



Solaris™ PC NetLink 2.0 High Availability Guide

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Contents

Preface vii

1. Introduction 1

Basic Terminology 1

New High Availability Features in
PC NetLink Software 2

PC NetLink Virtual Servers 2

Fault Monitoring 3

Server Consolidation and High Availability 3

Reading Path 6

2. Quick Start for Experienced Administrators 7

Before You Begin 7

System and Software Requirements 8

Gathering Information 8

Sun Cluster 2.2 Configuration 9

Quick Start Procedures 10

▼ How to Install and Configure PC NetLink Software 10

▼ How to Verify the Installation of PC NetLink Software 13

What Next 13

3. PC NetLink Software on a Cluster 15

Overview of Clusters 16

Redundant Devices 16

Failover Logic 17

The Process of Failover and Recovery 17

Failover Process 17

Recovery Times 21

Using PC NetLink Software on a Cluster 21

PC NetLink Software Differences When Installed on a Cluster 23

What Next 24

4. Setting Up PC NetLink Software on a Cluster 25

Before You Begin 25

System and Software Requirements 26

Gathering Information 27

Verifying Correct Cluster Operation 28

▼ How to Verify Correct Cluster Operation 28

Installing PC NetLink Software 29

Installing the PC NetLink HA Agent 29

▼ How to Install the PC NetLink HA Agent 29

Creating Logical Hosts 31

▼ How to Create Logical Hosts 32

Configuring Virtual Servers for
High Availability 34

▼ How to Create and Configure PC NetLink Virtual Servers on a Cluster 34

What Next 37

5. Maintaining PC NetLink Software on a Cluster 39

Maintaining PC NetLink Virtual Servers 39

▼	How to Add PC NetLink Virtual Servers to the Cluster	39
▼	How to Remove PC NetLink Virtual Servers From the Cluster	40
	Managing Interruptions in Service	41
▼	How to Remove PC NetLink Software	42
▼	How to Remove the PC NetLink HA Agent	42
	What Next	44

45

A. Upgrading a PC NetLink 1.2 Cluster 45

▼	How to Upgrade a PC NetLink 1.2 Cluster	45
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Preface

This document describes how to install, configure, and troubleshoot Solaris™ PC NetLink¹ 2.0 software running on Sun™ Cluster 2.2 software.

Before You Read This Book

Before attempting to set up PC NetLink software on a cluster, you should have a thorough understanding of high availability and the maintenance and recovery procedures of a cluster.

You should also understand the purpose of PC NetLink software and the administration it requires, as described in the *Solaris PC NetLink 2.0 Administration Guide*.

How This Book Is Organized

Chapter 1 provides an introduction to new high availability features in PC NetLink 2.0 software.

Chapter 2 is intended for experienced system and network administrators. It provides top-level instructions for installing PC NetLink software, configuring logical hosts for PC NetLink, and configuring PC NetLink virtual servers for operation in a cluster.

1. Solaris PC NetLink software incorporates AT&T's Advanced Server for UNIX Systems.

Chapter 3 is intended for administrators who have not installed PC NetLink software on a cluster. It provides an overview of how clusters work and how PC NetLink works in a cluster.

Chapter 4 provides instructions for installing and configuring PC NetLink software on a cluster.

Chapter 5 describes how to maintain PC NetLink software in a high availability environment.

Appendix A provides instructions for upgrading a PC NetLink 1.2 installation on a cluster to a PC NetLink 2.0 installation.

Using UNIX Commands

This document might not contain information on basic UNIX[®] commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:

- *Solaris Handbook for Sun Peripherals*
- AnswerBook2[™] online documentation for the Solaris[™] operating environment
- Other software documentation that you received with your system

Typographic Conventions

Typeface	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. % You have mail.
AaBbCc123	What you type, when contrasted with on-screen computer output	% su Password:
<i>AaBbCc123</i>	Book titles, new words or terms, words to be emphasized	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be superuser to do this.
	Command-line variable; replace with a real name or value	To delete a file, type <code>rm filename</code> .

Shell Prompts

Shell	Prompt
C shell	<i>machine-name%</i>
C shell superuser	<i>machine-name#</i>
Bourne shell and Korn shell	\$
Bourne shell and Korn shell superuser	#

Related Documentation

Sun Cluster, Solaris, and PC NetLink software work together to provide a high availability environment for both Solaris users and Microsoft Windows users. You will find the following publications relevant.

Application	Title	Part Number
Installation	<i>Solaris PC NetLink 2.0 Installation Guide</i>	816-0327-10
Administration	<i>Solaris PC NetLink 2.0 Administration Guide</i>	816-0266-10
Installation	<i>Sun Cluster 2.2 Software Installation Guide</i>	806-5342-10
Administration	<i>Sun Cluster 2.2 System Administration Guide</i>	806-5343-10
Administration	<i>Sun Cluster 2.2 Release Notes</i>	806-5345-10
Administration	<i>Sun Cluster 2.2 Hardware Site Preparation, Planning, and Installation Guide</i>	806-5346-10
Reference	instancecfg Reference Page \$ man instancecfg	

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Introduction

This chapter introduces new high availability (HA) features in Solaris PC NetLink 2.0 software. It contains the following sections:

- “Basic Terminology” on page 1
- “New High Availability Features in PC NetLink Software” on page 2
- “Server Consolidation and High Availability” on page 3
- “Reading Path” on page 6

Basic Terminology

Before introducing new high availability features in PC NetLink 2.0, it is important to clarify some basic terminology.

PC NetLink is a specialized, layered software product that is installed on a *physical host*, a Solaris server. To consolidate physical Windows¹ NT servers, PC NetLink captures all the network and user account configuration information associated with that NT server and creates a *virtual server* that functions as a replacement for it. Windows clients on the local area network (LAN) receive the same services from a PC NetLink virtual server as they do from a physical NT server.

Sun Cluster 2.2 software is installed on the same physical hosts as PC NetLink, but serves a very different function. Sun Cluster software creates a *cluster*, or collection of computer resources designed to function as a single, redundant system. Each physical host in the cluster is called a *node*. The node that manages all resources in the cluster is called the *default master node*. The other nodes in the cluster are called *backup nodes* because they wait for the default master node to send them work.

1. The name Windows in this document refers to Microsoft Windows products.

Software applications such as PC NetLink or Oracle are called *data services* in a cluster because they validate clients, create files, manage transactions, and otherwise generate data. When you install a data service like PC NetLink on a cluster, it becomes an object that the cluster can move from node to node.

If the copy of PC NetLink software running on one node in the cluster experiences a problem, Sun Cluster software moves its services to a backup node. This process of moving a service from one node to another is called *failover*. For this failover from node to node to work, however, Sun Cluster software must encapsulate all the information associated with the data service in something called a *logical host*. All the client accounts, IP addresses, data management structures, and processes associated with the data service need to move from node to node without modification for this failover process to work. *High Availability Agents* define what data service information needs to be monitored and managed by the cluster. Once a logical host understands how its data service operates, it is responsible for detecting a failure and negotiating a failover between nodes.

Just as PC NetLink software encapsulates NT server configurations in virtual servers, Sun Cluster software encapsulates PC NetLink virtual server information in its logical hosts. For each PC NetLink virtual server, the functional equivalent of an NT server, Sun Cluster creates a logical host. When necessary, Sun Cluster moves a logical host that contains a PC NetLink virtual server from one node to another, thereby increasing the availability of that PC NetLink virtual server to Windows clients on the LAN.

New High Availability Features in PC NetLink Software

PC NetLink 2.0 software offers two features that increase the attractiveness of installing it in an HA environment: multiple virtual servers and fault monitoring.

PC NetLink Virtual Servers

In PC NetLink 1.2 software, only a single node in a cluster could be running the PC NetLink data service. In effect, the other nodes in the cluster were simply acting as backup nodes for the PC NetLink data service. If the primary node failed, the backup nodes would restore the PC NetLink data service.

