

HP Auto Port Aggregation Administrator's Guide

HP-UX 11i v1, 11i v2

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About This Document

This document (formerly titled *HP Auto Port Aggregation Support Guide*) describes how to install, configure, and troubleshoot HP Auto Port Aggregation (APA) on HP-UX Version 11.0, 11i v1, 11i v2 platforms.

Document updates can be issued between editions to correct errors or document product changes. To ensure that you receive the updated or new editions, subscribe to the appropriate product support service. See your HP sales representative for details.

This document is not a tutorial.

Intended Audience

This document is intended for system and network administrators responsible for installing, configuring, and managing HP APA. Administrators are expected to have knowledge of operating system concepts, commands, and configuration.

A knowledge of Transmission Control Protocol/Internet Protocol (TCP/IP) networking concepts and network configuration is also helpful.

New and Changed Information in This Edition

The September 2007 release of HP APA for HP-UX 11i v1 supports Nortel Split Multi-Link Trunking (SMLT) technology and MANUAL mode link aggregate creation from ports with different group capability values.

The September 2007 release of HP APA for HP-UX 11i v2 supports HP Serviceguard over failover groups (LAN_MONITOR mode), Nortel Split Multi-Link Trunking (SMLT) technology, and improved HP Integrity virtual machine support.

The document has been reorganized and the troubleshooting section updated.

Document Organization

This document is organized as follows:

Chapter 1 (page 13)	Describes HP APA, its concepts, and administrative methods.
Chapter 2 (page 19)	Describes HP APA installation requirements and how to install HP APA.
Chapter 3 (page 23)	Shows sample HP APA configurations, and describes the information to gather and the steps to configure HP APA using the System Administration Manager (SAM).
Chapter 4 (page 51)	Describes how to administer HP APA using the <code>lanadmin</code> command.
Chapter 5 (page 63)	Describes those tasks that you perform for the day-to-day administration of HP APA.
Chapter 6 (page 67)	Describes how to diagnose and solve HP APA problems, including reporting problems to HP.
Appendix A (page 95)	Provides a summary of the HP APA product specifications.
Appendix B (page 97)	Describes the HP APA configuration files and their fields.
Appendix C (page 105)	Describes how to configure HP APA by editing the configuration files.
Appendix D (page 113)	Describes the steps to configure VLANs over HP APA using HP Procurve switches.
Appendix E (page 119)	Provides information on using various switches to configure link aggregates.

Typographic Conventions

This document uses the following typographical conventions:

<code>%</code> , <code>\$</code> , or <code>#</code>	A percent sign represents the C shell system prompt. A dollar sign represents the system prompt for the Bourne, Korn, and POSIX shells. A number sign represents the superuser prompt.
<code>audit(5)</code>	A manpage. The manpage name is <i>audit</i> , and it is located in Section 5.
Command	A command name or qualified command phrase.
Computer output	Text displayed by the computer.
Ctrl+x	A key sequence. A sequence such as Ctrl+x indicates that you must hold down the key labeled Ctrl while you press another key or mouse button.
ENVIRONMENT VARIABLE	The name of an environment variable, for example, <code>PATH</code> .
[ERROR NAME]	The name of an error, usually returned in the <code>errno</code> variable.
Key	The name of a keyboard key. Return and Enter both refer to the same key.
Term	The defined use of an important word or phrase.
User input	Commands and other text that you type.
<i>Variable</i>	The name of a placeholder in a command, function, or other syntax display that you replace with an actual value.
[]	The contents are optional in syntax. If the contents are a list separated by <code> </code> , you must choose one of the items.
{ }	The contents are required in syntax. If the contents are a list separated by <code> </code> , you must choose one of the items.
...	The preceding element can be repeated an arbitrary number of times.
.	Indicates the continuation of a code example.
	Separates items in a list of choices.
WARNING	A warning calls attention to important information that if not understood or followed will result in personal injury or nonrecoverable system problems.
CAUTION	A caution calls attention to important information that if not understood or followed will result in data loss, data corruption, or damage to hardware or software.
IMPORTANT	This alert provides essential information to explain a concept or to complete a task
NOTE	A note contains additional information to emphasize or supplement important points of the main text.

Related Information

You can find additional information about HP APA in docs.hp.com in the *Internet & Networking* topic area, in the *I/O Cards and Networking Software* collection under *Auto Port Aggregation (APA)* at:

<http://www.docs.hp.com/hpux/netcom/index.html#Auto%20Port%20Aggregation%20%28APA%29>

Other documents in this collection include:

- *HP Auto Port Aggregation (APA) Release Notes*
- *Performance and Scalability White Paper*
- *Using APA to Build a Screaming Fast Network Server Connection*

Publishing History

The document printing date and part number indicate the document's current edition. The printing date will change when a new edition is printed. Minor changes may be made at reprint without changing the printing date. The document part number will change when extensive changes are made. Document updates may be issued between editions to correct errors or document product changes. To ensure that you receive the updated or new editions, you must subscribe to the appropriate product support service. See your HP sales representative for details. You can find the latest version of this document on line at:

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1 Introduction

HP Auto Port Aggregation (APA) is a software product that creates link aggregates, often called trunks, which provide a logical grouping of two or more physical ports into a single fat pipe. This port arrangement provides more data bandwidth than would otherwise be available and enables you to build large bandwidth logical links into the server that are highly available and completely transparent to the client and server applications. HP APA provides the following features:

- Automatic link failure detection and recovery
- Support for load balancing of network traffic across all of the links in the aggregation.
- Support for the creation of failover groups, providing a failover capability for links. In the event of a link failure, LAN Monitor automatically migrates traffic to a standby link.
- Support for the TCP Segmentation Offload (Large Send) feature, if an aggregate is created with all Ethernet cards capable of TCP Segmentation Offload (TSO).
- Support for Virtual VLANs (VLANs) over APA link aggregates and failover groups. (September 2006 release of HP-UX 11i v2 (B.11.23.20) and later releases)
- Support for 64-bit MIB (RFC 2863) statistics, if all the interfaces within a link aggregate or failover group support 64-bit statistics.
- Support for IPv6 addresses on a link aggregate or failover group. (December 2005 release of APA for HP-UX 11i v2 (B.11.23.10) and later releases)

For release-specific information, see the release notes on the web at:

<http://www.docs.hp.com>

For a summary of HP APA capabilities, see Appendix A (page 95).

Conceptual Overview

HP APA offers you a comprehensive solution to create fast, highly available network server connections with minimal IT support costs. HP APA enables this with four key benefits:

- Automatic link failure detection and recovery in case of network failures. A link aggregate continues to operate as long as there is at least one port operating.
- Scalable high-performance link aggregates using Fast or Gigabit Ethernet and the HP APA load-balancing algorithms. See “Load Balancing” (page 14) for more information.
- Fault management and isolation with the HP MIB Monitor and `net t1` logging facilities.
- Lower IT costs with automated configuration and management tools using the IEEE 802.3ad or PAgP standards and the intuitive HP System Management Homepage (SMH) GUI.

This section describes the following features of HP APA:

- Link aggregate
- Failover group
- TCP segmentation offload
- VLAN support
- Interoperability with HP Serviceguard
- Administrative methods

Link Aggregate

HP APA enables you to combine 2 to 4 physical link ports (up to 32 for LACP mode) into one link aggregate. This gives the link aggregation a theoretical bandwidth of 4 times that of a single physical link (32 times for LACP mode). A link aggregate has the following characteristics:



NOTE: The December 2005 and later releases of APA for HP-UX 11i v2 (B.11.23.10) enable you to combine 2 to 8 physical link ports into one link aggregate.

- The physical ports in the link aggregation use the same MAC address.
The unique MAC address for a specific link aggregate is determined by using the MAC address of one of the ports in the link aggregate. All ports will use the same MAC address. When a physical port is removed from a link aggregate, the port's MAC address is reset to its own MAC address.
- HP APA link aggregates can migrate the network traffic from a failed physical link in the aggregate to the remaining operational links in the aggregate.
- HP APA distributes the outbound network traffic across the physical links in the link aggregation using a load balancing algorithm.
Effective APA load balancing requires many simultaneous, active client connections. The connections are distributed across the physical links. One client connection will have its traffic sent on one physical link. The connection is defined by the load-balancing algorithm. See “Load Balancing” (page 14) for more information.
- Each link aggregate can have one or more IP addresses assigned to it in the `/etc/rc.config.d/netconf` file.
- The link partner (the switch, router, or server) ports connected to the server ports must be configured for link aggregation (trunking). In addition, the mode on the link partner and the server must be the same. For example, if ports 1, 2, 3, and 4 are connected to a link partner switch's ports C1, C2, C3, and C4, respectively, and the server side is trunked using LACP_AUTO mode, the partner switch must be configured to trunk ports C1, C2, C3, and C4 using LACP_AUTO mode.



NOTE: MANUAL mode link aggregates using HOT_STANDBY load balancing can be connected to different switches. In addition, do not enable trunking on the corresponding switch ports.

- The link partner (the switch, router, or server) connected to the link aggregation can inhibit the usefulness of HP APA in some environments. See “HP APA Configuration Examples” (page 23) for more information.
- All the devices in the link aggregation must be the same type and must be configured for the same speed, duplex, and MTU. See “Supported LAN Cards” (page 19) for the devices HP APA supports.

Load Balancing

HP APA provides load balancing on outbound data transfers using a load distribution algorithm that you select when you configure a link aggregate. The load distribution algorithms are based on destination MAC address, IP address, or TCP/UDP port number. Inbound load balancing is strictly determined by the link partner (switch, router, or remote server) and has no effect on the outbound algorithms.

Although you can use each of these load distribution algorithms in all supported configurations, they may not all provide the same load on each of the physical ports in the link aggregate. Therefore, HP prefers you use the algorithm that is recommended for each supported configuration. See “Preparing for Configuration” (page 31) for more information.

