]="<%SG_PKG_IP%>"`" and replace the token with the IP address of the clog package. For example:

   ```
   IP[0]= 192.119.152.3
   ```

9. Find the line "`SUBNET[0]="<%SG_PKG_SUBNET%>"`" and replace the token with the subnet for the packages IP address. Use `netstat -i` to help determine the subnet. For example:

   ```
   SUBNET[0]= 192.119.152.0
   ```

You next need to distribute the package files cluster-wide. To do this, perform the following steps:

1. First, create the package directory on all the other members:

   ```
   # cexec mkdir /etc/cmcluster/clog
   ```

2. Copy the package control script and package ASCII configuration file:

   ```
   # ccp clog clog.conf /usr/local/cmcluster/conf/clog/
   ```

3. Update the `/etc/rc.config.d/syslog-ng` file, by adding the following lines:

   ```
   CLOG_PKG_VOL_GRP=LVM-volume-group
   CLOG_PKG_LOG_VOL=logical-volume(full path)
   ```

```
CLOG_PKG_FS=filesystem mount point where the consolidated logs are stored
CLOG_PKG_MNT_OPT=file systems mount options such as -o rw,largefiles
CLOG_PKG_FS_TYPE=file system type
CLOG_PKG_IP=IP address of the clog package
CLOG_PKG_SUBNET=subnet of the clog package's IP address
CLOG_SYSTEM_LOG_CONSOLIDATION_DIR=file system mount point/syslog
CLOG_SERVICEGUARD_PACKAGE_LOG_CONSOLIDATION_DIR=file system mount point/packages
CLOG_PKG_RETRY_TIMES=1
CLOG_PKG_MONITOR_INTERVAL=5
```

4. Distribute it cluster-wide:

   ```
   # ccp /etc/rc.config.d/syslog-ng /etc/rc.config.d/
   ```

3.3.2.2.2 Testing and Starting the clog Package

Before starting the package, test the configuration thus far:

1. Run `/opt/dsau/sbin/syslog-ng` with the `-s` or `--syntax-only` option to verify the syntax of the`/etc/syslog-ng.conf.server` and`/etc/syslog-ng.conf.client` files. For the package's adoptive node, a symbolic link will be created named `/etc/syslog-ng.conf` and this symbolic link will point to the `.server` file. For the remaining cluster members, the symbolic link will point to the`.client` file. Since the package is not yet running, use `syslog-ng` to check each file explicitly as follows:

   ```
   # /opt/dsau/sbin/syslog-ng --syntax-only --cfgfile /etc/syslog-ng.conf.server
   # /opt/dsau/sbin/syslog-ng --syntax-only --cfgfile /etc/syslog-ng.conf.client
   ```

   If all the edits have been applied correctly, no errors should be displayed.

2. Start `syslog-ng` on each cluster member. Each `syslog-ng` will start as a log forwarding client:

   ```
   # cexec /sbin/init.d/syslog-ng start
   ```

   Use the cluster-wide ps command, `cps`, to validate that all the daemons started correctly:

   ```
   # cps -ef   grep syslog-ng
   ```

   You should see a `syslog-ng` daemon running on each cluster member.

3. Create the clog package:

   ```
   # cd /etc/cmcluster/clog/
   # cmapplyconf -P clog.conf
   ```

   Serviceguard will validate the package configuration and report any errors. Correct any errors and try again.

4. Start the clog package:

   ```
   # cmmodpkg -e clog
   ```

   Then use cmviewcl to make sure it is running:

   ```
   # cmviewcl -p clog
   ```

   If there are problems running the package, check the `/etc/cmcluster/clog/clog.log` files on each member to help troubleshoot the problem.

5. Validate that log forwarding is working properly. If consolidating the cluster's local syslogs, use "logger *test-message*" and make sure this message is in the consolidated syslog.log. If you are not consolidating local logs, use the logger command from a log forwarding client.

   Note that logger messages are first sent to the local syslogd, which forwards them to syslog-ng. By default, syslogd suppresses duplicate messages. If you issue multiple logger test messages, make sure each is unique. The logger message should appear in the consolidated syslog.log located in the directory specified in the /etc/syslog-ng.conf.server file. For the examples above, that directory would be /clog/syslog/syslog.log.

   If consolidating package logs for this cluster, any package actions that generate package log information, such as a package failover, should cause a consolidated package log to appear in /clog/packages.

3.3.2.2.3 Using VxVM Instead of LVM

The default clog package script template assumes that you are using LVM based storage. To use VxVM storage instead, you must edit the clog package script under /usr/local/cmcluster/conf/clog/clog. Comment out the LVM Volume Group line "VG[0]="xxx"", uncomment the line "VXVM_DG[0]=", and enter the VxVM Disk Group.

3.3.2.3 Manually Configuring Log Forwarding Clients

You can configure either a standalone system or a Serviceguard cluster as log forwarding clients. You can also manually configure Serviceguard package logs as if they were syslog data. For each case, you set up both syslogd and syslog-ng.

3.3.2.3.1 Manually Configuring a Standalone Log Forwarding Client

1. Start by configuring the standard syslogd to co-exist with a syslog-ng forwarder.
   a. By default, syslogd listens for incoming log messages on UDP port 514. If you want to forward this system's syslogs, syslog-ng must listen on UDP port 514. Edit /etc/rc.config.d/syslogd and change SYSLOGD_OPTS to add the-N switch which prevents syslogd from listening on port 514. For example:

      ```
      SYSLOGD_OPTS="-D -N"
      ```

   b. Edit the system's /etc/syslog.conf file to forward log messages to port 514 on the local host where they will be read by syslog-ng. Using the HP-UX default /etc/syslog.conf as the example, add the following lines:

      ```
      mail.debug              @fully qualified hostname
      *.info;mail.none        @fully qualified hostname
      ```

      where fully qualified hostname is the fully qualified hostname of this system. The name must be fully qualified or syslogd will not forward the messages properly.

      If you have customized syslog.conf, make sure to add the forwarding lines for your customizations as well.

   c. Stop and restart syslogd for these changes to take effect:

      ```
      # /sbin/init.d/syslogd stop
      # /sbin/init.d/syslogd start
      ```

2. To configure syslog-ng, start with the same syslog-ng.conf templates used by the clog_wizard.

   Copy /opt/dsau/share/clog/templates/syslog-ng.conf.client.template to /etc/syslog-ng.conf.client. This file has tokens named <%*token-name*%> that are replaced by the wizard based on the administrator's answers to the wizard's questions.