PC NetLink 2.0 software supports the creation of multiple virtual servers running in the cluster simultaneously. This provides you flexibility when setting up your cluster, because you can run PC NetLink software on one node (as with PC NetLink

1.2), multiple nodes, or all nodes. Should any node running PC NetLink software fail, its PC NetLink virtual servers will fail over to another node in the cluster. This provides your users with uninterrupted service while you troubleshoot problems with the failed node.

In an HA environment, each PC NetLink 2.0 virtual server provides its data services within its own HA logical host. This is a significant enhancement over HA in PC NetLink 1.2 for two reasons. First, PC NetLink 2.0 allows you to run virtual servers on more than one node in the cluster at a time. Second, PC NetLink 2.0 sets the unit of failover to be the virtual server, not the entire PC NetLink data service. Greater isolation between virtual servers means that one failed virtual server will not cause the failover of other functioning virtual servers on the same node. In this way PC NetLink 2.0 software supports per-process failover in the HA environment and not per-system failover.

Fault Monitoring

PC NetLink 2.0 software now provides sophisticated monitoring of each virtual server running on each node in the cluster. The *fault monitoring daemon* installed with the PC NetLink 2.0 HA Agent polls each virtual server on each HA node periodically. If the monitoring daemon detects that one of the virtual servers on the node is hung or stopped, it diagnoses the problem and attempts to restart the virtual server. Only when all attempts to restart the PC NetLink virtual server fail does the monitoring daemon notify the cluster that a failover of that PC NetLink virtual server is required.

Proactive fault monitoring increases reliability in two ways. First, it decreases the time between the failure of a virtual server and corrective action by the fault monitoring daemon or Sun Cluster software. Second, it decreases the frequency of failovers because the fault monitoring daemon can often restart the failed virtual server without requiring a full HA failover to a backup node.

Server Consolidation and High Availability

To consolidate multiple NT servers with PC NetLink, you do not need to install PC NetLink on a cluster.

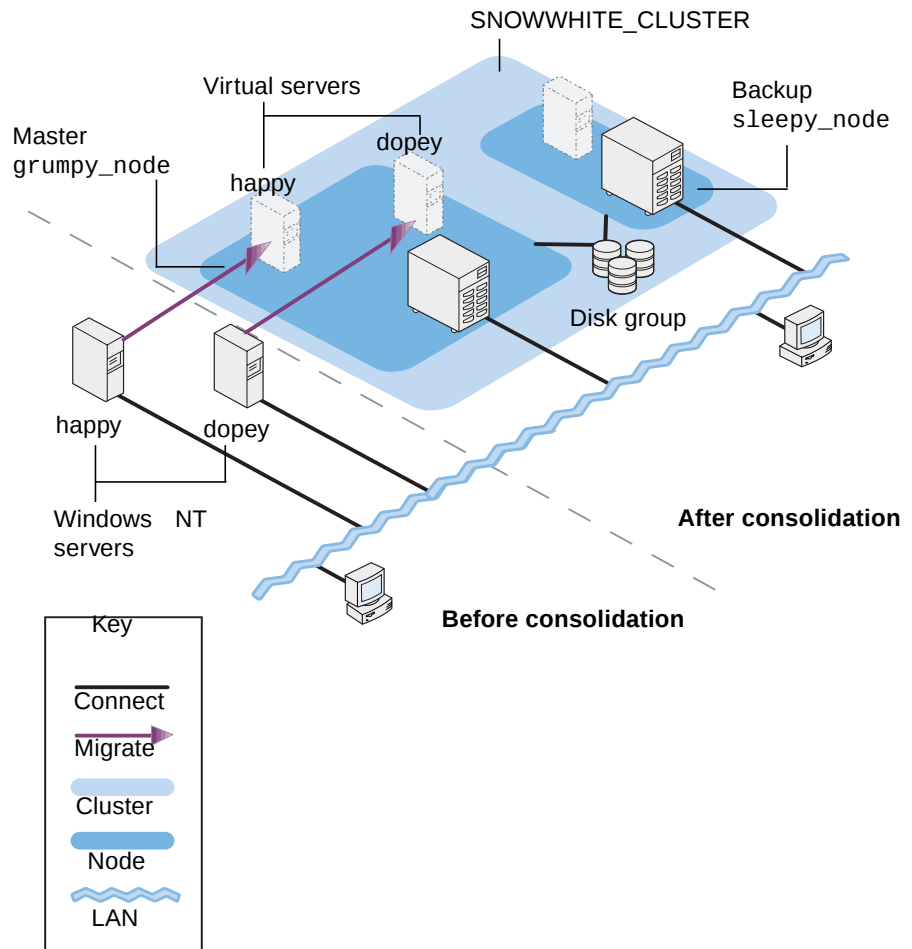
The additional reliability and availability that comes with running PC NetLink in an HA environment makes sense if some or all of your Windows clients do the following:

- Run mission-critical Windows applications that require uninterrupted access to shared disks
- Run Windows applications that manage frequent transactions with back-end databases or knowledgebases
- Run Windows applications that read or write very large data files

Consider the following scenario for consolidating multiple NT servers into a cluster running PC NetLink 2.0 and Sun Cluster 2.2 software.

- Four departments have independently deployed NT servers to support 400 users running Windows 2000, Windows 98, or Windows NT4 applications.
- Each of these NT servers has locally attached storage and locally managed printer shares.
- Two Solaris servers and some shared storage are available to support PC NetLink 2.0 and Sun Cluster 2.2 software.

Here is what a basic consolidation from standalone NT servers to high availability PC NetLink virtual servers would look like.



Consolidating these NT servers into a high availability environment is straight forward. Here is the general procedure:

1. Install and configure Sun Cluster 2.2 software on each Solaris physical host (node) in the cluster.
2. Install PC NetLink 2.0 software on each node in the cluster.
3. Install the PC NetLink HA package on each node in the cluster.
4. Run the Sun Cluster `scconf` or `scinstall` utility to create an HA logical host corresponding to each NT server that you want to consolidate.

5. Run the PC NetLink instancecfg utility to create and configure a PC NetLink virtual server for each logical host intended to support a PC NetLink virtual server.

Once each PC NetLink virtual server is configured to function within an HA logical host in the cluster, the consolidation is complete. The same file services, disk resources, shares, and IP address associated with standalone NT servers will be available transparently to your Windows clients as HA virtual servers.

Reading Path

Here is the recommended reading path for this book.

TABLE 1-1 Reading Path

If you are an experienced NT, PC NetLink, and Sun Cluster administrator, read:	If you have not administered either NT, PC NetLink, or Sun Cluster, read:
Chapter 1 “Introduction”	Chapter 1 “Introduction”
Chapter 2 “Quick Start for Experienced Administrators”	Chapter 3 “Solaris PC NetLink Software on a Cluster”
	Chapter 4 “Setting Up PC NetLink on a Cluster”
Chapter 5 “Maintaining PC NetLink on a Cluster”	Chapter 5 “Maintaining PC NetLink on a Cluster”

Quick Start for Experienced Administrators

This chapter explains how to install and configure Solaris PC NetLink 2.0 software on two or more Solaris servers running Sun Cluster 2.2 software. This chapter is intended for administrators who have experience installing PC NetLink, Sun Cluster 2.2, Solaris servers, and NT servers. If you do not have experience installing and configuring these software and hardware systems, consider reading Chapters 3 and Chapters 4 in this manual. These chapters address the same procedures, but do so in a detailed way. The chapter contains the following sections:

- “Before You Begin” on page 7
- “Quick Start Procedures” on page 10

Before You Begin

Before installing and configuring PC NetLink 2.0 software on a cluster, gather some important information about the cluster environment and verify that you have the correct hardware and software.

Note – If you are upgrading PC NetLink 1.2 that is running on a cluster, see Appendix A, “Upgrading a PC NetLink 1.2 Cluster.”

System and Software Requirements

Before you install PC NetLink 2.0 software, check the following system and software requirements.