The load balancing algorithm consists of the following steps:

1. **Data Flow Lookup** — The load distribution algorithm determines an index into a hash table that includes the physical port through which the outbound data flow is forwarded.
2. **Data Flow Physical Port Assignment** — If the hash index for the data flow has not been assigned a physical port (the entry is empty), a physical port in the link aggregate is assigned to that specific hash index. The physical port is selected on a Round Robin basis.
3. **Aging Data Flows** — Over time, each data flow is checked to determine if it is still active. If the data flow has not been active in the last 30 seconds, its specific hash index is cleared (aged out). If the data flow restarts after being cleared from the hash table, it is reassigned a new physical port on a Round Robin basis.

Each load distribution algorithm guarantees that it will not introduce any severe ordering problems within a specific data flow. This is required to ensure that the performance is not degraded significantly as a result of turning on one of the algorithms.

Also, all packets for a specific data flow always flow out through the same physical port until the data flow is aged out of the distribution table. This means that in order to generate simultaneous load on each of the physical ports in a link aggregate, start multiple data flows over the link aggregate.

Failover Group

HP APA enables you to combine 2 to 32 physical link ports into one failover group. A failover group is a link aggregate in LAN_MONITOR mode, but with the following differences:

- One port is the active link, and the others are standby links. Network traffic is sent and received on the active port.
- LAN Monitor periodically exchanges APA packets between the links making up the failover group. This enables better detection of non-operational links in the failover group.
- If the active port or its link partner fails, LAN Monitor automatically migrates the traffic to one of the standby ports in the failover group. When a port with a higher priority than the current active port recovers, the network traffic is migrated back to the previous active port. Sometimes, it is desirable to have the network traffic remain on the current active port after the failure and recovery of the previous active port. To achieve this, set the HP APA port priorities the same for all ports in the failover group.
- You can use 100BT, Gigabit, or 10 Gigabit Ethernet (10GbE) devices in the failover group. However, all the devices in the failover group must be of one type: 100BT, Gigabit, or 10GbE.
- The failover group can have one or more IP addresses assigned to it.
- The physical ports in the failover group do not share a common MAC address.
- You can include link aggregates in a failover group. This enables increased bandwidth and load balancing in a failover group.

Proactive Failover

By default, the port in a failover group with the highest priority is the active port. This is called priority-based failover. However, the May 2005 and later releases of APA for HP-UX 11i v1 (B.11.11.20) and PHNE_33116 (B.11.11.17) patch release also allow you to configure failover groups with proactive failover.

With proactive failover, the port that is the most efficient at carrying traffic is the active port. Efficiency is determined by assigning a cost to each port in a failover group. This cost is divided by the port's current link speed to yield a normalized port cost; link speed is the number of links in a link aggregate multiplied by the speed of a member link, or in the case of a single link, only the link speed. The lower the normalized port cost, the higher the link's efficiency. If two links have the same normalized cost, the one with the higher priority is preferred.

For each failover group, if you assign a cost value to one link, you must assign a cost value to all other links in the group. If you do not specify a cost value for any of the failover group's links, the failover group uses the default failover behavior based on priority.

During certain LAN Monitor events (for example, link failure and link recovery), the normalized port cost might change on the active or standby links. When these events occur, the normalized port cost of the active link and the standby links are compared. If a standby link has a lower normalized port cost than the active link, the standby link becomes the active link even if the current active link is UP.

TCP Segmentation Offload

HP APA supports TCP Segmentation Offload (TSO), also known as Large Send, on link aggregates and failover groups if all the Ethernet cards are capable of it. TSO is a mechanism by which the host stack offloads certain portions of outbound TCP packet processing to the Network Interface Card (NIC) thereby reducing host CPU utilization. This functionality can significantly reduce the load on the server for certain applications which primarily transmit large amounts of data from the system.

In link aggregates, TSO has the following behavior:

- If TSO is enabled on all of the physical ports in a link aggregate, TSO is enabled for the entire link aggregate. If any of the ports within that link aggregate go DOWN or UP, the TSO status of the link aggregate does not change. After the physical ports are added to the aggregate, the TSO capability of the physical ports cannot be changed.
- If a port is removed from a link aggregate, the following occurs:
 - If TSO was supported on the link aggregate before removing the port, TSO remains enabled on the link aggregate.
 - If TSO was disabled on the link aggregate before removing the port, TSO of the link aggregate is based on remaining ports in the link aggregate. If all remaining ports support TSO, TSO is enabled on the link aggregate; otherwise, TSO remains disabled.
- If a port is added to a link aggregate, the TSO settings are recalculated. If the added port has TSO disabled, TSO is disabled on the link aggregate.

In failover groups, the TSO status depends on the TSO status of the current active port. When the active port is changed, the TSO status of the failover group might change. For example, an active port supports TSO and the standby port does not. Therefore, the failover group supports TSO. If the active port goes down, the standby port becomes active and the failover group now no longer supports TSO.

By default, TSO is disabled. To enable TSO on each specific interface, see the Ethernet Support Guide, available in <http://www.docs.hp.com>, in the Networking and Communication section.

To verify if TSO is supported on an link aggregate or failover group, enter the following command:

```
# lanadmin -x vmtu linkAggPPA
Driver/Hardware does not support TCP Segmentation Offload
```

If TSO is supported, a message similar to the following is displayed:

```
Driver/Hardware supports TCP Segmentation Offload, Current VMTU = 32160
```

VLAN Support

For the September 2006 and later releases of HP APA for HP-UX 11i v2 (B.11.23.20), VLANs over link aggregates and failover groups have the same advantages of VLANs over physical links, but with the following additional features:

- VLANs over link aggregates offer higher bandwidth than VLANs over a single physical link.
- VLANs over failover groups offer improved reliability. The VLANs continue to carry traffic in case the active link failed.
- You can use VLANs over one link aggregate to serve multiple workgroups. This also enables broadcast traffic to be isolated within the same broadcast domain, offering improved security for workgroups.

- The same link aggregate or failover group can offer different level of service for each user using ToS. You gain more flexibility in how you deploy link aggregates and failover groups.
- You can create, remove, and modify VLANs over link aggregates and failover groups without rebooting the system. This enables you to configure networking on a server without disrupting other users.

For more information on managing and using VLANs, see *HP-UX VLAN Administrator's Guide* and your switch documentation.

Appendix D (page 113) describes characteristics of using VLANs over link aggregates and failover groups and guidelines for each configuration.

Interoperability with HP Serviceguard

Table 1-1 shows the HP APA interoperability with HP Serviceguard. For installation guidelines, see “Configuring HP Serviceguard” (page 47).

Table 1-1 Interoperability with HP Serviceguard

HP Serviceguard Version	HP APA Version	Supported Modes	Number of Links
A.11.15, A.11.16	B.11.23.10	FEC_AUTO, Hot Standby	4 (FEC_AUTO)
A.11.17 and PHSS_35427 patch ¹ , A.11.18	B.11.23.10 and PHNE_34774 patch	FEC_AUTO, LACP_AUTO, and Hot Standby	8 (FEC_AUTO), 32 (LACP_AUTO)
A.11.17 and PHSS_35427 patch ¹ , A.11.18	B.11.23.30 (September 2007)	FEC_AUTO, LACP_AUTO, Hot Standby, and LAN_MONITOR ²	8 (FEC_AUTO), 32 (LACP_AUTO)

1 Supports LACP link aggregations and link aggregations with more than four ports.

2 HP Serviceguard Primary LAN interface only.

Administrative Methods

The following sections provide a brief overview of the methods for administering HP APA. HP recommends that you use the System Administration Manager (SAM) whenever possible.

HP System Administration Manager

The HP System Administration Manager (SAM) enables you to administer your HP-UX system locally via a graphical user interface (GUI) and terminal user interface (TUI). SAM produces fewer errors and saves your configuration data permanently so configuration does not require a reboot to take effect. It is the recommended method for configuring link aggregates.



NOTE: You cannot use SAM to configure failover groups. For more information, see “Editing Configuration Files for Failover Groups” (page 107) and “Configuring VLANs over Failover Groups” (page 114).

In this manual, wherever SAM is mentioned in relation to HP APA configuration tasks, it is presumed that you know how to invoke it.

For more information about the System Administration Manager, see *sam(1M)* and the online help.

lanadmin Command

You can also use the `lanadmin` command from the HP-UX command line to make changes to HP APA. By default, those changes are not preserved across reboots. For more information about the `lanadmin` command and using it to administer APA, see *lanadmin(1M)* and [Chapter 4 \(page 51\)](#), respectively.

Manually Editing Configuration Files

Some sections of this manual describe the system files that are updated or modified when you perform an administrative task. Experienced UNIX administrators might prefer to administer their systems manually by editing these files, as opposed to invoking the documented utility; however, HP strongly recommends that you use SAM to update the system files.

In many cases, the SAM is the best alternative to manually editing system files, thus it is the utility that is most frequently discussed in this manual.

2 Installing the APA Software

This chapter describes the information required in order to install APA on your system.

Installation Requirements

1. Log in to the HP-UX server as superuser.
2. Confirm that the `/usr/bin`, `/usr/sbin`, and `/sbin` directories are in your PATH by using the `echo $PATH` command.
3. Use the `uname -a` command to determine the HP-UX version of your system.
4. Install the required patches for your system as described in the “Required Patches” section of the release notes.

Hardware Requirements

Supported Switches

HP APA supports the Cisco FastEtherChannel (PAgP) protocol, the Link Aggregation Control Protocol (LACP) (IEEE 802.3ad), and manual trunking mechanisms. HP has tested switches from the following vendors to work with HP APA:

- 3Com
- Cisco
- HP Procurve
- Foundry
- Alteon
- Nortel
- Extreme

With the September 2007 release of HP APA for HP-UX 11i v1 and HP-UX 11i v2 (B.11.11.30 and B.11.23.30, respectively), HP APA also supports Nortel's Split Multi-Link Trunking (SMLT) technology. Specifically, HP has tested the Passport 8006 and Passport 8010 switches with the version 3.7.13.0 of the software.