   Manually replace the tokens in /etc/syslog-ng.conf.client as follows:

a. If configuring the system to forward its `syslogs` to the consolidation server, replace the `<%UDP_LOOPBACK_SOURCE%>` token with:

   ```
   source s_syslog_udp { udp(port(514)); };
   ```

   Replace the `<%UDP_LOOPBACK_LOG%>` token with:

   ```
   log { source(s_syslog_udp); destination(d_syslog_type); };
   ```

   where `type` is either `tcp` or `udp` depending on the desired log transport. This causes `syslog-ng` to read the local `syslogd`'s UDP messages and send them to the log consolidation server. If you do not want to consolidate the local `syslogs` of this system, delete the `<%UDP_LOOPBACK_SOURCE%>` and `<%UDP_LOOPBACK_LOG%>` tokens.

b. Replace all the `<%TYPE%>` tokens with either tcp or udp depending on the desired log transport.

c. Find the line

   ```
   "destination d_syslog_<%TYPE%>{<%TYPE%>("<%IP%>" port(<%PORT%>)); };"
   ```

   If using the UDP protocol, replace `<%IP%>` with the IP address of the log consolidation server and `<%PORT%>` with 514, the standard UDP port.

   If using the TCP protocol with `ssh` port forwarding, replace `<%IP%>` with 127.0.0.1 and `<%PORT%>` with the port chosen for `ssh` port forwarding. The same guidelines for choosing a free `syslog-ng` TCP port apply to this port. For details, refer to "Configuring a Log Consolidation Standalone Server with clog_wizard" (page 46).

   Non-interactive secure shell authentication must be set up between this system and the log consolidator (you can use the `/opt/dsau/bin/csshsetup` tool for the configuration). For details, refer to "ssh Port Forwarding" (page 78).

   If using the TCP protocol without `ssh` port forwarding, replace `<%IP%>` with the IP address of the log consolidation server and `<%PORT%>` with TCP port chosen on the log consolidator used for log consolidation.

d. Create the following symbolic link:

   ```
   ln -sf /etc/syslog-ng.conf.client /etc/syslog-ng.conf
   ```

3. The `syslog-ng startup` procedure, `/sbin/init.d/syslog-ng`, relies on several configuration variables. Edit `/etc/rc.config.d/syslog-ng` as follows:
   a. Change the `CLOG_CONFIGURED` line to:
   ```
   CLOG_CONFIGURED=1
   ```
   b. Add the following lines:
   ```
   CLOG_CONSOLIDATOR=0
   CLOG_CONS_IP=IP address of the log consolidator
   ```
   c. If using the TCP protocol add the following lines:
   ```
   CLOG_TCP=1
   CLOG_TCP_PORT=log consolidation server tcp port
   ```
   If using `ssh` port forwarding add:
   ```
   CLOG_SSH=1
   CLOG_SSH_PORT=ssh port chosen
   ```
   otherwise , use:
   ```
   CLOG_SSH=0
   ```
   otherwise, if using the UDP protocol, use:
   ```
   CLOG_TCP=0
   ```
   If consolidating the local `syslogs`, use:
   ```
   CLOG_SYSLOG=1
   ```
   otherwise, use:
   ```
   CLOG_SYSLOG=0
   ```
4. When using TCP with `ssh` port forwarding, record the `ssh` port number you chose above in the `/etc/services` file. For example, add the line:
   ```
   clog_ssh  1776/tcp    # Consolidated logging with ssh port forwarding
   ```
   Add this line to the `/etc/services` file of this system.
5. Test the configuration by performing the following steps:
   a. Run `/opt/dsau/sbin/syslog-ng` with the `-s` or `--syntax-only` option to verify the syntax of the `/etc/syslog-ng.conf` file. This should be a symbolic link to `/etc/syslog-ng.conf.client` as described above.
   b. Start `syslog-ng` using the following command:
   ```
   # /sbin/init.d/syslog-ng start
   ```
   c. If consolidating the local `syslogs`, use "`logger` *`test-message`*" and make sure this message is in the consolidated `syslog.log` on the log consolidation server. Note that the `logger` messages are first sent to the local `syslog` which forwards them to `syslog-ng`. By default, `syslogd` suppresses duplicate messages. If you issue multiple `logger` test messages, make sure each is unique.

3.3.2.3.2 Manually Configuring a Serviceguard Cluster as a Log Forwarding Client

Configuring a Serviceguard cluster as a log forwarding client is similar to configuring a single system. All cluster members must be up and accessible before proceeding. You will first configure `syslogd`, then `syslog-ng`.

Create the configuration files described below on every cluster member. The simplest approach is to completely configure one member and then copy each configuration file cluster-wide. The `cexec` and `ccp` tools can simplify replicating changes cluster-wide.

1. If you want the `syslog` messages for the cluster to be forwarded to the log consolidator, do the following:

    a. Start by configuring the standard `syslogd` to co-exist with a `syslog-ng` forwarder. By default, `syslogd` listens for incoming log messages on UDP port 514. To forward this cluster's `syslogs`, `syslog-ng` must listen on UDP port 514. Edit `/etc/rc.config.d/syslogd` and change `SYSLOGD_OPTS` to add the `-N` switch; this prevents `syslogd` from listening on port 514. For example,

    ```
    SYSLOGD_OPTS="-D -N"
    ```

    b. Edit the system's `/etc/syslog.conf` file to forward log messages to port 514 on the local host where they will be read by `syslog-ng`. Using the HP-UX default /etc/syslog.conf as the example, add the following lines:

    ```
    mail.debug          @fully qualified hostname
    *.info;mail.none    @fully qualified hostname
    ```

    where `fully qualified hostname` is the fully qualified hostname of this cluster member. This name must be fully qualified or `syslogd` will not forward the messages properly.

    If you have customized `syslog.conf`, make sure to add the forwarding lines for your customizations as well.

    c. Stop and restart `syslogd` as follows for these changes to take effect:

    ```
    # /sbin/init.d/syslogd stop
    # /sbin/init.d/syslogd start
    ```

    d. Since `/etc/rc.config.d/syslogd` is generic, it can be distributed cluster-wide using `ccp`:

    ```
    # cpp /etc/rc.config.d/syslogd /etc/rc.config.d/
    ```

    e. The `/etc/syslog.conf` is specific to each member and the edits described above must be performed on each cluster member.

    f. Making the above changes on each cluster member, `syslogd` must be restarted for these changes to take effect. Use `cexec` to do this on all members of the cluster:

    ```
    # cexec "/sbin/init.d/syslogd stop;/sbin/init.d/syslogd start"
    ```

2. To configure `syslog-ng`, start with the same `syslog-ng.conf` templates used by the `clog_wizard`.

   On one cluster member, copy the `/opt/dsau/share/clog/templates/syslog-ng.conf.client.template` to `/etc/syslog-ng.conf.client`. This file contains tokens named `<%`*`token-name`*`%>` which are replaced by the wizard based on the administrator's answers to the wizard's questions.