TABLE 2-1 System and Software Requirements

Physical hosts	PC NetLink 2.0 supports the following servers: * Sun Ultra 5 and Ultra 10 * Sun Enterprise 220R, 250, 420R, and 450 * Sun Enterprise 3500, 4500, 6500, and 10000 * Sun Fire 280R, 880
Operating system	PC NetLink 2.0 and Sun Cluster 2.2 support the following versions of the Solaris operating environment: * Solaris 2.6 * Solaris 2.7 * Solaris 8 (SU5)
System memory	48 Mbytes or more of RAM
Free disk space on each node	100 Mbytes for the /opt directory (where PC NetLink installs its executable files) 100 Mbytes for the /var directory (where PC NetLink installs default user information)
Sun Cluster software	Sun Cluster 2.2 with RAID (disk group) software versions 2.1, 2.2, 2.2.1

Caution – Do not use an NFS-exported file system on any node in the cluster as a PC NetLink shared file system. Use separate file systems for PC NetLink shares and NFS-exported file systems.

Gathering Information

To complete the installation and configuration of PC NetLink in a high availability (HA) environment, you must supply information about the NT servers that you are consolidating and the cluster. In most cases, the installation scripts read

configuration information from your systems and prompt you to confirm that information. Familiarizing yourself with this information before installing PC NetLink is nevertheless recommended.

TABLE 2-2 HA Environment Information to Collect Before Installation

NT servers	IP addresses NT server names (for example, dopey, sneezy) NT printer share names (for example, bldg3_hpcolor) NT shared disk names (for example, accounting_disk)
Cluster	Default master node name (for example, grumpy_node) Cluster name (for example, SNOWWHITE_CLUSTER)
Physical hosts	Root password Node names (for example, grumpy_node, sleepy_node) Disk group directory path
PC NetLink	Netlogon service name (if created during PC NetLink installation) Default domain name (for example, accounting_domain) Password for the primary domain controller (PDC)

During the installation and configuration process, you must specify the following information.

TABLE 2-3 HA Information to Confirm or Modify During Installation

Logical hosts	Logical host names corresponding to the NT servers you consolidate (for example, dopey_loghost, sneezy_loghost) Network interface number
Disks	Shared disks or disk groups
PC NetLink	Role for logical host in the PC NetLink domain (primary, backup, member server)

Sun Cluster 2.2 Configuration

Before you install PC NetLink 2.0 software, you must install and configure Sun Cluster 2.2 software on each node in the cluster. See the *Sun Cluster 2.2 System Administration Guide* for more information about configuration.

Quick Start Procedures

Use the following procedures to install, configure, and verify PC NetLink 2.0 software installation for use on a cluster.

▼ How to Install and Configure PC NetLink Software

Before installing PC NetLink software, verify that all nodes share the same security files (/etc/group, /etc/passwd, and /etc/shadow) and that the cluster is operating correctly.

1. **Log in to the default master node as root.**
2. **Starting with the default master node, install PC NetLink software from the distribution CD.**

```
grumpy# cd /cdrom/pcn1_2/  
grumpy# ./install
```

Follow instructions in the installation script to create a default installation on each node in the cluster. PC NetLink creates one default virtual server. You do not need to configure this virtual server during the installation process and can delete it after HA installation and configuration.

3. **Starting with the default master node, install the PC NetLink High Availability Agent on each node.**

```
grumpy# cd cdrom/pcn2/sparc  
grumpy# pkgadd -d . SUNWlzha
```

4. **From any node in the cluster, create one logical host for each virtual server.**

For example, if you plan to host two virtual servers named happy and bashful on grumpy_node, you must create two logical hosts on the cluster, for example, happy_loghost and bashful_loghost.

```
grumpy# ./scinstall
```

Choose Change - Logical Hosts - Add from the `scinstall` menu system to add logical hosts to the cluster. If you plan to add other PC NetLink virtual servers at a later date, take this opportunity to create more logical hosts than you require for initial installation.

5. On each node that will host PC NetLink virtual servers, create the same number of virtual servers as the number of HA logical hosts that you created in Step 4.

For example, create a virtual server named `happy` on `grumpy_node` corresponding to the logical host named `happy_loghost` on that same node.

```
grumpy# cd /opt/lanman/sbin/
grumpy# ./instancecfg -a
```

Follow instructions in the configuration script to specify the name of the PC NetLink virtual server (for example, `happy`), the logical host associated with the virtual server (for example, `happy_loghost`), its PC NetLink domain (for example, `CLUSTER_DOMAIN`), its PC NetLink role (for example, `primary`), and the disk group(s) available to it (for example, `snowwhite_disk1`).

For more information about using the `instancecfg` command to set up PC NetLink virtual servers, see the `instancecfg` man page.

At the end of the script, PC NetLink will confirm that the new virtual server has been created and that it is running as an HA service (`pc_netlink2`).

```
...
Confirm choices:      servername    : happy
                      role          : primary
                      domain        : CLUSTER_DOMAIN

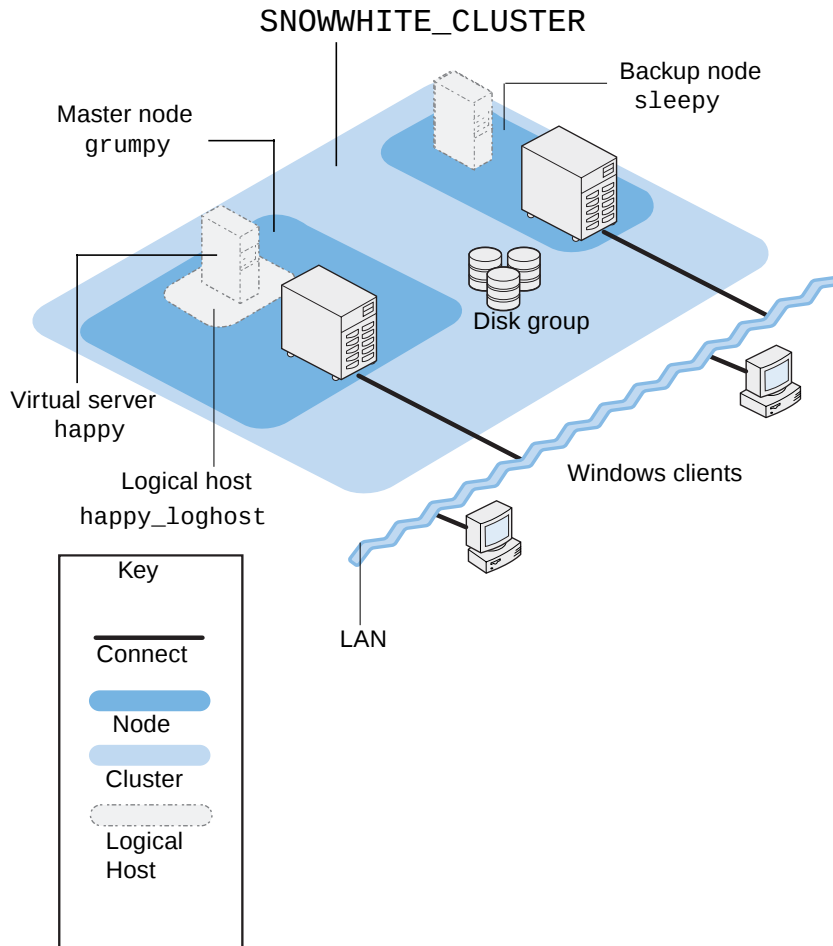
Is this correct [y/n]? y

Enter the password for Administrator: password
Re-enter password: password

Creating Solaris (TM) PC NetLink Server accounts database.
Mar 12 09:53:58 happy ID[SUNWcluster.ha.hareg.3024]: (info)
Service pc_netlink2 is registered
HA service pc_netlink has been successfully registered.
Mar 12 09:54:03 happy ID[SUNWcluster.ha.hareg.1008]: (info)
Service pc_netlink2 successfully turned on.
HA service pc_netlink2 started successfully on happy_loghost.
Success.
Instance  created

grumpy#
```

PC NetLink software is now configured to operate with all the Sun Cluster 2.2 services available on the cluster. When Windows clients subsequently connect to the server named happy in their domain, they will actually be connecting to the PC NetLink virtual server named happy running as a logical host named happy_loghost on a node named grumpy_node in a cluster named SNOWWHITE_CLUSTER.