Supported LAN Cards

The following network interface cards are supported for HP-UX 11.0 and 11i v1:

- All HP HP-PB, HSC, and PCI 10/100Base cards (both FX and TX)
- All HP HSC and PCI 1000Base cards (both Base-T and SX)
- HP-PB and PCI Token Ring (failover groups only)
- HP-PB and PCI FDDI (failover groups only)

The following network interface cards are supported for HP-UX 11i v2:

- All HP PCI 10/100Base cards (both FX and TX)



NOTE: HP APA does not support the 10/100 BT Standard/Management LAN interface found on some systems and controlled by the `int1100` driver, and any other devices controlled by the `int1100` driver.

- All HP PCI 1000Base cards (both Base-T and SX)
- PCI-X 10 GbE Fiber cards (failover groups only)
- All HP PCI-X 2-port Combination cards (network ports only)
- PCI Token Ring (failover groups only)
- PCI FDDI (failover groups only)

Operating System Requirements

HP-UX 11.0, 11i v1, or 11i v2.

Software Requirements

For the December 2005 release of HP APA for HP-UX 11i v2 (B.11.23.10) and later releases, if you want to use 8 ports for trunking HP APA requires the following software:

- Transport Optional Upgrade (TOUR) 3.0
- Streams Advance Release (STAR) 1.0
- IPFilter version A.03.05.12, if you use IP Filter

Installing the Software

Skip this section if you ordered product option 0D1—preinstallation.

1. To install the software from the installation media, enter the following command:

```
swinstall
```

2. Choose the appropriate Source Depot Type (for example, Local CD, Local tape, Local Directory, Network Directory/CDROM).
3. Choose Source Host Name.
4. Choose Source Depot Path. If you do not know the exact path, you can click the Source Depot Path button to display a list of valid choices.
5. Highlight the HP APA software:
J4240AA
6. Choose **Mark for Install** from the Actions menu.
7. Choose **Install** from the Actions menu to begin product installation and to display the Install Analysis window.
8. Click **OK** in the Install Analysis window when the Status field displays a Ready message.
9. Click **YES** at the Confirmation window to confirm that you want to install the software. The `swinstall` command loads the fileset, runs the control scripts for the filesets, and builds the kernel. The estimated time for processing is 3 to 5 minutes depending on the complexity of your system. When the status field indicates Ready, a Note window opens. Click **OK** on the Note window to reboot the system.



NOTE: You must reboot the system after the software installation to configure HP APA into the kernel.

After you have installed HP APA, it will be in MANUAL port configuration mode until you configure it to aggregate eligible ports.

See `swinstall(1M)` for more information.

Verifying the Installation

To verify that the HP APA software (J4240AA) has been successfully installed, complete the following steps:

1. Verify that the product was installed by issuing the following command:

```
# swlist -l product | grep -i HP-APA
```

Output similar to the following displays:

```
HP-APA-FMT      B.11.23.40      HP Auto-Port Aggregation APA formatter product.
HP-APA-KRN      B.11.31.20      HP Auto-Port Aggregation kernel products.
HP-APA-LM       B.11.31.20      HP Auto-Port Aggregation LM commands.
HP-APA-NETMOD   B.11.31.20      HP Auto-Port Aggregation nwmgr/NCweb libraries.
HP-APA-RUN      B.11.31.20      HP Auto-Port Aggregation APA command products.
```

If the sub-products are not displayed, reinstall the software. See “Installing the Software” (page 20) for more information.

2. Verify that the software is configured in the kernel by issuing the following command:

```
# what /stand/vmunix | egrep -i hp_apa
```

Output similar to the following displays:

```
$Revision: hp_apa:      HP Auto-Port Aggregation (APA): B.11.31.20 Aug 20 2008 11:30
```

If nothing is displayed, rebuild the kernel.

Removing the Software

If you need to remove the HP APA software, complete the following steps:

1. To remove the software from the system, enter the following command:

```
swremove
```

2. Highlight the HP APA software:

```
J4240AA
```

3. Choose **Mark for Remove** from the Actions menu.
4. Choose **Remove** from the Actions menu to begin product removal and to display the Remove Analysis window.
5. Click **OK** in the Remove Analysis window when the Status field displays a Ready message.
6. Click **YES** at the Confirmation window to confirm that you want to remove the software. The `swremove` command unloads the fileset, runs the control scripts for the filesets, and builds the kernel. The estimated time for processing is 3 to 5 minutes depending on the complexity of your system. When the status field indicates Ready, a Note window opens. Click **OK** on the Note window to reboot the system.



NOTE: You must reboot the system after the software removal to deconfigure HP APA in the kernel.

See `swremove(1M)` for more information.

3 Configuring APA

This chapter describes how to configure HP APA on your system. This includes:

- Reviewing sample HP APA configurations
- Preparing for the configuration by gathering information
- Configuring systems in sample configurations
- Configuring a link aggregate
- Configuring a failover group
- Configuring the link partner
- Performing post-configuration tasks

HP APA Configuration Examples

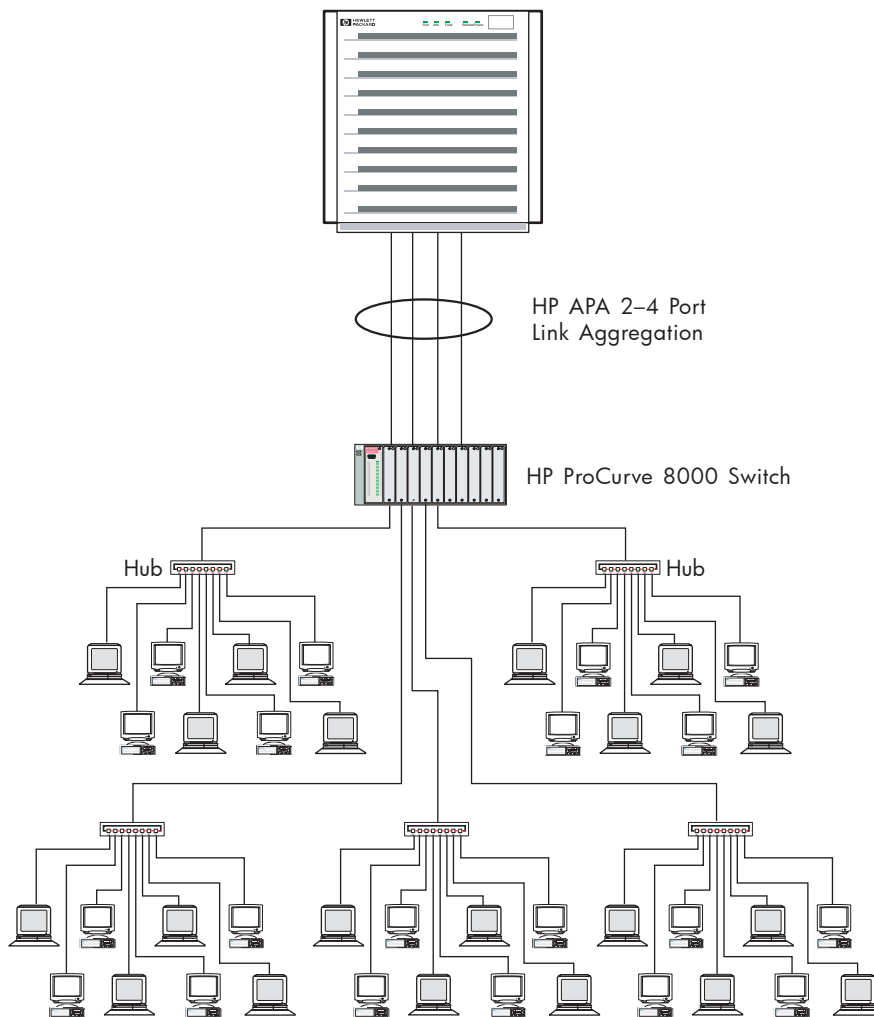
This section shows some sample HP APA configurations. Select a configuration that most closely matches the environment into which you want to configure HP APA on your system.

Enterprise Intranet Client/Server Environment

Figure 3-1 shows a sample enterprise client/server environment. This type of environment is a good candidate for HP APA link aggregations, and has the following characteristics:

- Requires a switch capable of trunking or load balancing.
- Many clients produce many connections. This makes effective use of the HP APA outbound network traffic distribution algorithms. The HP APA MAC address load-balancing algorithm is a good choice. The IP address and TCP/UDP port address load-balancing algorithm also works effectively in this configuration.
- The switch typically provides good inbound traffic distribution. Most switches use the data packet's source MAC address, or a combination of the packet's source and destination MAC addresses, to provide inbound load balancing.
- Depending on the network traffic bandwidth requirements, you can use two to four 100BT interfaces or two to four Gigabit interfaces in an PAgP or MANUAL link aggregation. For the December 2005 release (B.11.23.10), you can use two to eight interfaces. With LACP, you can use up to 32 interfaces in the link aggregation. This enables bandwidth scalability as network loads increase as the organization grows.

Figure 3-1 Sample Enterprise Intranet Client/Server Configuration



Internet or Large Enterprise Environments Using Routers

You can use HP APA link aggregation successfully in certain environments employing routers. You must be careful because a particular router might not have a load balancing capability. Additionally, switches employed between the server employing HP APA and the router inject another level of complexity that you must analyze before determining that the environment is a candidate for HP APA link aggregations.