   Manually replace the tokens in `/etc/syslog-ng.conf.client` as follows:

   a. If configuring the cluster to forward its `syslogs` to the consolidation server, replace the `<%UDP_LOOPBACK_SOURCE%>` token with:

      ```
      source s_syslog_udp { udp(port(514)); };
      ```

      Replace the `<%UDP_LOOPBACK_LOG%>` token with:

      ```
      log { source(s_syslog_udp); destination(d_syslog_type); };
      ```

      where `type` is either `tcp` or `udp` depending on the desired log transport. This causes `syslog-ng` to read the local `syslogd`'s UDP messages and send them to the log consolidation server. If you do not want to consolidate the local syslogs of this cluster, delete the `<%UDP_LOOPBACK_SOURCE%>` and `<%UDP_LOOPBACK_LOG%>` tokens.

   b. Replace all the `<%TYPE%>` tokens with either `tcp` or `udp` depending on the desired log transport.

   c. Find the line

      ```
      "destination d_syslog_<%TYPE%> {<%TYPE%>("<%IP%>"port(<%PORT%>)); };"
      ```

      If using the UDP protocol, replace `<%IP%>` with the IP address of the log consolidation server and `<%PORT%>` with 514, the standard UDP port. If using TCP protocol with `ssh` port forwarding, replace `<%IP%>` with 127.0.0.1 and `<%PORT%>` with the port chosen for `ssh` port forwarding. The same guidelines for choosing a free `syslog-ng` TCP port apply to this port. For details, refer to "Configuring a Log Consolidation Standalone Server with clog_wizard" (page 46). (Note that the `ssh` port chosen should be a free port on all cluster members). Non-interactive secure shell authentication must be set up between each member of this cluster and the log consolidator (can use `/opt/dsau/bin/csshsetup` tool for the configuration). For details, refer to "ssh Port Forwarding" (page 78).

      If using the TCP protocol without `ssh` port forwarding, replace `<%IP%>` with the IP address of the log consolidation server and `<%PORT%>` with TCP port chosen on the log consolidator used for log consolidation.

3. The `syslog-ng` startup procedure, `/sbin/init.d/syslog-ng`, relies on several configuration variables. Edit `/etc/rc.config.d/syslog-ng` as follows:
   a. Change the `CLOG_CONFIGURED` line to:
      ```
      CLOG_CONFIGURED=1
      ```
   b. Add the following lines:
      ```
      CLOG_CONSOLIDATOR=0
      CLOG_CONS_IP=IP address of the log consolidator
      ```
   c. If using the TCP protocol, add the following lines:
      ```
      CLOG_TCP=1
      CLOG_TCP_PORT=log consolidation server tcp port
      ```
      If using ssh port forwarding, add:
      ```
      CLOG_SSH=1
      CLOG_SSH_PORT=ssh port chosen
      ```
      otherwise, add:
      ```
      CLOG_SSH=0
      ```
      otherwise, if using the UDP protocol, add:
      ```
      CLOG_TCP=0
      ```
      If consolidating the local syslogs, add:
      ```
      CLOG_SYSLOG=1
      ```
      otherwise add:
      ```
      CLOG_SYSLOG=0
      ```
      If consolidating this cluster's package logs, add:
      ```
      CLOG_PACKAGE=1
      ```
      otherwise, add:
      ```
      CLOG_PACKAGE=0
      ```
4. All the files edited thus far need to be distributed cluster-wide:
   ```
   # ccp /etc/syslog-ng.conf.client /etc/
   # ccp /etc/rc.config.d/syslog-ng /etc/rc.config.d/
   ```
   Create the following symbolic link on each cluster member:
   ```
   # ln -sf /etc/syslog-ng.conf.client /etc/syslog-ng.conf
   ```
5. When using TCP with `ssh` port forwarding, record the `ssh` port number you chose above in the `/etc/services` file. For example, add the line:
   ```
   clog_ssh  1776/tcp   # Consolidated logging with ssh port forwarding
   ```
   Add this line to the `/etc/services` file of each cluster member.
6. To consolidate this cluster's package logs, additional manual steps are needed on the log consolidation server. Each time a package is created or deleted on this cluster, these steps need to be done. Refer to "Consolidating Package Logs on the Log Consolidation Server" (page 74).

7. Test the configuration by performing the following steps:
   a. Run `/opt/dsau/sbin/syslog-ng` with the `-s` or `--syntax-only` option to verify the syntax of the `/etc/syslog-ng.conf` file. This should be a symbolic link to `/etc/syslog-ng.conf.client` as described above.
   b. Start `syslog-ng` on all cluster members using

      ```
      # cexec "/sbin/init.d/syslog-ng start"
      ```

   c. If consolidating the local syslogs, use "`logger` *`test-message`*" and make sure this message is in the consolidated `syslog.log` on the log consolidation server. Note that the `logger` messages are first sent to the local syslog which forwards them to syslog-ng. By default, syslogd suppresses duplicate messages. If you issue multiple logger test messages, make sure each is unique.

3.3.2.3.3 Forwarding ASCII Log Data

The Consolidated Logging Wizard can automatically configure Serviceguard package logs to be monitored and forwarded as if they were `syslog` data. These logs are standard ASCII log files. For manual configurations, setting CLOG_PACKAGE=1, as described in "Manually Configuring a Serviceguard Cluster as a Log Forwarding Client" (page 68), automatically takes care of package log forwarding.

You can manually configure log consolidation for arbitrary ASCII log files using the following procedures for:

- Forwarding text logs for consolidation
- Consolidating text logs on the log consolidation server

3.3.2.3.3.1 Forwarding Text Logs for Consolidation

This procedure contains several steps:

1. Make sure the system is configured as a log consolidation client or server. (Check the `/etc/rc.config.d/syslog-ng` file: if CLOG_CONFIGURED=1, the system is configured.) If not, use the Consolidated Logging wizard or the manual configuration methods described in this document to configure the system for log consolidation.

2. Edit the system's `/etc/rc.config.d/syslog-ng` file. For each ASCII log file you plan to consolidate, do the following:
   - Add an entry to the `CLOG_TEXT_LOG[]` array, starting at array index 0. The value for the array entry must be a complete path to the ASCII log file. For example,

     ```
     CLOG_TEXT_LOG[0]=/var/opt/myapp/myapp.log
     CLOG_TEXT_LOG[1]=/var/adm/logs/mylog.log
     ```

   - By default, as each line of the text log is forwarded to the log consolidator, values for several parameters are prepended to each record make the record compatible with syslog record format.
     — If the system is part of a Serviceguard cluster, the following values are prepended: *date timestamp hostname clustername_logfilename*
     — If the system is not part of a Serviceguard cluster, the following values are prepended: *date timestamp hostname hostname_logfilename*

       This is equivalent to specifying the following: `CLOG_TEXT_FORMAT[n]="custom"`

     For example, assuming the log files `myapp.log`and `mylog.log`are not in `syslog` format, the original example could have been fully specified as the following:

     ```
     CLOG_TEXT_LOG[0]=/var/opt/myapp/myapp.log
     CLOG_TEXT_FORMAT[0]="custom"
     CLOG_TEXT_LOG[1]=/var/adm/logs/mylog.log
     CLOG_TEXT_FORMAT[1]="custom"
     ```

If the text file is already formatted using the `syslog`-compatible format shown above, then add the corresponding `CLOG_TEXT_FORMAT[n]` entry with a value of "syslog".