▼ How to Verify the Installation of PC NetLink Software

1. Log in to the default master node as root.

```
grumpy% root  
passwd: password  
grumpy#
```

2. Use the `net start` command to start PC NetLink software services.

```
grumpy# net start
```

If the default master node displays a list of running PC NetLink services, then you have successfully installed PC NetLink. If the default master node displays an error message that the PC NetLink server has not been started, your installation is incomplete or incorrect.

What Next

You have successfully installed PC NetLink 2.0 software. Learn more about maintaining PC NetLink in Chapter 5.

PC NetLink Software on a Cluster

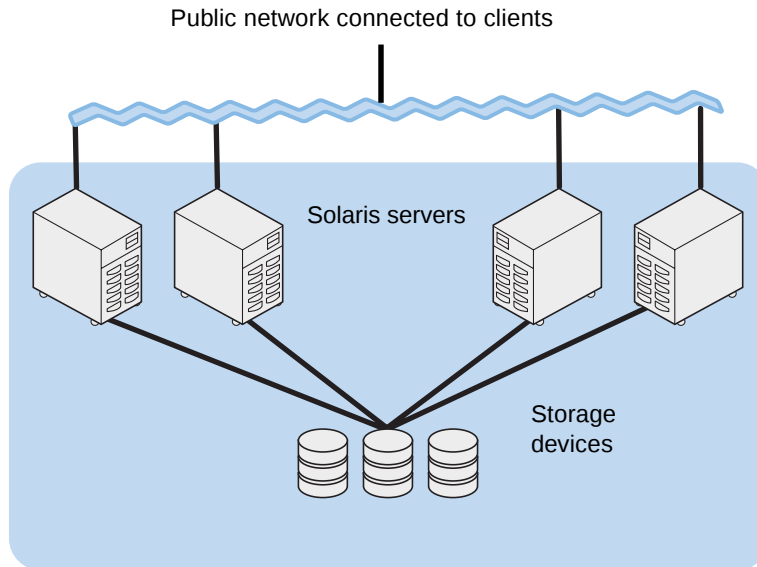
This chapter provides an introduction to basic concepts of high availability (HA). If you have not administered a cluster or Solaris PC NetLink software, this information will help you design an effective high availability solution. This chapter contains the following sections:

- “Overview of Clusters” on page 16
- “The Process of Failover and Recovery” on page 17
- “Using PC NetLink Software on a Cluster” on page 21

Review Chapter 1 for detailed explanations of some terms used in this chapter.

Overview of Clusters

A *cluster* is a collection of computer resources designed to function as a single, redundant system.



Two things make a cluster unique: redundant devices and failover logic.

Redundant Devices

Clusters have a backup device for each resource so there will be no single points of failure. If one storage device fails, for example, another storage device in the cluster is available to take over its functions. The time required for the backup storage device to recover these functions is brief because at least one backup storage device in the cluster had been mirroring all the data stored on the original storage device. Similarly, redundant servers in a cluster are ready to process scheduled tasks if one of the servers in the cluster fails.

To consolidate from two to ten NT servers within the PC NetLink environment on a cluster, you need at least two dual-processor servers and twice as much storage as was available to the NT servers. As you add more NT servers to the PC NetLink environment on the cluster, increase the number of servers and the amount of storage proportionately.

Failover Logic

Sun Cluster 2.2 software maintains a “picture” of all the devices in a cluster and all the operations that are performed via those devices. The cluster, for example, reserves sufficient disk space to handle not only the data operations requested by a logical host but also sufficient disk space to mirror all the data stored anywhere in the cluster.

Data services such as PC NetLink or Oracle instruct Sun Cluster software about their individual user accounts, permissions, and operations. Sun Cluster software rolls all this information up into a collection of rules and policies about managing data services. Based on these rules, Sun Cluster software knows when a device or process is hung and where to assign the failover. Knowing the what, when, and where of available resources in the cluster constitutes that *failover logic* for the cluster.

The PC NetLink HA Agent enhances basic failover logic in the cluster by educating Sun Cluster software about the workings of PC NetLink *virtual servers*. Once the HA Agent has been installed, Sun Cluster software can respond to an overloaded or hung virtual server with its default failover logic.

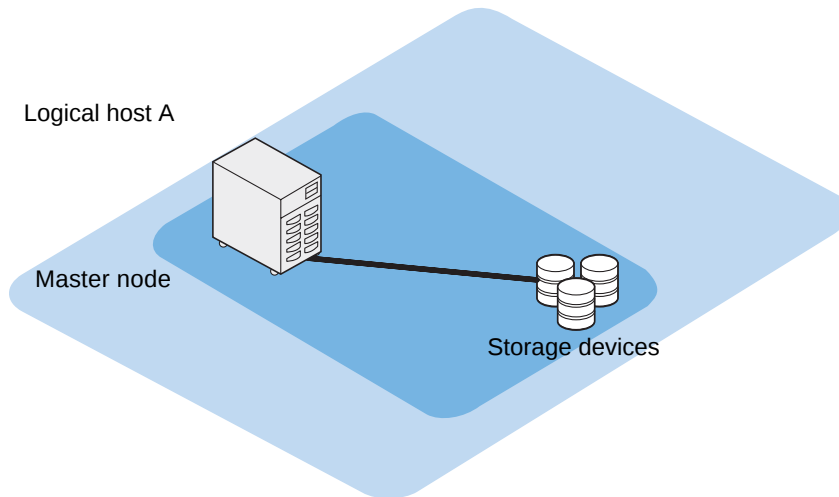
The Process of Failover and Recovery

The purpose of a cluster is to provide computing resources for services such as web hosting that need to remain available to customers at all times. Because of its failover capabilities, a cluster composed of two servers and two storage devices is far more reliable than two standalone servers with associated storage devices connected over a network. The redundant technology makes a cluster better than the sum of its parts.

Failover Process

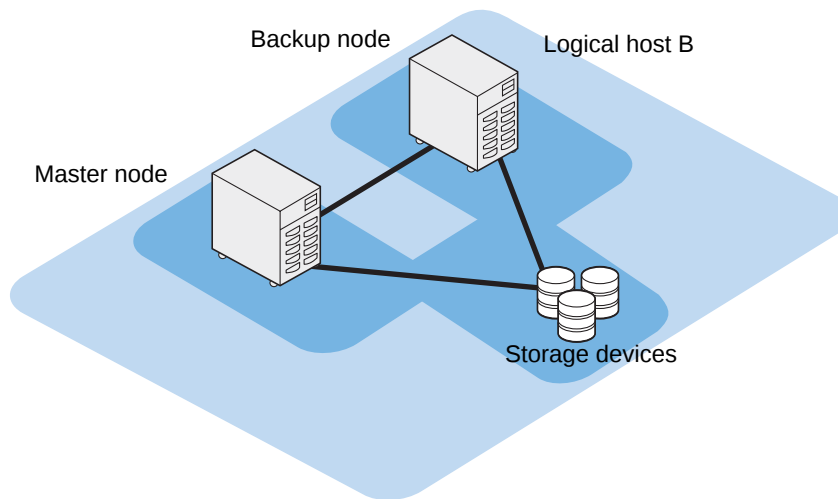
Clusters provide high availability by employing the notion of *logical hosts*. A logical host is a device that exists only in name. Its processing, database, or networking duties are carried out by the *physical nodes* and storage devices that are assigned to “host” it. The logical hosts are meant to exist “above” individual nodes or storage devices so that if a node or storage device fails, the logical host continues operating.

A logical host is assigned its own name and address. One node in the cluster is designated the *default master node* of the cluster.