Figure 3-2 (page 25) shows a sample router and server configuration with no switch. This configuration makes the following assumptions:

- The router or switching router connected to the server provides trunking or load balancing using an IP address-based load-balancing algorithm.
- There will be many TCP/UDP client connections. The HP APA IP address load-balancing algorithm provides effective outbound network traffic load balancing, as does the TCP/UDP port address algorithm. Do not use the MAC address algorithm because all packets transmitted from the server would contain the same source and destination MAC addresses.

Figure 3-2 Sample Router and Server Configuration (No Switch)

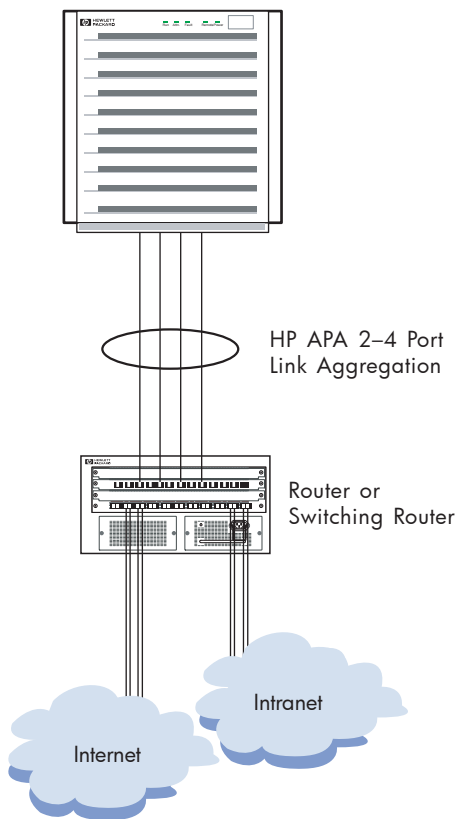
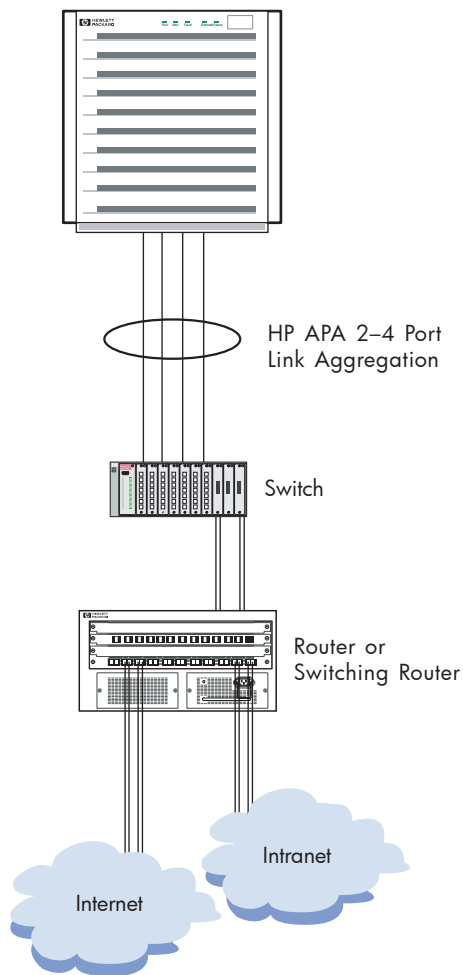


Figure 3-3 (page 26) shows a sample router and server configuration with a switch. In this configuration, the switch might present problems because switches typically use a MAC address load-balancing algorithm. This might make the switch a bottleneck point because the packets from the router and from the server will contain the same source and destination MAC addresses, thus defeating the load-balancing algorithm for both inbound and outbound data at the server. This condition might be acceptable if the load balancing of inbound traffic to the server is not a concern and the link between the switch and the router has greater bandwidth capacity than the server's link aggregation. For example: The server's link aggregation is composed of 100BT links and the link between the switch and the router is a Gigabit link.

Figure 3-3 Sample Router and Server Configuration (Switch)

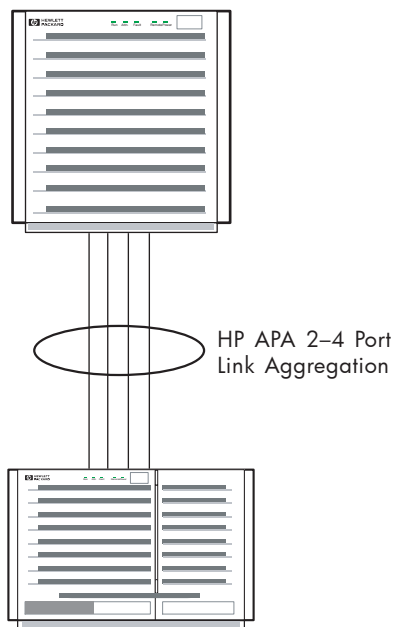


Server-to-Server (Back-to-Back)

Figure 3-4 (page 27) shows a sample server-to-server configuration. You create server-to-server aggregations by directly connecting the physical ports in one server's link aggregation to the physical ports in the other server's link aggregation. This configuration has the following characteristics:

- It needs many TCP/UDP client connections between the servers in order for load balancing to be effective. Therefore, use the HP APA TCP/UDP port load-balancing algorithm.
- Depending on the network traffic bandwidth requirements, use two to four 100BT interfaces or two to four Gigabit interfaces in an PAgP or MANUAL link aggregation. For the December 2005 release (B.11.23.10), you can use two to eight interfaces. With LACP, you can use up to 32 interfaces in the link aggregation. This enables bandwidth scalability as network loads increase as the organization grows.

Figure 3-4 Sample Server-to-Server Configuration (Back-to-Back)



Hot Standby for High Availability

Figure 3-5 (page 28) shows a sample MANUAL (Hot Standby) mode configuration. These link aggregations provide high availability network access with an active link and a standby link.

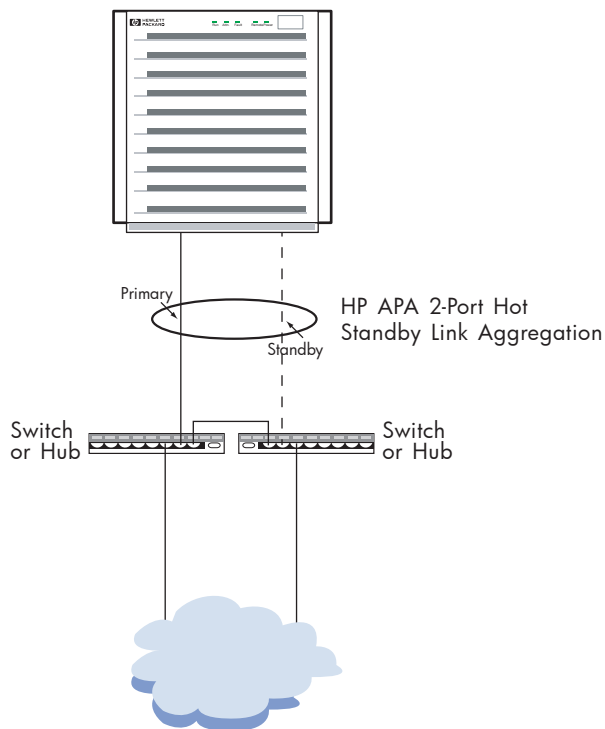


NOTE: HP strongly recommends using failover groups (LAN_MONITOR mode) rather than Hot Standby mode. Hot Standby aggregates are deprecated.

This configuration has the following characteristics:

- The Hot Standby active link carries network traffic until it or its link partner fails. In that event, the standby link takes over the responsibility for delivering network traffic. If the previous active link is configured with a higher port priority than the current active link, when it recovers it resumes being the active link delivering the network traffic. If the port priorities are the same, the current active link continues as the active link.
- The active and standby links must both be the same type of device: 100Base-T or Gigabit.
- Hot Standby link aggregations can be connected to any switch or hub. The ports must be cabled to a switch and the switch ports must not be configured for an aggregation.
- Dual switches or hubs (as used in Figure 3-5) are not required. But dual switches and hubs provide a more reliable network environment by removing single points of failure. Both switches or hubs must be on the same subnet.

Figure 3-5 Sample Hot Standby Configuration for High Availability

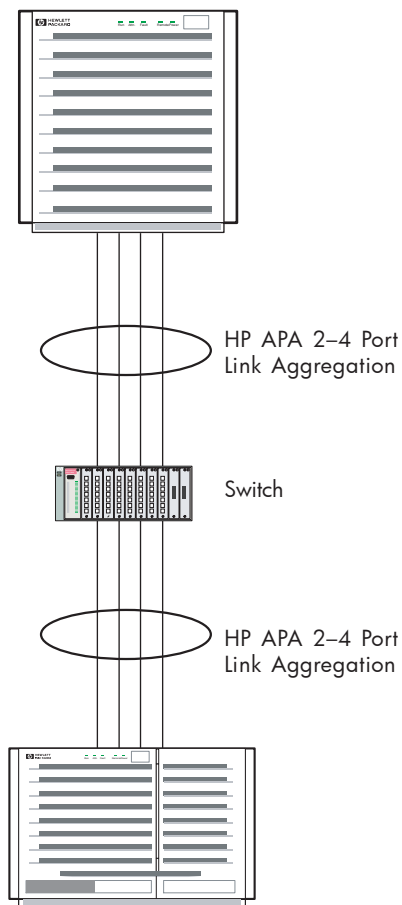


Server-to-Server with Switch (Not Recommended)

Figure 3-6 (page 29) shows a sample server-to-server HP APA link aggregation configuration with a switch between the servers. This configuration will not work as intended for the following reasons:

- The switch nullifies any load balancing of network traffic provided by HP APA.
- The switch uses a MAC address load-balancing algorithm. Because the servers' link aggregations have fixed MAC addresses, the switch will not load balance; it will only transmit data on one physical link.