For example,

```
CLOG_TEXT_LOG[2]=/var/adm/app/logs/app.log
CLOG_TEXT_FORMAT[2]="syslog"
```

If no `CLOG_TEXT_FORMAT[]` entry is made for a corresponding `CLOG_TEXT_LOG[]` entry, the default is "custom".

For an example of a file in `syslog`format, see the actual system log file `/var/adm/syslog/syslog.log`.

3. After completing the required edits, there are two ways to initiate forwarding for the new log files:
   - Restarting `syslog-ng` (recommended if not in a production environment)
   - Manual restart, that does not disrupt syslog-ng

   The procedures are the following:

   - Restart `syslog-ng`. For example, issue the following command:

     ```
     /sbin/init.d/syslog-ng restart
     ```

     This will disrupt `syslog-ng` and may cause loss of messages that are being forwarded or consolidated. If your system is not in a production environment, and losing some messages is acceptable, this method is preferable to using the more difficult manual restart.

   - Start the `clog_tail` process manually for the text log file.

     If the text log file is in `syslog` format, use the following command:

     ```
     /opt/dsau/bin/clog_tail -q -n 0 -p log_file_path
     ```

     If the text log file is in a custom format, use the following command:

     ```
     /opt/dsau/bin/clog_tail -q -n 0 -p -a log_file_path
     ```

     where *log_file_path* is the complete path to the ASCII log file.

     For example, for a log called `myapp.log` in custom format, the following command starts `clog_tail`:

     ```
     # /opt/dsau/bin/clog_tail -q -n 0 -p -a /var/opt/myapp/myapp.log
     ```

     If the system is a Serviceguard cluster, copy the edited `/etc/rc.config.d/syslog-ng` file cluster-wide with the following command:

     ```
     # ccp /etc/syslog-ng.conf.server /etc/
     ```

     Either restart `syslog-ng` or start the `clog_tail` of the `text-log` on all cluster nodes.

3.3.2.3.3.2 Consolidating Text Logs on the Log Consolidation Server

To consolidate the text logs forwarded from clients to a Log Consolidation Server, complete the following tasks on the Log Consolidation Server:

1. For each text log that will be forwarded from a client, add the following destination, filter and log lines to the file `syslog-ng.conf.server`, after the section called `HP_AUTOMATED_LOG_FILE_CONSOLIDATION`:

   For the destination line:

   ```
   destination d_node1_text1{ file("fs/textdir/node1_text1.log"); };
   ```

   For the filter line:

   ```
   filter f_node1_text1{ program(node1_text1.log); };
   ```

For the log line:

```
log { source(s_syslog_type); filter (f_node1_text1);destination(d_node1_text1); flags(final);};
```

where *text1* is the text logfile name, *node1* is the relocatable IP address (for a Serviceguard cluster) or *hostname* (for a non-Serviceguard cluster) that is forwarding this text log, *fs* is the filesystem on the log consolidator where the consolidated logs will be stored, *type* is the "s_source" definition, either `_tcp` or `_udp`, depending on the log transport selected, and *textdir* is the name of the directory where you plan to store all text logs.

2. If the log consolidator is a Serviceguard cluster, make sure to copy the edited `/etc/syslog-ng.conf.server` file cluster-wide with the following command:

   ```
   # ccp /etc/syslog-ng.conf.server /etc/
   ```

3. sighup `syslog-ng` on the log consolidator so that it rereads its configuration file. (sighup is a UNIX method for restarting a process.) On a Serviceguard log consolidator, sighup `syslog-ng` only on the adoptive node of the clog package.

3.3.2.3.3.3 Stopping Consolidation of Text Logs

To stop consolidation of text logs, complete the following tasks for each system where you plan to stop log consolidation:

1. Edit the system's `/etc/rc.config.d/syslog-ng` file. For each ASCII log file you plan to stop consolidating, do the following:
   - Remove the CLOG_TEXT_LOG[] and the corresponding CLOG_TEXT_FORMAT[] entry for that text log, if present.

     For example, to stop consolidation of the text log `myapp.log`, remove the following entries from the `/etc/rc.config.d/syslog-ng` file:

     ```
     CLOG_TEXT_LOG[4]=/var/opt/myapp.log
     CLOG_TEXT_FORMAT[4]="syslog"
     ```

2. After making the required edits, restart `syslog-ng` using the command:

   `/sbin/init.d.syslog-ng restart` so that the changes to the `/etc/rc/config.d/syslog-ng` file take effect.

   If the system is a Serviceguard cluster, copy the edited `/etc/rc.config.d/syslog-ng` file cluster-wide with the following command:

   ```
   # ccp /etc/syslog-ng.conf.server /etc/
   ```

   Restart `syslog-ng` on all cluster nodes.

3. For each text log that is deleted from a client that is forwarding its text logs, delete the corresponding destination, filter and log lines from the `/etc/syslog-ng.conf.server` file of the log consolidator. `syslog-ng` on the log consolidator must be sighup'd so that it rereads this configuration file.

   On a Serviceguard log consolidator, the updated `/etc/syslog-ng.conf.server` file must be distributed cluster-wide. However, the sighup of `syslog-ng` needs to be done only on the adoptive node of the clog package.

3.3.2.4 Consolidating Package Logs on the Log Consolidation Server

When remote Serviceguard clusters forward package log data to a log consolidation server, the default is to place all forwarded log messages in the consolidated `syslog.log` file on the consolidation server. It can be much more convenient to place these messages in cluster-specific consolidated package log files instead of in the consolidated `syslog.log` file. This can be achieved using `syslog-ng`'s filtering rules as follows:

1. For each package that will be forwarded from a cluster client, add the following destination, filter and log lines to the `syslog-ng.conf.server` file, after the `HP_AUTOMATED_LOG_FILE_CONSOLIDATION` section.

   ```
   destination d_<clu1>_<pkg1> { file("<fs>/packages/<clu1>_<pkg1>.log"); };
   filter f_<clu1>_<pkg1> { program(<clu1>_<pkg1>.log); };
   log { source(s_syslog_<type>);
   filter(f_<clu1>_<pkg1>);destination(d_<clu1>_<pkg1>); flags(final);};
   ```

   where `<pkg1>` is the package name, `<clu1>` is the package's relocatable IP address that is forwarding this package log, `<type>` is either `_tcp` or `_udp`, depending on the log transport selected, and `<fs>` is the filesystem on the log consolidator where the consolidated logs will be stored.