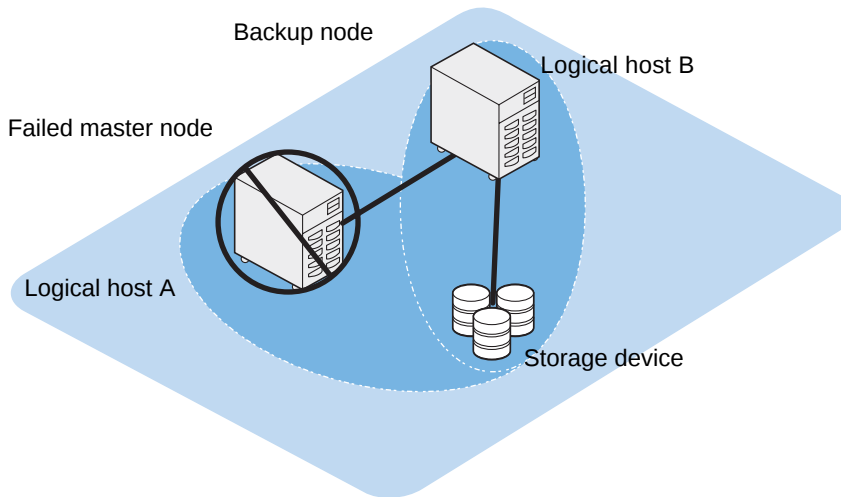


The remaining nodes in the cluster become *backup nodes*.

When a data service such as PC NetLink is installed and configured on a cluster, its services are assigned to one or more logical hosts in the cluster. The nodes assigned to the logical hosts can act as each other's backup nodes.



When a master node fails, the logical host is automatically moved to a backup node and continues operating.



A failover follows this sequence of events:

1. Sun Cluster software instructs the backup node to assume control of all the disk groups associated with all the logical hosts on the default master node.
2. The backup node checks the consistency of all the file systems associated with the disk group and mounts them.
3. The backup node initiates recovery procedures and restarts all the data services associated with all the logical hosts on the default master node.
4. The backup node assumes the IP address of the logical host and resumes the fault monitoring process.

Although the physical devices supporting the logical host have changed, the logical host's name, IP address, and availability to its data services have not.

Recovery Times

The services running on a cluster experience failover under four principal conditions:

- The hardware fails.
- The cluster software is stopped on the primary node.
- An individual data service is manually switched over from the master to the backup node.
- The data service software is hung or stopped.

The time a cluster takes to recover from a failover depends on several factors:

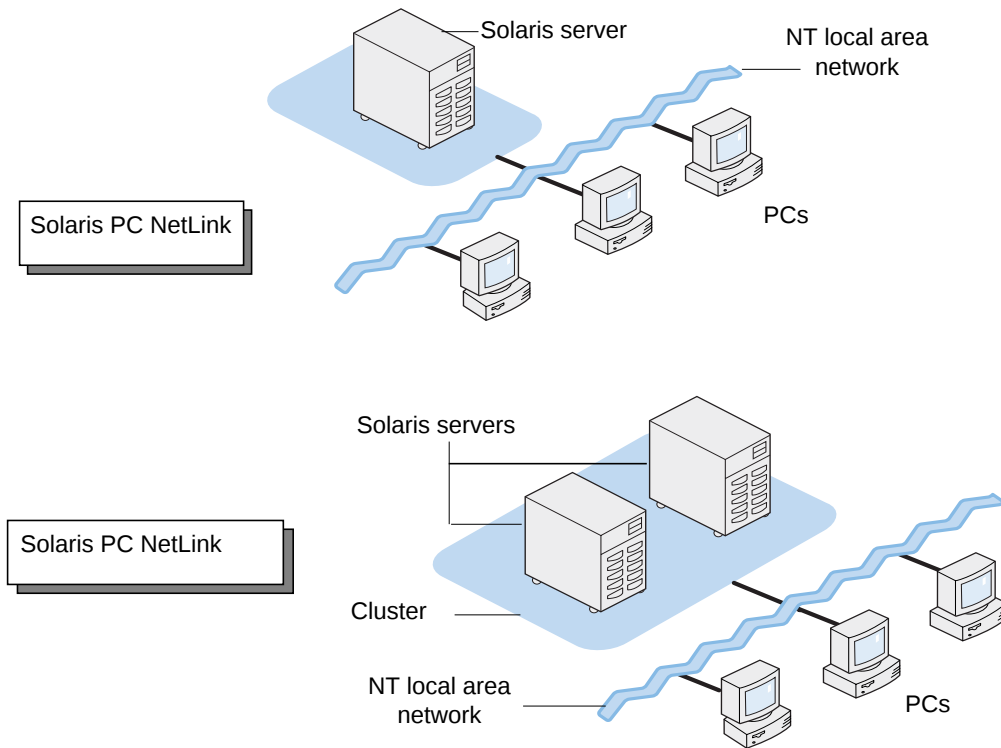
- Total storage
- Storage layout (number and size of disk volumes)
- Number of logical hosts
- Dirty region logging (VERITAS File System volumes)
- Type and size of operation in progress during failover

Sun Microsystems has run several tests to measure recovery time under different conditions. Descriptions of the tests are available in *The Sun Enterprise Cluster Failover White Paper*, available from the Sun Microsystems web site, <http://www.sun.com>.

Using PC NetLink Software on a Cluster

PC NetLink 2.0 software and Sun Cluster 2.2 software offer an attractive alternative to installing high availability software on native NT servers. Consider the progression. A standalone Solaris server running PC NetLink provides greater

reliability than multiple native NT servers. By extension, a cluster of Solaris servers running PC NetLink and Sun Cluster software offers the highest degree of reliability and availability for Windows clients performing mission-critical tasks.



Whether you are setting up a basic cluster configuration with two Sun Fire™ 280R rack servers or a mission-critical cluster with four Sun Enterprise™ 10000 mainframes, PC NetLink and Sun Cluster software take advantage of the cluster's device redundancy and failover logic to ensure that PC NetLink virtual servers operate without downtime. This solution consists of:

- The basic set of PC NetLink packages that install the software and its management tools on all the nodes in the cluster
- One additional HA-specific package that is installed on all the nodes of the cluster
- A PC NetLink script named `instancecfg` that creates the virtual servers corresponding to the logical hosts on the cluster

PC NetLink Software Differences When Installed on a Cluster

There are only four differences between running PC NetLink software on a standalone Solaris server and running it on a cluster.

Installation and Configuration

The most obvious difference between standalone PC NetLink and clustered PC NetLink is the initial installation and configuration process. Setting up PC NetLink on a cluster involves three additional steps:

- Installing the PC NetLink HA Agent
- Creating multiple logical hosts on the cluster, if required
- Creating and configuring PC NetLink virtual servers designed to work as logical hosts, if required

Shared File Systems

Do not use an NFS-exported file system on any node in the cluster as a PC NetLink shared filesystem. Use separate file systems for PC NetLink shares and NFS-exported file systems.

Roles on the Network and in the Cluster

In some cases, PC NetLink and Sun Cluster software use the same terms to describe different operations. This can cause some confusion.

PC NetLink software requires that you specify a role for each virtual server on the NT LAN: *primary domain controller* (PDC), *backup domain controller* (BDC), or *member server*. These roles determine what kinds of account and login information are maintained by each NT physical host. When a PC NetLink virtual server is in the role of primary domain controller, it manages the “master” copy of account and resource information for one or more other virtual servers in a LAN domain. The backup domain controller maintains a mirror copy of the configuration information stored on the primary domain controller. “Primary” and “backup” in this context infer no load balancing or proactive monitoring of processes between virtual servers. In fact, backup and member servers are not required for a functioning NT LAN.