Figure 3-6 Sample Server-to-Server Configuration with Switch (Not Recommended)

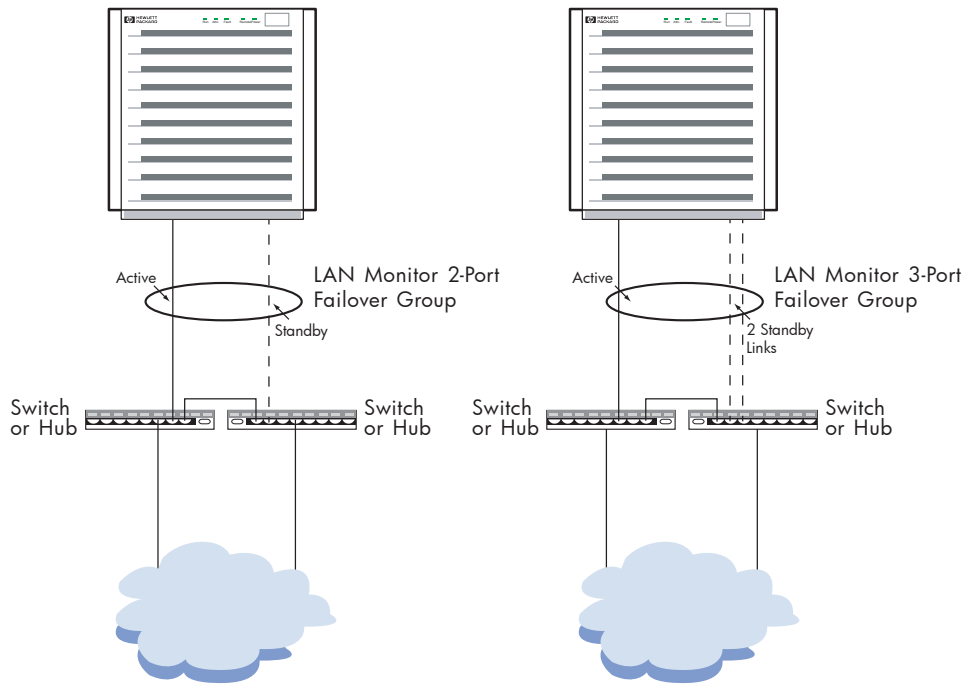


Failover Group

Figure 3-7 (page 30) shows a sample failover group (LAN_MONITOR mode) configuration. This configuration provides high availability network access with an active link and a standby link, and has the following characteristics:

- Dual switches or hubs are not required. However, dual switches and hubs provide a more reliable network environment by removing the switch or hub as a single point of failure. If two switches or hubs are used, there must be a data path between them to allow them to be on the same subnet.
- You can connect failover groups to any switch or hub.
- The link partner does not require trunking to be enabled.

Figure 3-7 Sample Failover Group (LAN_MONITOR) Configuration

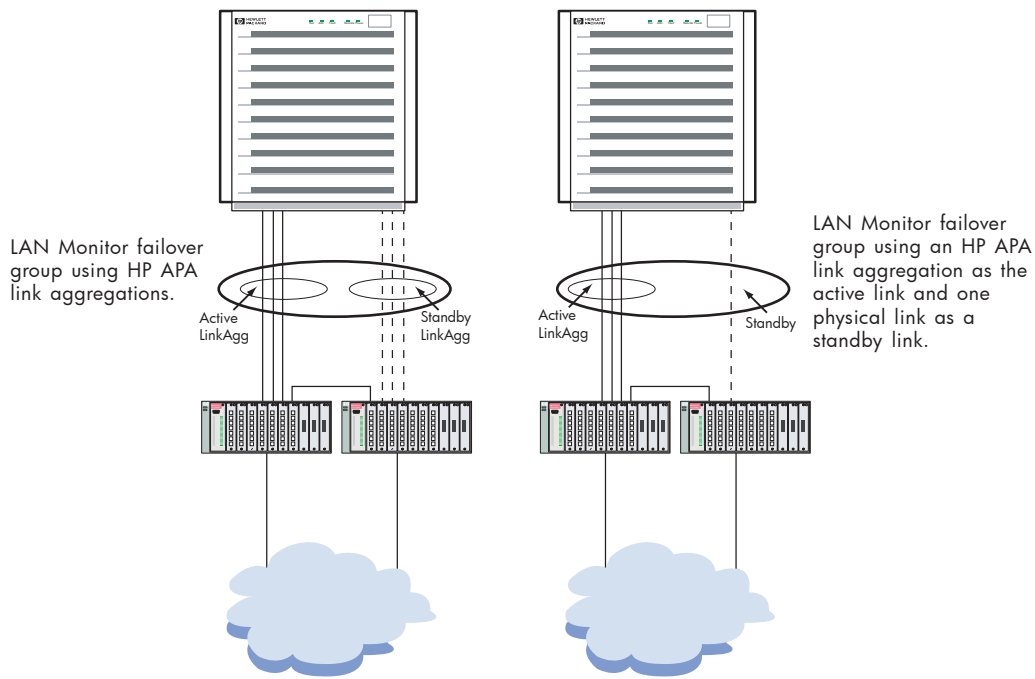


Failover Group Using Link Aggregates

Figure 3-8 (page 31) shows a failover group that uses link aggregates as the active and standby devices to increase the network bandwidth through load balancing across the physical links. This configuration has the following characteristics:

- You can use any HP APA link aggregate, except Hot Standby, as a device in the failover group.
- The standby link does not have to be a link aggregation. It can be a single physical link of the same type as used in the link aggregation.
- Dual switches are not required. However, dual switches provide a more reliable network environment by removing the switch as a single point of failure. If two switches are used, there must be a data path between them.
- LAN Monitor failover groups using link aggregates are restricted to switches supported by HP APA link aggregates.

Figure 3-8 Sample Failover Group Using Link Aggregates Configuration



Preparing for Configuration

Before you configure the HP APA software, you must gather information about your system and network environment. Figure 3-9 shows the APA Configuration Worksheet. The following sections describe the information that you need to record on the worksheets. If you are viewing this manual on line, you can use the print feature to print a copy of this worksheet.

Figure 3-9 HP APA Configuration Worksheet

HP APA Configuration Worksheet				
Aggregate Instance Number _____				
Mode <input type="checkbox"/> FEC_AUTO <input type="checkbox"/> LACP_AUTO <input type="checkbox"/> MANUAL				
<input type="checkbox"/> LAN_MONITOR <input type="checkbox"/> Not_Enabled				
Failover <input type="checkbox"/> Priority Based <input type="checkbox"/> Cost Based				
Instance Number:	Hardware Path:	Interface Type:	Priority:	Cost:
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
Advanced Parameters (Link Aggregates)				
Load Distribution Algorithm <input type="checkbox"/> LB_MAC <input type="checkbox"/> LB_IP <input type="checkbox"/> LB_PORT				
<input type="checkbox"/> HOT_STANDBY				
Group Capability _____ (FEC_AUTO only)				
Key _____ (LACP_AUTO only)				
Advanced Parameters (Failover Groups)				
Dead Count _____				
Polling Interval _____				
Rapid ARP <input type="checkbox"/> on <input type="checkbox"/> off				
Rapid ARP Interval _____				
Rapid ARP Count _____				

Aggregate Instance Number

The PPA number of the link aggregate or failover group. Enter a value. For example, use 900 for lan900.



NOTE: For HP-UX 11.0 releases, use 100 as the starting instance number.

Mode

The configuration mode of the link aggregate or failover group. Your choice will be determined by the capabilities of the link partner (for example, switch, router, or server) to which the link aggregate physical interfaces will be connected. See your link partner's documentation to determine which modes it supports. Check the mode you want to use. The following choices are available:

FEC_AUTO	Automatically start the FEC protocol on the physical port.
LACP_AUTO	Automatically start LACP on the physical port.
MANUAL	HP APA does not automatically aggregate ports. You must manually add or remove ports from a link aggregate.
LAN_MONITOR	The ports are used for a <i>failover group</i> .
Not_Enabled	Create the link aggregate with the Key, Group Capability, or Load Distribution Algorithm set to a non-default value, but without any ports. You must add ports to enable it.

Failover Policy

The mechanism by which LAN Monitor chooses the active port in a *failover group*. The following choices are available:

Priority Based	If the active port fails, LAN Monitor chooses the standby link that is UP and that has the highest <i>port priority</i> (highest value) to be the new active link. For the December 2005 and later releases of HP APA for HP-UX 11i v1 (B.11.11.20) and PHNE_33116 (B.11.11.17) patch release.
Cost Based	If the active port fails, LAN Monitor chooses the standby link that is UP and has the lowest normalized port cost to be the new active link. This is also called proactive failover . See “Proactive Failover” (page 15) for a description of proactive failover and “Proactive Failover Examples” (page 110) for proactive failover examples.

Check the failover policy you want to use.

Instance Number

The PPA numbers of the ports that will be in the link aggregation or failover group. Enter the numbers on the sheet.



NOTE: Before adding ports to a failover group, you must check link connectivity between the ports.

HW Path

The hardware path to the NIC associated with the port to include in the link aggregate or failover group. A numeric string of hardware components, noted sequentially from the bus address to the device address.

For link aggregates, this is a string in the form `LinkAggxx`, where `xx` is the last two digits of the instance number (00 – 49).

This field is provided as a convenience in case you either do not know the PPA number of the port or want a place to capture and save both values.

Interface Type

A short description of the NIC associated with the port. For example, 100Base-TX.

Priority

The port priority in a failover group (LAN_MONITOR mode) using priority-based failover or cost-based failover. If you assign a priority value to one link, you must assign a priority value to all links in the failover group. Leave this blank if you do not want to assign a priority value; HP APA will assign it. For the December 2005 and later releases of HP APA for HP-UX 11i v1 (B.11.11.20) and PHNE_33116 (B.11.11.17) patch release.