2. If the log consolidator is a Serviceguard cluster, make sure to copy the edited `/etc/syslog-ng.conf.server` file cluster-wide as follows:

   ```
   # ccp /etc/syslog-ng.conf.server /etc/
   ```

3. sighup `syslog-ng` on the log consolidator, so that it re-reads its configuration file. (sighup is a UNIX method for restarting a process.) On a Serviceguard log consolidator, sighup `syslog-ng` only on the adoptive node of the `clog` package.
4. For each package that is deleted from a cluster client that is forwarding its package logs, delete the corresponding destination, filter and log lines from the `/etc/syslog-ng.conf.server` file of the log consolidator. `syslog-ng` on the log consolidator will need to be sighup'd so that it re-reads this configuration file. On a Serviceguard log consolidator, the updated `/etc/syslog-ng.conf.server` file will need to be distributed cluster-wide. However, the sighup of `syslog-ng` only needs to be done on the adoptive node of the `clog` package.

3.4 Disabling Log Consolidation

The `clog_wizard` enables log consolidation configurations but does not have an unconfigure or deconfigure option. Thus you must disable a system from participating in log consolidation manually, using the following instructions for each system type to:

- Disable a standalone log consolidation system
- Disable a Serviceguard cluster log consolidation system
- Disable a standalone log forwarding client
- Disable a Serviceguard log forwarding client

3.4.1 Disabling a Standalone Log Consolidation System

Perform the following steps to disable log consolidation:

1. If the local syslogs were being consolidated, or the UDP protocol was used, edit `/etc/rc.config.d/syslogd` and change `SYSLOGD_OPTS` to remove the `-N` switch. For example, make the following edit:

   ```
   SYSLOGD_OPTS="-D"
   ```

2. If the local syslogs were being consolidated, also edit the system's `/etc/syslog.conf` file to remove the following lines:

   ```
   mail.debug          @fully qualified hostname
   *.info;mail.none    @fully qualified hostname
   ```

   where `fully qualified hostname` is the fully qualified hostname of this system.

NOTE: A <tab> precedes each @ sign.

3. Stop and restart `syslogd` using the following commands:

   ```
   #/sbin/init.d/syslogd stop
   ```

```
#/sbin/init.d/syslogd start
```

4. Stop `syslog-ng`:

   ```
   # /sbin/init.d/syslog-ng stop
   ```

5. Edit the `/etc/rc.config.d/syslog-ng` file, as follows:
   a. Change the `CLOG_CONFIGURED` line to `CLOG_CONFIGURED=0`.
   b. Remove all other `CLOG` lines except for the following:

      ```
      CLOG_LAYOUTS_DIR=/var/opt/dsau/layouts
      CLOG_ADDITIONAL_LOG_DIRS[0]=/var/adm/syslog
      ```

6. If the TCP protocol was used, remove the following line from `/etc/services`:

   ```
   clog_tcp port/tcp # Consolidated logging with syslog-ng
   ```

3.4.2 Disabling a Serviceguard Cluster Log Consolidation System

Perform the following steps to disable log consolidation in a Serviceguard cluster. Perform these steps on each cluster member:

1. If local syslogs were being consolidated or the UDP protocol was used, edit `/etc/rc.config.d/syslogd` and change `SYSLOGD_OPTS` to remove the `-N` switch. For example:

   ```
   SYSLOG_OPTS="-D"
   ```

2. Stop and restart `syslogd` with the following commands:

   ```
   # /sbin/init.d/syslogd stop
   # /sbin/init.d/syslogd start
   ```

3. If the local syslogs were being consolidated, edit the system's `/etc/syslog.conf` file to remove the following lines:

   ```
   mail.debug              @fully qualified hostname
   *.info;mail.none        @fully qualified hostname
   ```

   Where `fully qualified hostname` is the fully qualified hostname of this system. Note that a <tab> precedes each @ sign.

4. Halt the `clog` package with the command:

   ```
   #/usr/sbin/cmhaltpkg clog
   ```

5. Stop `syslog-ng` with the following command:

   ```
   # /sbin/init.d/syslog-ng stop
   ```

   (This stops the `syslog-ng` daemon and package log consolidation if configured.)

6. Edit the `/etc/rc.config.d/syslog-ng` file and change the `CLOG_CONFIGURED` line to the following:

   ```
   CLOG_CONFIGURED=0
   ```

   Remove all other CLOG lines except for:

   ```
   CLOG_LAYOUTS_DIR=/var/opt/dsau/layouts
   CLOG_ADDITIONAL_LOG_DIRS[0]=/var/adm/syslog
   ```

7. Delete the clog package with the following command:

   ```
   # cmdeleteconf -p clog
   ```

3.4.3 Disabling a Standalone Log Forwarding Client

Perform the following steps to disable log forwarding on a standalone client:

1. If `syslog` messages were being forwarded to the log consolidator, edit `/etc/rc.config.d/syslogd` and change `SYSLOGD_OPTS` to remove the `-N` switch. For example,

   ```
   SYSLOGD_OPTS="-D"
   ```

2. Edit the systems `/etc/syslog.conf` file to remove the following lines:

   ```
   mail.debug              @fully qualified hostname
   *.info;mail.none        @fully qualified hostname
   ```

   where `fully qualified hostname` is the fully qualified hostname of this system.

NOTE: A <tab> precedes each @ sign.

3. Stop and restart `syslogd` with the following commands:

   ```
   #/sbin/init.d/syslogd stop
   #/sbin/init.d/syslogd start
   ```

4. Stop `syslog-ng` with the following command:

   ```
   # /sbin/init.d/syslog-ng stop
   ```

   This stops the `syslog-ng` daemon and also `ssh` port forwarding if configured.

5. Edit the `/etc/rc.config.d/syslog-ng` file and change the `CLOG_CONFIGURED` line to the following:

   ```
   CLOG_CONFIGURED=0
   ```

   Remove all other `CLOG` lines except for the following:

   ```
   CLOG_LAYOUTS_DIR=/var/opt/dsau/layouts
   CLOG_ADDITIONAL_LOG_DIRS[0]=/var/adm/syslog
   ```

6. If `ssh` port forwarding had been configured, remove the following line from `/etc/services`:

   ```
   clog_ssh port/tcp # Consolidated logging with ssh port forwarding
   ```

3.4.4 Disabling a Serviceguard Cluster Log Forwarding Client

Perform the following steps to disable log forwarding. Complete these steps on each cluster member:

1. If syslog messages were being forwarded to the log consolidator, edit `/etc/rc.config.d/syslogd` and change `SYSLOGD_OPTS` to remove the `-N` switch. For example, `SYSLOGD_OPTS="-D"`.
2. Edit the system's `/etc/syslog.conf` file to remove the following lines:

   ```
    mail.debug             @fully qualified hostname
   *.info;mail.none        @fully qualified hostname
   ```

   where `fully qualified hostname` is the fully qualified hostname of this system.