Sun Cluster software uses the terms *primary node* and *backup node* to refer to the roles that nodes play in a failover situation. Primary nodes support one or more logical hosts. Each logical host on the primary node does the “heavy lifting” for data services while the backup nodes silently mirror the processes and files managed by

the primary node. “Primary” and “backup” in the cluster refer to roles that nodes play in the overall failover logic of the cluster and not to any role outside the cluster on the LAN. A primary node can support any number of PC NetLink virtual servers functioning in the LAN roles of PDC, BDC, or member server. Regardless of its LAN role, Sun Cluster software will failover a virtual server to a backup node if required.

Maintenance

If you add or remove important devices in the cluster, you may need to reinstall or reconfigure data services such as PC NetLink to take advantage of those new device configurations.

For more information about maintenance tasks associated with Sun Cluster 2.2, see the *Sun Cluster 2.2 System Administration Guide*.

What Next

Read the next chapter to install PC NetLink on your cluster.

Setting Up PC NetLink Software on a Cluster

This chapter provides a set of detailed procedures for installing Solaris PC NetLink 2.0 high availability (HA) software on a cluster and for configuring PC NetLink software to operate in that cluster. It contains the following sections:

- “Before You Begin” on page 25
- “Verifying Correct Cluster Operation” on page 28
- “Installing PC NetLink Software” on page 29
- “Installing the PC NetLink HA Agent” on page 29
- “Creating Logical Hosts” on page 31
- “Configuring Virtual Servers for High Availability” on page 34

Before You Begin

Before you install and configure PC NetLink 2.0 software on a cluster, gather some important information about the cluster environment and verify that you have the correct hardware and software.

Note – If you are upgrading PC NetLink 1.2 that is running on a cluster, see Appendix A “Upgrading a PC NetLink 1.2 Cluster.”

System and Software Requirements

Before you install PC NetLink 2.0 software, check the following system and software requirements.

TABLE 4-1 System and Software Requirements

Physical hosts	PC NetLink 2.0 supports the following servers: * Sun Ultra 5 and Ultra 10 * Sun Enterprise 220R, 250, 420R, and 450 * Sun Enterprise 3500, 4500, 6500, and 10000 * Sun Fire 280R, 880
Operating system	PC NetLink 2.0 and Sun Cluster 2.2 support the following versions of the Solaris operating environment: * Solaris 2.6 * Solaris 2.7 * Solaris 8 (SU5)
System memory	48 Mbytes or more of RAM
Free disk space on each node	100 Mbytes for the /opt directory (where PC NetLink installs its executable files) 100 Mbytes for the /var directory (where PC NetLink installs default user information)
Sun Cluster software	Sun Cluster 2.2 with RAID (disk group) software versions 2.1, 2.2, 2.2.1 or later

Caution – Do not use an NFS-exported file system on any node in the cluster as a PC NetLink shared filesystem. Use separate file systems for PC NetLink shares and NFS-exported file systems.

Gathering Information

To complete the installation and configuration of PC NetLink in an HA environment, you must supply information about the NT servers that you are consolidating and the cluster. In most cases, the installation scripts read configuration information from your systems and prompt you to confirm that information. Familiarizing yourself with this information before installing PC NetLink is nevertheless recommended.

TABLE 4-2 HA Environment Information to Collect Before Installation

NT servers	IP addresses
	NT server names (for example, dopey, sneezy)
	NT printer share names (for example, bldg3_hpcolor)
	NT shared disk names (for example, accounting_disk)
Cluster	Default master node name (e.g., grumpy_node)
	Cluster name (for example, SNOWWHITE_CLUSTER)
Physical hosts	Root password
	Node names (for example, grumpy_node, sleepy_node)
	Disk group directory path
PC NetLink	Netlogon service name (if created during PC NetLink installation)
	Default domain name (for example, accounting_domain)
	Password for the primary domain controller (PDC)

During the installation and configuration process, you must specify the following information.

TABLE 4-3 HA Information to Confirm or Modify During Installation

Logical hosts	Logical host names corresponding to the NT servers you consolidate (for example, dopey_loghost, sneezy_loghost)
	Network interface number
Disks	Shared disks or disk groups
PC NetLink	Role for logical host in the PC NetLink domain (primary, backup, member server)

Verifying Correct Cluster Operation

Before you install PC NetLink 2.0 software, you must verify that basic cluster operations are working correctly.

▼ How to Verify Correct Cluster Operation

1. Log in to the default master node as root.

```
grumpy% root
passwd: password
grumpy#
```

2. Use the `hastat` command to view the status of nodes in the cluster.

```
grumpy# hastat
Getting Information from all the nodes .....
                HIGH AVAILABILITY CONFIGURATION AND STATUS
                -----

LIST OF NODES CONFIGURED IN <SNOWWHITE_CLUSTER> CLUSTER
    grumpy  sleepy  doc
...
STATUS OF DATA SERVICES RUNNING IN THE CLUSTER

Status Of Registered Data Services
    pc_netlink2:                On

Status Of Data Services Running On grumpy
    No Status Method for Data Service "pc_netlink2"

Status Of Data Services Running On sleepy
    Data Service "pc_netlink2":
    Not being managed on this system

RECENT  ERROR MESSAGES FROM THE CLUSTER
Recent Error Messages on grumpy
...

```

3. Use the `haswitch` command to test failover between nodes in the cluster.

```
grumpy# haswitch sleepy doc
```

Installing PC NetLink Software

The next task involves installing the PC NetLink software on each node in the cluster. The procedures and requirements for installing PC NetLink software on a cluster do not differ from those for installing it on a standalone Solaris server.

For detailed information about installing PC NetLink software, see the *Solaris PC NetLink 2.0 Installation Guide*.

Installing the PC NetLink HA Agent

The PC NetLink HA Agent is distributed as a separate package named `SUNWLzha`. This agent instructs Sun Cluster software on how to support PC NetLink as a data service. Install the PC NetLink HA Agent on each node after you have:

- Verified that the cluster is working properly
- Installed PC NetLink 2.0 software on each node in the cluster

▼ How to Install the PC NetLink HA Agent

1. Insert the PC NetLink 2.0 CD into the server's CD-ROM or DVD drive.
2. Open a Terminal window.
3. Log in to the node as root.

```
grumpy% root
passwd: password
grumpy#
```

4. Use the **cd** command to go to the **/cdrom/PCNL/sparc** subdirectory containing the **SUNWlzh** package.

```
grumpy# cd /cdrom/PCNL/sparc
```

5. Use the **pkgadd** command to install the **SUNWlzh** package.

```
grumpy# pkgadd -d . SUNWlzh

Processing package instance <SUNWlzh> from /cdrom/PCNL/sparc

Solaris (TM) PC NetLink HA (sparc)
2.0,REV=RR
Copyright 2001 Sun Microsystems, Inc. All rights reserved.
Using </> as the package base directory.
## Processing package information.
## Processing system information.
4 package pathnames are already properly installed.
## Verifying package dependencies.
## Verifying disk space requirements.
## Checking for conflicts with packages already installed.
## Checking for setuid/getuid programs.
```

6. Verify that you want to continue with the installation.

When the following question appears, type y for Yes.

```
This package contains scripts which will be executed with super-
user permission during the process of installing this package. Do
you want to continue with the installation of <SUNWlzh>?[y,n] y
```

7. Verify that the package was installed correctly.

Check the output of the script for the words “Installation of <SUNWlzh> was successful.”

```
Installing Solaris(TM) PC NetLink HA as <SUNWlzh>

## Installing part 1 of 1.
/opt/lanman/lib/ha/ha_1paddclass
/opt/lanman/lib/ha/ha_1paddprinter
.
.
.
[verifying class <none>]

Installation of <SUNWlzh> was successful.
```

8. Repeat this procedure for each other node in the cluster.

Creating Logical Hosts

All the required software is now installed. The next task involves using Sun Cluster 2.2 utilities to create logical hosts on the cluster. Create at least one logical host for each PC NetLink virtual server that you plan to support on the cluster. Create these logical hosts after you have:

- Verified that the cluster is working properly
- Installed PC NetLink 2.0 software on each node in the cluster
- Installed the PC NetLink HA Agent on each node in the cluster

Note – Sun Cluster 2.2 software offers tremendous flexibility in configuration. If you have customized your Sun Cluster configuration beyond the defaults, consult the *Sun Cluster 2.2 Administration Guide* on creating logical hosts before continuing.