Cost

The port cost in a failover group (LAN_MONITOR mode) using cost-based failover. A link that has a lower normalized cost (cost divided by the link speed) is preferred over one with a higher normalized cost. When both links have the same normalized cost, the one with the higher priority is preferred. If you assign a cost value to one link, you must assign a cost value to all links in the failover group. Leave this blank if you do not want to assign a cost value; HP APA will assign it.

Link Aggregate Advanced Parameters

Load Distribution Algorithm

The algorithm to use for outbound data transfer. Inbound load balancing and data flow distribution are strictly determined by the link partner and have no effect on the outbound algorithm. For a complete description of load balancing, see “Load Balancing” (page 14). Check the algorithm you want to use. The following choices are available:

LB_MAC	This algorithm uses the least significant byte of the link level destination MAC address of the data flow as an index into a table of 256 possible entries. The physical port selected will be used to send packets for the duration of the specific data flow. This is the default algorithm for all link aggregates. Recommended Configuration: Server-to-Switch
LB_IP	This algorithm uses the least significant bytes of the source and destination IP addresses of the data flow as an index into a table of 256 possible entries. Recommended Configuration: Server-to-Router
LB_PORT	This algorithm uses the TCP/UDP source and destination port numbers to distribute traffic across the ports in a link aggregate. Recommended configuration: Server-to-Server
HOT_STANDBY (MANUAL mode only)	This algorithm uses one link in the link aggregate on which to send all outbound traffic; there is no actual load balancing across the network physical ports in the link aggregate. The link is the one with highest port priority. If the link goes down (for example, cable disconnect), all the traffic on the link is automatically switched to a secondary link in the same link aggregate. If you chose this option, the ports must be cabled to a switch and the switch ports must not be configured for aggregation.

Recommended configuration: Servers that need highly available network interfaces.



CAUTION: For HP Serviceguard configurations, the member links of an APA Hot Standby link aggregate must be bridged to function properly. If they are not, the node or cluster might go down when a member link fails.

Group Capability

An integer value that determines which network physical ports can be aggregated into a common FEC_AUTO mode link aggregate or MANUAL mode link aggregate for HP APA releases for HP-UX 11i v1 prior to September 2007. The easiest way to create a value is to use the instance number of the link aggregate as the group capability. You must use the same group capability for all ports that you want to join this link aggregate and use the same group capability for the link aggregate.



TIP: When configuring link aggregates, if more than one FEC_AUTO aggregation is used on the system, each FEC_AUTO aggregation must have a different group capability.

Key

An integer value that determines which network physical ports can be aggregated into a common LACP_AUTO mode link aggregate. The easiest way to create a value is to use the instance number of the link aggregate as the key. You must use the same key value for all of the ports that you want to join this link aggregate and use the same key value for the link aggregate.

Failover Group Advanced Parameters

Dead Count

The number of polling packets that are missed before LAN Monitor sends a `net t 1` log message to the user that indicates the link might have problems and the network must be checked. The default is 3.

Polling Interval

The number of microseconds between polling messages. Polling messages are sent between links in the specified interval for monitoring the health of all the links in the link aggregate. Default is 10,000,000 (10 seconds).

Rapid ARP

Enables (on) or disables (off) the ability to transmit gratuitous ARP messages at intervals shorter than 5 seconds. By default, this parameter is on.

By default, when the MAC address of a failover group changes, LAN Monitor transmits one gratuitous ARP packet. Then, it transmits gratuitous ARP packets at a set interval (`LM_RAPID_ARP_INTERVAL`) for a set number of times (`LM_RAPID_ARP_COUNT`) to ensure that other clients and servers receive the new IP-MAC address mapping. LAN Monitor then transmits gratuitous ARP packets every 5 seconds until 1 minute has elapsed from the first gratuitous ARP packet.

If you disable this parameter, immediately after the MAC address changes LAN Monitor transmits gratuitous ARP packets every 5 seconds for 1 minute.

Rapid ARP Interval

The number of microseconds between rapid gratuitous ARP messages. The range of valid values is 1000000–4000000, inclusive (1 second to 4 seconds). The default value is 1000000 (1 second). Specify a whole number of seconds because the value you specify is rounded up to the next whole number of seconds. The value must be a valid integer. The rapid ARP interval multiplied by the rapid ARP count must be less than or equal to 60 seconds.

Rapid ARP Count

The number of gratuitous ARP packets sent rapidly. The valid range is 5–60, inclusive. The default value is 10. The value must be a valid integer. The rapid ARP interval multiplied by the rapid ARP count must be less than or equal to 60 seconds.

Configuring a Link Aggregate

This section shows how to configure the following using SAM:

- FEC_AUTO mode link aggregates
- MANUAL mode link aggregates

For information on configuring link aggregates by editing configuration files, see “Editing Configuration Files for Link Aggregates” (page 105).

Configuring an FEC_AUTO Mode Link Aggregate

When configuring an automatic link aggregate (FEC_AUTO or LACP_AUTO) using SAM, you configure the link aggregation characteristics first, followed by the port's modes and characteristics.



NOTE: Although this example shows how to configure an FEC_AUTO mode link aggregate, you can use these steps to configure an LACP_AUTO link aggregate. Substitute LACP_AUTO for FEC_AUTO, and *key* for *group_capability*.

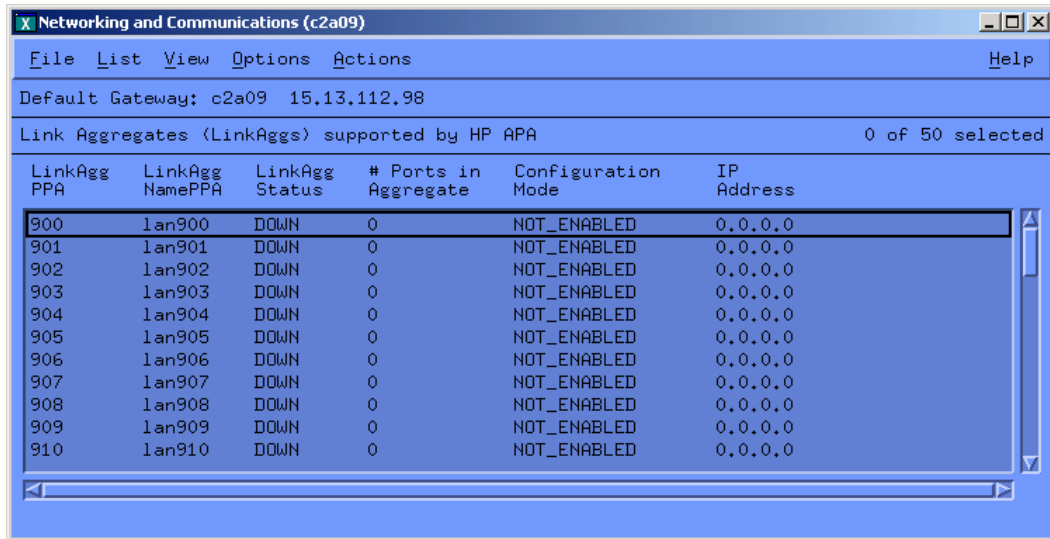
Complete the following steps:

1. Log in as superuser.
2. Enter **sam** at the HP-UX system prompt.
3. Double-click **Networking and Communications**, and then **Auto Port Aggregation**. A window like the one in Figure 3-10 appears. The Networking and Communications screen's **List** pull-down menu displays one of the following:
 - Link Aggregates supported by HP APA. This is the list of all available link aggregates in the system.
 - Network Physical Ports that Support HP APA. This is the list of all physical ports in the system that support HP APA.



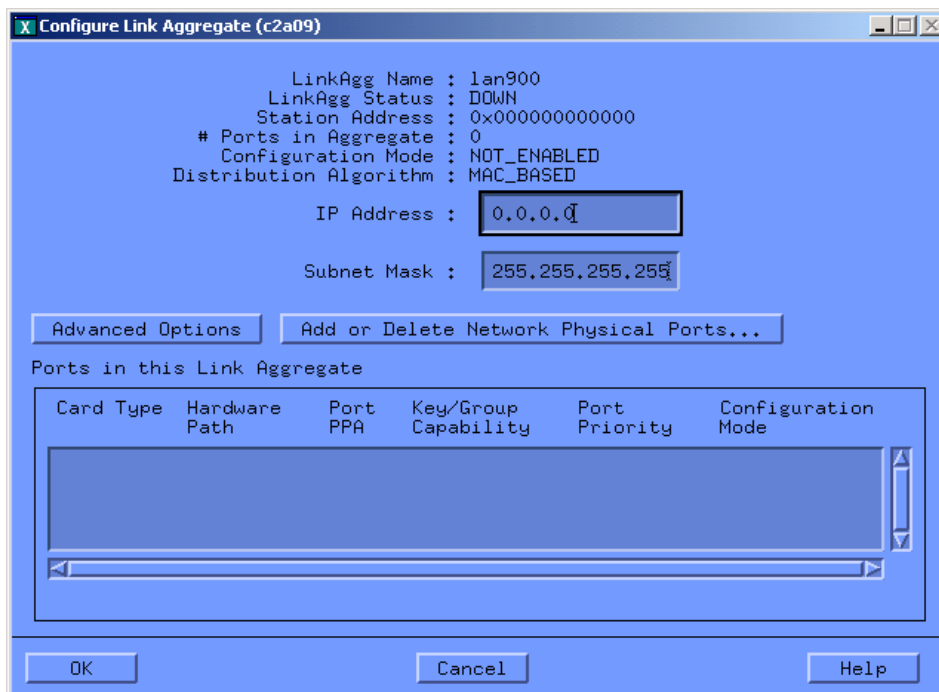
NOTE: The starting PPA number for link aggregates varies with the operating system installed: for HP-UX 11.0, it is 100; and for all versions of 11i, it is 900.