NOTE: A <tab> precedes each @ sign.

3. Stop and restart `syslogd` with the following commands:

   ```
   # /sbin/init.d/syslogd stop
   # /sbin/init.d/syslogd start
   ```

4. Stop `syslog-ng`:

   ```
   # /sbin/init.d/syslog-ng stop
   ```

   This stops the `syslog-ng` daemon, stops `ssh` port forwarding if configured, and stops package log forwarding if configured.)

5. Edit the `/etc/rc.config.d/syslog-ng` file and change the `CLOG_CONFIGURED` line to `CLOG_CONFIGURED=0`. Remove all other `CLOG` lines except for the following:

   ```
   CLOG_LAYOUTS_DIR=/var/opt/dsau/layouts
   CLOG_ADDITIONAL_LOG_DIRS[0]=/var/adm/syslog
   ```

6. If `ssh` port forwarding had been configured, remove the following line from `/etc/services`:

   ```
   clog_ssh port/tcp # Consolidated logging with ssh port forwarding
   ```

3.5 Securing Consolidated Logs

On a standard HP-UX system, all users can view the system's local `/var/adm/syslog/syslog.log`. Access to consolidated logs is typically restricted. The log consolidation server system itself is usually a restricted access system with strict security policies in place.

3.5.1 Log File Protections

One level of protection is the permissions on the consolidated log files themselves. This is controlled using the `syslog-ng.conf.server` file. Each syslog-ng "file" destination can have specific permissions specified. If the log directory for a consolidated file does not exist, syslog-ng can be instructed to create it (create_dirs(yes)) and set the directory's ownership and permissions on the directory as well. For example,

```
destination d_file { file("/clog/test/example.log" );
 dir_owner(root);
 dir_group(sys);
 dir_perm(0600);
 owner(root);
 group(sys);
 perm(0600);
};
```

3.5.2 ssh Port Forwarding

`ssh` port forwarding sets up a tunnel for the log traffic between the `syslog-ng` log forwarding client and the `syslog-ng` log consolidation server. This `ssh`-based tunnel is only available when using the TCP transport, not UDP. Also, `ssh` port forwarding is not used when forwarding log traffic within a Serviceguard cluster (member to member). Standard TCP or UDP is used for intra-cluster log traffic.

`ssh` port forwarding is transparent to syslog-ng. The `/etc/syslog-ng.conf.client` file is configured so that `syslog-ng` forwards log traffic to a local port managed by `ssh`. The local `ssh` connects to the remote `sshd` on the log consolidation server and `sshd` opens the standard `syslog-ng` TCP port. The remote log consolidation believes it has a standard log forwarding client and is unaware of the tunneling taking place.

One problem with `ssh` tunneling is failure of the log consolidation server. If the `syslog-ng` server stops or crashes, the remote `ssh` tunnels disconnect. The client `ssh` tunnels will try to reconnect at one minute intervals. The reconnect time is configurable.

Each failed reconnect attempt is logged to the client's local `syslog.log`. During this time, `syslog-ng`'s client log (`/var/adm/syslog/syslog-ng.log`) will show it trying to reconnect to the tunnel. The default reconnect time is 10 seconds. This is configurable using `syslog-ng's` global setting `"time_reopen(`*`seconds`*`)"` parameter. See the `syslog-ng` open source reference manual (`/opt/dsau/doc/syslog-ng`) for details.

3.5.2.1 ssh Port Forwarding to a Serviceguard Cluster Log Consolidator

When using `ssh` port forwarding with a Serviceguard cluster as the log consolidation server, a special ssh configuration is required.

In general, using `ssh` port forwarding requires that the log consolidation server perform a key exchange with the log forwarding client. Specifically, the `ssh` public key for the remote log forwarding client must be added to the consolidation server's authorized keys file. Also, the fingerprint for the log consolidation server is added to the log forwarding client's `/.ssh/known_hosts` file. The client log forwarder is a trusted system after this key exchange, and the consolidation server does not need to prompt for any `ssh` passwords at this point.

Since the consolidation server is a package, it can potentially run on every member of the cluster. This key exchange between the remote log forwarding client and a cluster member must be replicated for each cluster member. Each cluster member has to establish the same trust relationship to the log forwarding clients.

A problem can arise with the log forwarding client's `known_host` fingerprints. When using a package's relocatable IP address for the initial `ssh` key exchange, the client will have the adoptive node's fingerprint added to its local `/.ssh/known_hosts` file. When the package fails over and the `ssh` connection is reestablished, the new adoptive node will have a different fingerprint and `ssh` will detect this as a man-in-the-middle attack and refuse to reestablish the `ssh` tunnel.

In order to prevent this, each cluster member must look like the same system from the perspective of the log forwarding clients. This can be achieved by having each cluster member use an identical host key. The `ssh` host keys are located in `/opt/ssh/etc` and contained in the following files:

- `ssh_host_key`
- `ssh_host_key.pub`
- `ssh_host_dsa_key`
- `ssh_host_dsa_key.pub`
- `ssh_host_rsa_key`
- `ssh_host_rsa_key.pub`

Pick one of the cluster members and copy these files to the same directory on the other cluster members. Using the "cluster copy" or `ccp` tool is a quick way to do this, using the following commands:

```
# cd /opt/ssh/etc/
# ccp ssh_host_* /opt/ssh/etc/
```

Then from each log consolidation client, perform a standard `ssh` key exchange with the relocatable IP address of the `clog` package. One way to do this is using the `csshsetup` tool (see *csshsetup*(1)), as follows:

```
# csshsetup DNS name of the clog package
```

`csshsetup` will prompt for the password of the cluster in order to do the initial key exchange.

3.5.3 clog Network Port Usage

`syslog` and `syslog-ng` require specific network ports to be available for correct operation. These ports are the following:

- UDP 514 – this port is used by `syslogd` clients for forwarding log messages
- TCP port *`selected port`* - the administrator chooses which TCP port a `syslog-ng` log consolidator uses to receive messages.
- TCP port 22 – When using `ssh` port forwarding to create encrypted tunnels, the remote clients communicate with the log consolidation server's `sshd` daemon. In a default configuration, this daemon listens on TCP port 22.

3.5.4 Using Bastille to Harden the System

Bastille is a security-hardening lockdown tool that can be used to enhance the security of the HP-UX operating system. It provides customized lockdown on a system-by-system basis by allowing the administrator to choose which security features to enable or disable from hardening/lockdown checklists.

Bastille can be used to harden a log consolidation server by enabling security tools such as IP filtering. If IP filtering is enabled, the ports described in "clog Network Port Usage" (page 79) must not be blocked.