▼ How to Create Logical Hosts

1. Log in to the default master node as root.

```
grumpy% root
passwd: password
grumpy#
```

2. Use the `scinstall` or `scconf` commands to add logical hosts to the cluster.

```
grumpy# scinstall
Assuming a default cluster name of planets
Note: Cluster SNOWWHITE_CLUSTER is currently running.
      Install/Uninstall actions are disabled during
      cluster operation.

      <<Press return to continue>>

      Checking on installed package state
      .....

===== Main Menu =====

1) Change - Modify cluster or data service configuration.
2) Verify - Verify installed package sets.
3) List   - List installed package sets.
4) Quit   - Quit this program.
5) Help   - The Help screen for this menu.

Please choose one of the menu items: [5]: 1
```

3. From the Changes menu, choose the Logical Hosts option.

```
===== Changes Menu =====

Choices from this menu:

1) Logical Hosts      - Change the logical hosts configuration.
2) NAFO               - Re-initialize the NAFO configuration.
3) Close              - Close this menu to return to the Main Menu.
4) Quit               - Exit this program.
5) Help               - Show the Help screen.

Please choose a displayed option: [5] 1
```

This will display the Logical Hosts Configuration menu.

4. From the Logical Hosts Configuration menu, select the Add option.

```
===== Logical Hosts Configuration =====

1) Add                - Add a logical host to the cluster.
2) Remove              - Remove a logical host from the cluster.
3) List                - List the logical hosts in the cluster.
4) Close               - Return to the previous menu.
5) Quit                - Exit.

Please choose an option: 1
```

You are asked a series of questions regarding the new logical host.

```
What is the primary public network controller for phys-hahost1 ?
What is the primary public network controller for phys-hahost2 ?
Does the cluster serve any secondary public subnets (yes/no) [no]?
Re-initialize NAFO on phys-hahost1 with one ctrl per group
(yes/no)?

What is the name of the new logical host? dopey_ha
What is the name of the default master for hahost1 ? grumpy
Enable automatic failback for hahost1 (yes/no) [no]?
Disk group name for logical host hahost1 [hahost1]?
Is it okay to add logical host hahost1 now (yes/no) [yes]?
/etc/opt/SUNWcluster/conf/ha.cdb

Checking node status...
```

5. Respond to the prompts with the required information.

Once the `scinstall` portion of this procedure is complete, you are returned to the Logical Hosts Configuration menu.

6. Create a new HA administrative file system and update the `/etc/opt/SUNWcluster/conf/hanfs/vfstab.logicalhost` file.

When you add a logical host, you must set up a file system on a disk group within the logical host to store administrative information. The steps for setting up the HA administrative file system differ depending on your volume manager. These steps are described in the appendices of the *Sun Cluster 2.2 Software Installation Guide*.

Configuring Virtual Servers for High Availability

The final task involves using a PC NetLink utility named `instancecfg` to create and configure virtual servers corresponding to the Sun Cluster 2.2 logical hosts that you created in the previous procedure. Create and configure these virtual servers after you have:

- Verified that the cluster is working properly
- Installed PC NetLink 2.0 software on each node in the cluster
- Installed the PC NetLink HA Agent on each node in the cluster
- Created logical hosts in the cluster

The procedure to create PC NetLink virtual servers on a cluster is similar to the procedure to create virtual servers for a standalone physical server.

▼ How to Create and Configure PC NetLink Virtual Servers on a Cluster

- 1. Log in to each node supporting the logical hosts created in the previous procedure.**
- 2. Log in as root.**

3. Use the PC NetLink `instancecfg` command to create and configure virtual servers on the cluster.

```
grumpy# cd /opt/lanman/sbin/  
grumpy# ./instancecfg -a
```

The `instancecfg` utility tests whether Sun Cluster 2.2 software is running and fully configured on the node. If these conditions are met, `instancecfg` polls the default master node for the names of available logical hosts, shared disk groups, and other cluster information.

4. Specify the name of the logical host to be associated with the new PC NetLink virtual server.

```
The logical hosts available on this cluster are: happy_loghost  
dopey_loghost sneezy_loghost
```

```
Enter the logical host to be used for clustered installation  
(or <Return> if this instance should not be configured on a  
cluster) : happy_loghost
```

5. Specify the name of a shared file system or disk group in the cluster to be used by the new virtual server.

```
The file systems available for the logical host happy_loghost are:  
/snowwhite_disk1  
Enter the directory path to be used: /snowwhite_disk1  
The path of the shared directory you entered was: /snowwhite_disk1  
Creating Directory: /export/lanman/2
```

6. Specify the name of the domain supporting the virtual server (for example, SNOWWHITE_DOMAIN), the role of the virtual server in that domain (for example, primary), and the name of the virtual server.

```
The current name of this server is (happy).

Would you like to change this name now [y/n]? n

Enter role ('primary', 'backup', or 'member'): p

This server will become a primary domain controller.

The domain that this server will join is named (SNOWWHITE_DOMAIN).
Would you like to change this domain name now [y/n]? n
```

7. Confirm the names that you have provided.

```
...
Confirm choices:      servername   : happy
                      role         : primary
                      domain       : CLUSTER_DOMAIN

Is this correct [y/n]? y
```

8. Re-enter your administrator password and verify that the PC NetLink software has created a new virtual server.

```
Enter the password for Administrator: password
Re-enter password: password

Creating Solaris (TM) PC NetLink Server accounts database.
Mar 12 09:53:58 happy ID[SUNWcluster.ha.hareg.3024]: (info)
Service pc_netlink2 is registered
HA service pc_netlink has been successfully registered.
Mar 12 09:54:03 happy ID[SUNWcluster.ha.hareg.1008]: (info)
Service pc_netlink2 successfully turned on.
HA service pc_netlink2 started successfully on happy_loghost.
Success.
Instance created

grumpy#
```

9. Repeat this entire procedure for each virtual server that you require.

PC NetLink software has now been installed and configured to operate in a high availability environment.

What Next

You have successfully installed and configured PC NetLink software in an HA environment. To learn more about maintaining PC NetLink in an HA environment, read the next chapter.

Maintaining PC NetLink Software on a Cluster

Clusters are not static systems, so you should expect to perform maintenance periodically to add or remove PC NetLink services or to respond to interruptions in normal Sun Cluster 2.2 operation. This chapter explains how to perform common maintenance tasks. It has two sections:

- “Maintaining PC NetLink Virtual Servers” on page 39
- “Managing Interruptions in Service” on page 41

Maintaining PC NetLink Virtual Servers

Adding and removing PC NetLink virtual servers are the most common maintenance tasks.

▼ How to Add PC NetLink Virtual Servers to the Cluster

1. **Log in to the node that will support the new PC NetLink virtual server.**
2. **Log in as root.**
3. **Use the PC NetLink `instancecfg` command to create and configure a new virtual server.**

```
grumpy# cd /opt/lanman/sbin/  
grumpy# ./instancecfg -a
```

The `instancecfg` utility tests whether Sun Cluster 2.2 software is running and fully configured on the node. If these conditions are met, `instancecfg` polls the default master node for the names of available logical hosts, shared disk groups, and other cluster information.