Figure 3-10 Displaying Link Aggregates



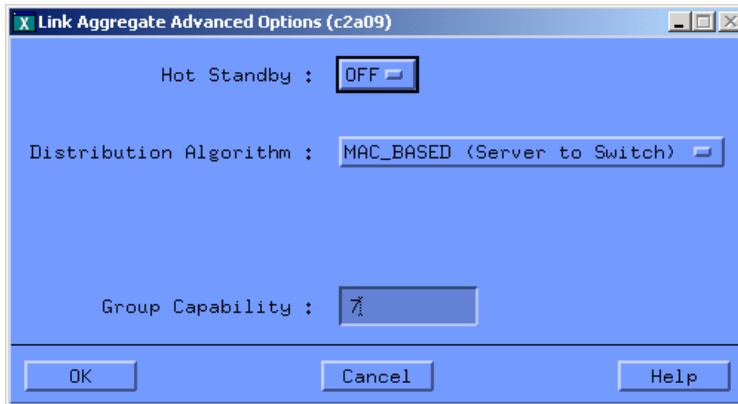
4. Click on the link aggregate to be configured. From the **Actions** pull-down menu choose the **Configure Link Aggregate** option. A window similar to Figure 3-11 will appear.

Figure 3-11 Configuring Link Aggregates



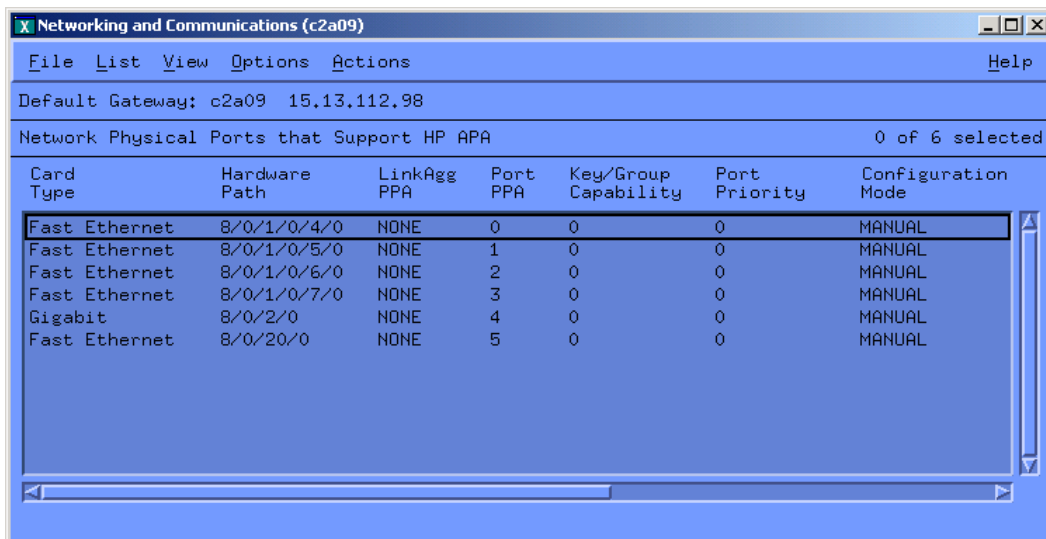
- Click **Advanced Options** to display window similar to Figure 3-12.

Figure 3-12 Link Aggregate Advanced Options



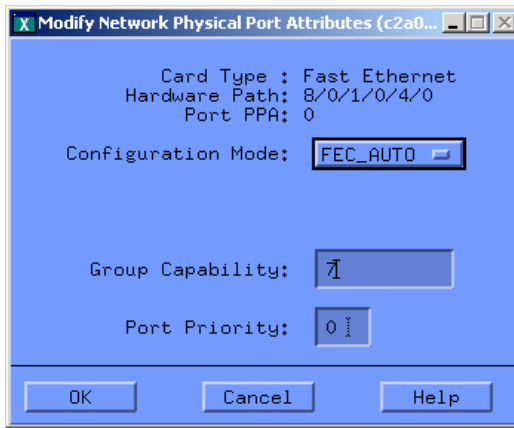
- Verify the correct settings for the load-balancing (distribution) algorithm. If required, make the necessary changes.
- Change the group capability of this link aggregate as required. The group capability must be a nonzero number that differs from the group capability of any other link aggregate. It must also match the group capability that will be assigned later to the ports intended to join the link aggregate. Click **OK**, then click **OK** in the Configure Link Aggregate window.
- Choose the **Network Physical Ports that Support HP APA** option from the **List** pull-down menu. The displayed port configuration mode (column 7 in Figure 3-13) determines the mode for the link aggregation. In Figure 3-13 the configuration mode for the ports that support APA is, by default, set to MANUAL mode. You might need to adjust the horizontal scroll bar to see all the window's fields.

Figure 3-13 Network Physical Ports Supporting HP APA



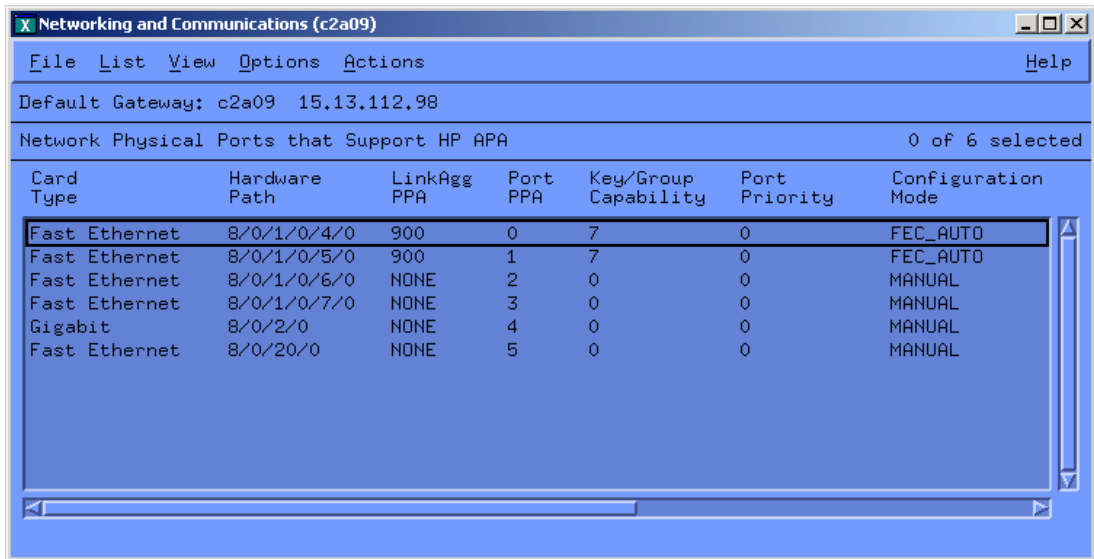
- For each port to be configured in the automatic link aggregation, verify that the port's configuration mode is set to the desired mode: FEC_AUTO. Check that the port's group capability matches the group capability that was previously assigned to the link aggregation. If changes are needed, go to the next step.
- Highlight the port to configure by clicking on the port designated by its PPA.
- In the **Actions** pull-down menu, choose the **Modify Network Physical Port Attributes** option. You will see a window like the one in Figure 3-14.

Figure 3-14 Modify Network Physical Port Attributes



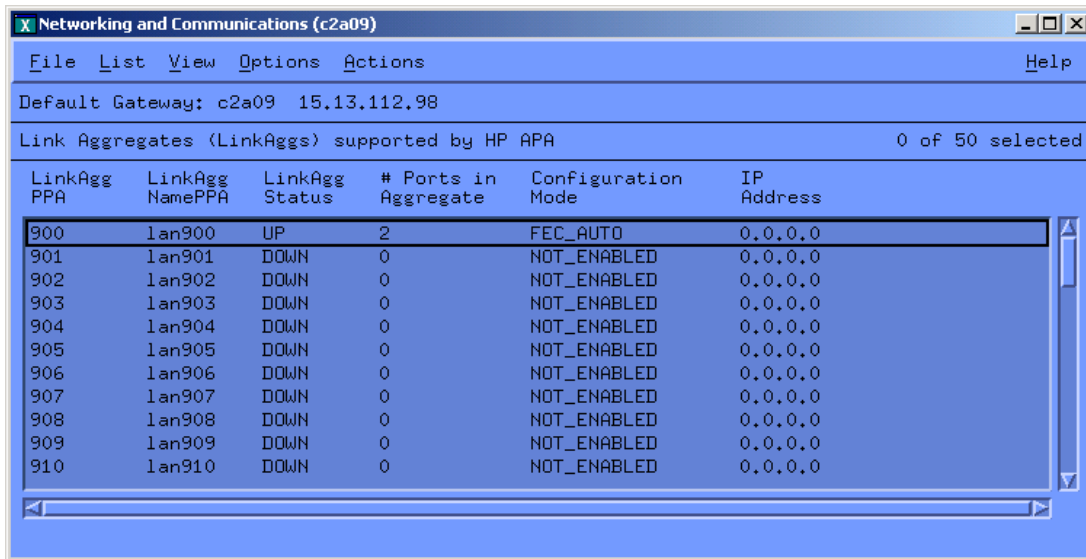
12. In this window, make the necessary changes and click **OK**.
13. Repeat steps 8 through 12 to configure the remaining ports to be in the aggregate. Figure 3-15 shows a sample FEC_AUTO configuration using ports 0 and 1 with a group capability of 7.