Additionally, Bastille asks the following questions that impact a log consolidation system:

```
Do you want to BLOCK incoming Secure Shell connections with IPFilter?
```

When configuring a log consolidation server, answer No to the question if you plan to support clients using the tcp transport and ssh tunneled connections to the server.

```
Would you like to restrict the system logging daemon to local
connections?
```

Answering yes to this question adds the -N option to `/etc/syslog.conf`. When configuring a log consolidation server, this option is required. The `clog_wizard` adds it automatically; the manual configuration instructions also explain the appropriate edits to `/etc/syslog.conf`.

3.6 Viewing System and Consolidated Logs

Use the System Management Homepage's System and Consolidated Log Viewer to filter and view a system's local `syslog` log files. For a system that is also a log consolidator, the System and Consolidated Log Viewer also filters and displays the consolidated logs.

3.6.1 Starting System Management Homepage

To log in to the System Management Homepage, navigate to:

`http://`*`hostname`*`:2301`

Enter a username and password. Root logins are enabled by default. For additional information on starting and logging into the System Management Homepage, refer to the *HP System Management Homepage User Guide*.

After logging in to System Management Homepage, choose the Logs tab and then System and Consolidated Log Viewer.

3.6.2 Using the System and Consolidated Log Viewer

The System and Consolidated Log Viewer will display the `syslog`-related logs for the system. By default, this includes the local logs for the system from `/var/adm/syslog`. If this system is also a log consolidator, the consolidated logs will also be listed.

NOTE: In a Serviceguard cluster configured as a log consolidation server, the consolidated logs are placed on the filesystem associated with the "clog" package. See "Cluster Configuration Notes for clog" (page 52) for additional details. When using LVM and VxVM storage failover configurations, this means that the consolidated logs are only accessible to a single cluster member at a time. When using the `http://hostname:2301` technique for starting SMH in a cluster, the administrator needs to know which cluster member is currently hosting the package, and should use that hostname in the URL.

Fortunately, there is a simpler solution: System Management Homepage supports virtual IP addresses such as those used by Serviceguard packages. This allows the administrator to use the package's virtual IP address or DNS name in the auto-start URL (`http://`*virtual_IP_address*`:2301`) to launch the viewer on the system hosting the consolidated logs. For additional information, refer to the *HP System Management Homepage User Guide*.

Choose a log to view from the main Select tab. Use the Filter tab to specify filter expressions to search for specific entries, and then choose the Display tab to display the contents of the log. For additional information on using the System and Consolidated Log Viewer, use the help available from within the application.

4 Command Fanout

Command fanout utilities allow the system administrator to replicate shell commands across multiple systems. Traditionally, administrators have created wrappers around tools such as remote shell (see *remsh*(1)) and secure shell (see *ssh*(1)) to provide command fanout functions.

4.1 Parallel Distributed Shell

The Distributed Systems Administration Utilities (DSAU) include the open source tool Parallel Distributed Shell (`pdsh`). `pdsh` formalizes the use of `remsh` and `ssh` for distributing commands to groups of systems. Unlike `remsh/ssh` wrappers, `pdsh` offers the following benefits:

- High performance

  Commands are issued in parallel to groups of target system. `pdsh` supports a sliding window or fanout setting to control the number of concurrent commands.

- Command timeout settings

  `pdsh` supports a command execution timeout which controls how long a remote command can execute before being disconnected (to prevent problem commands from hanging). It also supports a connect timeout which prevents blocking when remote systems are unreachable.

- Output processing and return status

  `pdsh` correctly handles stdout and stderr processing and supports returning a “worst of” return status so the caller can detect errors from remote systems.

- Flexible target system specifications

  `pdsh` supports several mechanisms for specifying the target hosts on which to operate. They can be specified on the command line, on `stdin`, in a well known file (`/etc/machines`) or in a file pointed to by the `WCOLL` environment variable. Specific systems can be excluded from the command line as well.

- Hostlist expressions

  For groups of systems using a *`prefixNNN`* naming convention (for example, h1, h2, ..., h*N*), `pdsh` allows target nodes specification using hostlist expressions such as “h[1-10]” which would fan out a command to hosts named h1 through h10.

- Intelligent output filtering

  `pdsh` prefaces each line of output with the hostname of originating system. `dshbak` (see *dshbak*(8)) is a filter that can format the standard `pdsh` output in several different ways. The `dshbak -c` flag looks for output from different hosts that is identical and consolidates the output instead of duplicating it. The header will indicate the hosts to which the consolidated output applies.

- Choice of command transports

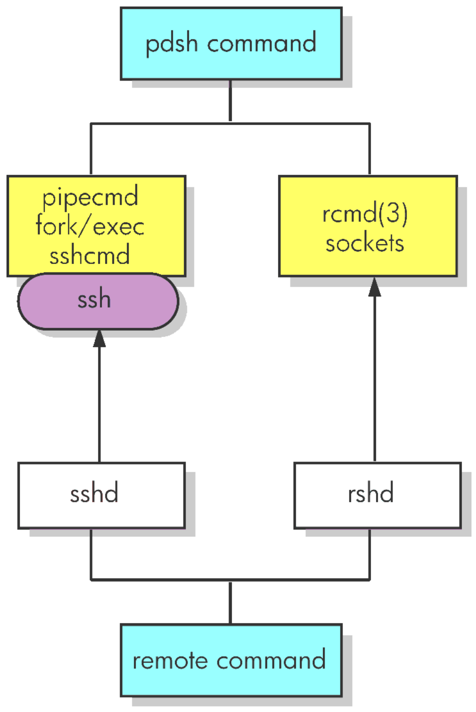
  `pdsh` can use either remote shell `rcmd` (see *rcmd*(3)) or `ssh` as a command transport. Note that the `ssh` transport offers greatly improved security. See “Security Configuration” (page 85) for details.

- Parallel copy command

  The `pdcp` command provides a parallelized copy command to copy a local source file to multiple targets.

Figure 4-1: “pdsh Architecture ”, shows the components of `pdsh` and its architecture.

Figure 4-1 pdsh Architecture



For more information on `pdsh` and `dshbak`, refer to their reference manpages.

4.2 pdsh Utility Wrappers

Administrators can build wrapper commands around `pdsh` for commands that are frequently used across multiple systems and Serviceguard clusters. Several such wrapper commands are provided with DSAU. These wrappers are Serviceguard cluster-aware and default to fanning out cluster-wide when used in a Serviceguard environment. These wrappers support most standard `pdsh` command line options and also support long options (`--`*`option`* syntax) .