4. Respond to the prompts displayed by the `instancecfg` utility.

```
grumpy# instancecfg -a
The logical hosts available on this cluster are: grumpy
Enter the logical host to be used for clustered installation
(or <Return> if this instance should not be configured on a
cluster) : grumpy
The file systems available for the logical host grumpy are:
  /grumpydisk0
Enter the directory path to be used: /grumpydisk0
The path of the shared directory you entered was: /grumpydisk0

Creating accounts database.
Configuring registry...
reg.ini created successfully
Upgrading <listenname>...
reg.ini upgraded successfully
Creating new registry file...
processed 899 lines...
Registry file created successfully
...
The Solaris (TM) PC NetLink Server configuration utility
(joindomain) allows you to specify the server name, the domain
name, and the server's role within that domain. Each time you run
this utility, the server will be stopped and the user accounts
database and associated files will be re-initialized. All data
currently in those files will be replaced.

Do you want to continue [y/n]? y
...
```

▼ How to Remove PC NetLink Virtual Servers From the Cluster

- 1. Log in to the node supporting the PC NetLink virtual server that you want to delete.**
- 2. Log in as root.**

3. Use the PC NetLink instancecfg command to delete the virtual server from the cluster.

```
grumpy# cd /opt/lanman/sbin/
grumpy# ./instancecfg -l
ServerName      No.      DataPath      LogicalHost
grumpy          1        /
cluster_dc      2        /dc-227      dc-227

grumpy# instancecfg -d 2

This command will remove data configured in this virtual server:
- customized print processor scripts
- shared printers
- shared directories
- users and accounts
- WINS database

Do you wish to proceed? y

Removing Unix user accounts created by this virtual server.

Removing printers configured by this virtual server.

Removing contents of /dc-227/var/opt/lanman/2 and /dc-227/etc/opt/
lanman/2.
Nov 26 11:06:00 grumpy ID[SUNWcluster.ha.hareg.1011]: (info)
Service pc_netlink2 succesfully turned off
Nov 26 11:06:01 grumpy ID[SUNWcluster.ha.hareg.3023]: (info)
Service pc_netlink2 is unregistered
grumpy# instancecfg -l
ServerName      No.      DataPath      LogicalHost
grumpy          1        /
```

Managing Interruptions in Service

Clusters are designed to provide uninterrupted service even when individual components fail. However, when entire systems fail or when the entire cluster is undergoing maintenance, the PC NetLink data service may be unavailable.

In some cases, a PC NetLink virtual server automatically restarts, as when its logical host is restored after a maintenance cycle. In some cases, however, as when a logical host is removed or has its IP address changed, you need to reinstall and reconfigure the PC NetLink service.

▼ How to Remove PC NetLink Software

1. **Log in to the default master node as root.**

```
grumpy% root
passwd: password
grumpy#
```

2. **Use the `uninstall` command to remove PC NetLink software from the node.**

```
grumpy# cd /opt/lanman/sbin/
grumpy# uninstall
```

Note – This step removes all PC NetLink virtual servers if the cluster is configured to support more than one PC NetLink virtual server. To remove one or more virtual servers without uninstalling PC NetLink software, use the `instancecfg` command.

▼ How to Remove the PC NetLink HA Agent

Although you can use the following procedure to remove the PC NetLink HA agent from one or more nodes in your cluster, doing so does not affect the operation of PC NetLink software running in your cluster after it has been installed and configured. Removing the agent will not solve any configuration problems that you may be experiencing.

1. **Log in to the default master node as root.**

```
grumpy% root
passwd: password
grumpy#
```

2. Use the `pkgrm` command to remove the package.

```
grumpy# pkgrm SUNWlzhzha

The following package is currently installed:
SUNWlzhzha Solaris (TM) PC NetLink HA
...
```

3. Confirm that you want to remove the package.

Type `y` at the prompt.

```
Do you want to remove this package? y

## Removing installed package instance <SUNWlzhzha>

This package contains scripts which will be executed with super-
user permission during the process of removing this package.
```

4. Confirm that you want to continue with the removal of the package.

Type `y` at the prompt.

```
Do you want to continue with the removal of this package [y,n,q]? y
## Verifying package dependencies.
## Processing package information.
## Executing preremove script.
## Removing pathnames in class <none>
/opt/lanman/sbin <shared pathname not removed>
/opt/lanman/lib/ha/netlink_stop_net
/opt/lanman/lib/ha/netlink_start_net
/opt/lanman/lib/ha/netlink_check_mastered
/opt/lanman/lib/ha/netlink_check_configured
/opt/lanman/lib/ha/ha_lpaddprinter
/opt/lanman/lib/ha/ha_lpaddclass
/opt/lanman/lib/ha
/opt/lanman/lib <shared pathname not removed>
/opt/lanman <shared pathname not removed>
/opt <shared pathname not removed>
## Updating system information.

Removal of <SUNWlzhzha> was successful.
```

What Next

Once you have installed and configured PC NetLink software on your cluster, read the *Solaris PC NetLink 2.0 Administration Guide* for more information about PC NetLink features and administrative tasks.

Upgrading a PC NetLink 1.2 Cluster

This appendix explains how to upgrade a cluster running PC NetLink 1.2 software to support PC NetLink 2.0 software.

Overview of the Upgrade Process

PC NetLink software does not support rolling upgrades in a cluster. When any one node in the cluster is upgraded, the PC NetLink data service stops on all nodes and does not restart until all nodes have been upgraded.

To upgrade PC NetLink 1.2 software on a cluster, you must perform two tasks:

- Move the logical host supporting the PC NetLink 1.2 software to the node on which it was originally installed.
- Install PC NetLink 2.0 software on each node in the cluster.

Note – For more information about PC NetLink and Sun Cluster 2.2 system requirements, see “Installing PC NetLink Software” on page 29.

▼ How to Upgrade a PC NetLink 1.2 Cluster

1. **Log in to the default master node as root.**

2. Use the `haswitch` command to move the PC NetLink 1.2 logical host to the cluster node on which it was originally installed.

For example, assume that a cluster has three nodes (NodeA, NodeB, and NodeC) and the PC NetLink 1.2 logical host is currently running on NodeC. If PC NetLink was installed originally on NodeA, you must move its logical host from NodeC to NodeA.

```
# haswitch NodeA pcn1_loghost_OnNodeC
```

3. Upgrade the PC NetLink software on each node in the cluster.

See the *Solaris PC NetLink 2.0 Installation Guide* for information about installing PC NetLink software.

4. Use the `net start` command to restart the upgraded PC NetLink software.

```
# net start server /I:n
```

where *n* is the instance number of the PC NetLink server being restarted.

Index

B

- backup devices, 16
- backup domain controller (BDC), 23
- backup node
 - defined, 1, 23
 - operation, 18

C

- cluster, defined, 1, 16
- configuration
 - gathering information, 8, 27
 - Sun Cluster 2.2, 9
- consolidation, NT servers, 3
- creation
 - logical host, 10, 31
 - virtual server, 11

D

- data service
 - defined, 2
 - operation, 3, 17
- default master node, defined, 1

F

- failover
 - causes, 21
 - defined, 2, 20

- operation, 17
 - process, 20
 - recovery time, 21
- failover logic, defined, 17
- fault monitoring daemon, defined, 3

H

- hastat command, 28
- haswitch command, 29
- High Availability (HA) Agent
 - defined, 2
 - installation, 10

I

- installation
 - PC NetLink HA Agent, 10, 29
 - PC NetLink software, 29
 - upgrade, 45
- instancecfg command, 11, 35

L

- logical host
 - creation, 10, 31
 - defined, 2, 17
 - operation, 17

M

- maintenance, PC NetLink software, 39
- member server, 23
- Microsoft Windows, 1

N

- NFS-exported file system, 8, 23, 26
- node, defined, 1
- NT servers, consolidation, 3

P

- PC NetLink software
 - benefits on a cluster, 23
 - differences on a cluster, 23
 - HA Agent installation, 29
 - installation, 29
 - removal, 42
- physical host, defined, 1
- primary domain controller (PDC), 23
- primary node, 23

Q

- Quick Start procedures, 10

R

- reading path, 6
- recovery time, 21
- redundant devices, 16
- removal, PC NetLink software, 42

S

- server consolidation, 3
- service interruptions, 41
- Sun Cluster 2.2 software, 9
- system and software requirements, 8, 26

U

- upgrade installation, 45

V

- verification, Sun Cluster operation, 28
- virtual server
 - additional servers, 39
 - creation, 11
 - defined, 1
 - HA configuration, 34
 - removal from the cluster, 39