`cexec`	`cexec` is a general purpose `pdsh` wrapper. In addition to the standard `pdsh` features, `cexec` includes a reporting feature. Use the `--report_loc` option to have `cexec` display the report location for a command. The command report records the command issued in addition to the nodes where the command succeeded, failed, or the nodes that were unreachable. The report can be used with the `--retry` option to replay the command against nodes that failed, succeeded, were unreachable, or all nodes.
`ccp`	`ccp` is a wrapper for `pdcp` and copies files cluster-wide or to the specified set of systems.
`cps`	`cps` fans out a `ps` command across a set of systems or cluster.
`ckill`	`ckill` allows the administrator to signal a process by name since the pid of a specific process will vary across a set of systems or the members of a cluster.
`cuptime`	`cuptime` displays the uptime statistics for a set of systems or a cluster.
`cwall`	`cwall` displays a `wall(1M)` broadcast message on multiple hosts.

All the wrappers support the CFANOUT_HOSTS environment variable when not executing in a Serviceguard cluster. The environment variable specifies a file containing the list of hosts to target, one hostname per line. This will be used if no other host specifications are present on the command line. When no target nodelist command line options are used and CFANOUT_HOSTS is undefined, the command will be executed on the local host.

For more information on these commands, refer to their reference manpages.

4.3 Security Configuration

The command fanout tools support both remote shell (`rsh` or `rcmd`) and `ssh` transports. Each requires specific security setup steps in order to authorize the user initiating the command fanout operation to execute a command on the remote target systems. The command fanout tools require that the remote system not prompt for a password. Both `rsh` and `ssh` transports must be preconfigured on each remote system to allow non-interactive access. The following sections describe the required setup steps to enable command fanout operations for each transport.

4.3.1 Remote Shell Security Setup

When using the remote shell command transport, the local user must have a `$HOME/.rhosts` file configured on each remote target system. Refer to the *rhosts*(4) reference manpage for details on configuring the `$HOME/.rhosts` file.

4.3.2 ssh Security Setup

`ssh` uses public host keys to authenticate remote hosts and supports public key authentication to authenticate users. When users' public keys are properly configured on a set of remote systems, they can access those systems without being prompted for a password. Manually configuring `ssh` for non-interactive access is a multistep process where `ssh` configuration files are edited on each system. The `csshsetup` tool greatly simplifies configuring ssh trust relationships. For example, when using the command fanout tools in a Serviceguard cluster, you typically want to be able to issue commands from any member and target any other member. This requires an n^2 distribution of `ssh` public keys. Start by creating a text file listing the members the cluster, one per line. Invoke `csshsetup` using this file. Note that this command needs to be issued only once since it configures each member of the cluster:

```
# csshsetup -r -f members_list.txt
```

The `-r` option instructs `csshsetup` to distribute the keys in a round-robin or n^2 fashion. The user will be prompted for his password on each remote host. `csshsetup` then automates the entire public key distribution process.

Note that `csshsetup` is not specific to Serviceguard clusters; it can be used for arbitrary groups of systems. Also, the trust relationship does not have to be bidirectional. Omit the `-r` option when setting up a one-way trust relationship between the current host and a set of remote target hosts. For additional details, refer to the *csshsetup*(1) reference manpage.

4.3.3 Security Notes

The remote shell protocol is an inherently insecure protocol. It is the protocol used by the Berkeley "r commands," `rlogin`, `rcp`, `remsh`, and so on. Many system administrators disable the use of the "r" commands as a matter of policy. For example, the Bastille security hardening tool offers a default option to disable these insecure services. If disabled, the `pdsh -R rsh` option to use the remote shell transport will not work.

If the "r" services are not disabled, use of the `pdsh -R rsh` option by unprivileged users is still disabled by default because of the inherent security risk. By default, only users with root privileges can use the `pdsh -R rsh` option. This is because the remote shell `rcmd` library call requires the use of a privileged port. Even though privileged users can use `-R rsh`, the `ssh` transport is still preferred.

If the hosts and users are trusted in your environment, you can enable the use of the `pdsh -R rsh` option for unprivileged users with the following commands:

```
# cd /opt/dsau/bin/pdsh
# chown root:bin pdsh
# chmod u+s pdsh
```

4.4 Command Fanout Troubleshooting

This section contains troubleshooting tips for common error messages produced by `pdsh` and the wrapper commands.

You may see the following error messages when using command fanout:

Table 4-1 `ssh` Command Messages

Message	Cause	To Correct
`pdsh@`*`local_hostname`*`:` *`target_hostname`*`:ssh exited with exit code 1`	The target system is unreachable.	Ensure that the target system is up and connected.
`pdsh@`*`local_hostname`*`:` *`target_hostname`*`:ssh exited with exit code 255`	This message occurs when the target hostname is unknown, the target host's IP address in `/etc/hosts` is incorrect, or the user does not have permissions to use the target host. Note that 255 is the exit code used by ssh when ssh itself encounters an error.	Obtain the correct hostname or IP address or set ssh permissions appropriately and try again.

Table 4-2 `rsh` Command Messages

Message	Cause	To Correct
`pdsh@`*`local_hostname`*`:` `gethostbyname("`*`target_hostname`*`")` `failed`	The target hostname is unknown.	Determine the target hostname and try again.
`pdsh@`*`local_hostname`*`:` *`target_hostname`*`:connect: Connection refused`	The target system is unreachable, or the r services may be disabled for this system.	Check the r services and whether the target system is up and connected.
`pdsh@`*`local_hostname`*`:` *`target_hostname`*`:connect: timed out`	The hostname exists (that is, IP address lookup succeeded) but the target system is down or unreachable.	Check that the system is up, connected and reachable.
`rresvport: bind: Permission denied pdsh@`*`local_hostname`*`:` *`local_hostname`*`:rcmd: socket: Permission denied`	An unprivileged user attempted to use the remote shell transport.	See the Security Notes section for details on allowing unprivileged users to use pdsh with the remote shell transport.
`target_hostname``: remshd: Login incorrect. remote`	The user's $HOME/.rhosts on the remote system is not allowing access.	Ensure that the user's $HOME/.rhosts on the remote system gives access.

Table 4-3 Target Node Error Messages

Message	Cause	To Correct
`target_hostname``:sh:`*`command_name`*`:not found`	The command does not exist on the target node. The remote shell invoked by pdsh has only a minimal path, and a user's login scripts are not executed on remote nodes.	Use full paths to specify commands.

A HP-Supported Open Source pdsh Options

This release of DSAU includes open source `pdsh` code that was compiled with the following options:

- `readline` support.
- The secure shell (`ssh`) remote command module (`pdsh —R ssh`).
- The remote shell (`rsh`) remote command module (`pdsh —R rsh`).

  Because of security concerns, this option is disabled by default at installation time. For information on Parallel Distributed Shell, see the Chapter 4 (page 83) chapter.

- The machines module (`pdsh —a` option).

The command `pdsh —V` provides a summary of the options, and `pdsh —L` lists details on each module.

Index