Figure 3-15 Example of Configured Link Aggregates



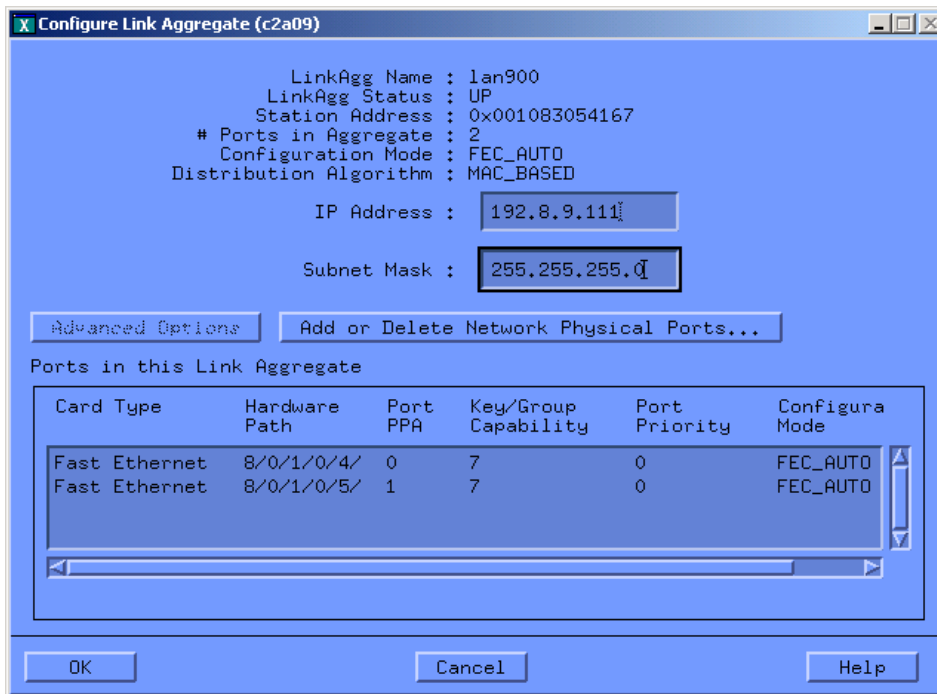
14. From the **List** pull-down menu, choose the **Link Aggregates Supported by HP APA** option. A window similar to Figure 3-16 will appear. Note that the link aggregate might not have a status of UP immediately because HP APA and the switch or link partner might not have completed the negotiation required for forming the link aggregation. Wait for the link aggregate to change status to LINK_UP. Then, configure the IP address on the link aggregate and continue with the next step.

Figure 3-16 Status of Configured Link Aggregate is UP



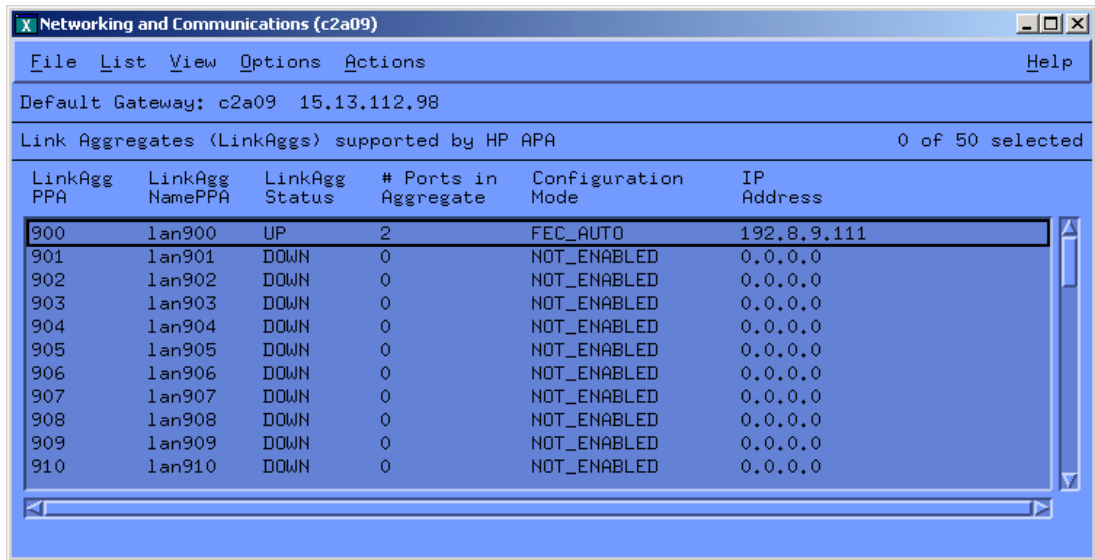
- Click once again on the link aggregate being configured. Then from the **Actions** pull-down menu, choose the **Configure Link Aggregate** option. A window like that in Figure 3-17 will appear.

Figure 3-17 Configuring Link Aggregates



- Fill in the desired IP address and subnet mask to be used for the link aggregate. Then click **OK**. A window like that in Figure 3-18 will appear.

Figure 3-18 Link Aggregate with Configured IP Address



Perform one of the following:

- If the link aggregate has a status of UP
the configuration is complete. Exit SAM. Verify that the proper ports are configured in the proper link aggregation with the `lanadmin -x -v 900` command.
- If the link aggregate is DOWN
If the switch has not been configured, then exit SAM and configure the switch. The APA configuration will have been permanently saved and can be modified later if needed. If the switch has been configured, verify the switch and HP APA configuration and make the required changes to bring them into agreement. If the link aggregate still does not form correctly, see Chapter 6 (page 67).

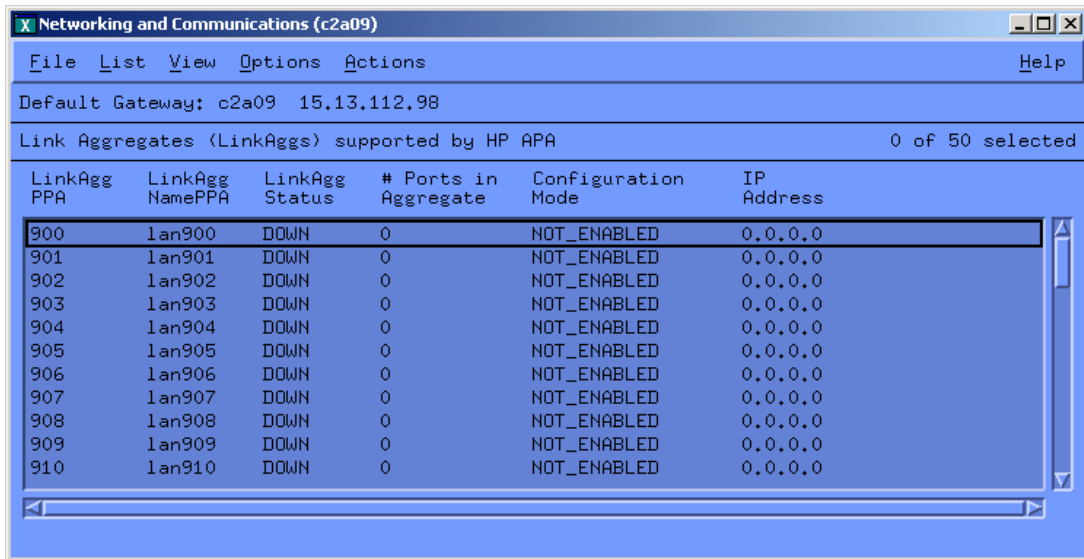
SAM permanently saves the HP APA configuration values in the `/etc/rc.config.d/hp_apaconf` and `/etc/rc.config.d/hp_apaportconf` files, which maintains the values across reboots.

Using SAM to Configure a MANUAL Mode Link Aggregate

When configuring a manual link aggregate using SAM, you first configure the port's modes and characteristics, then configure the link aggregate characteristics.

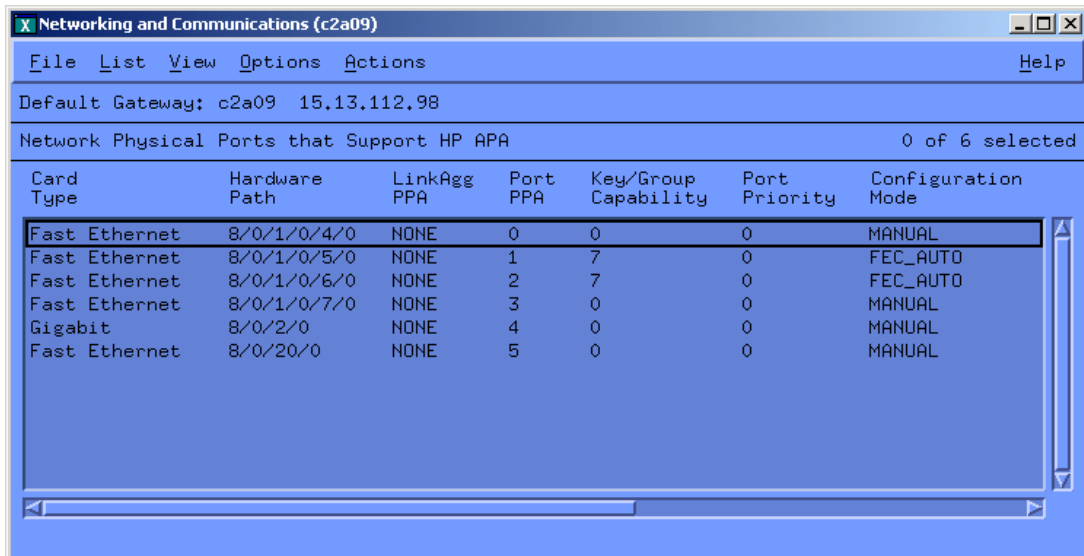
- Log in as superuser.
- Enter `sam` at the HP-UX system prompt.
- Double-click **Networking and Communications**, and then **Auto Port Aggregation**. A window like the one in Figure 3-19 appears. The Networking and Communications screen **List** pull-down menu (Figure 3-19) displays either of the following:
 - Link Aggregates supported by HP APA. This is the list of all available link aggregates in the system.
 - Network Physical Ports that Support HP APA. This is the list of all physical ports in the system that support HP APA.

Figure 3-19 Link Aggregates Supporting HP APA



- Choose the **Network Physical Ports that Support HP APA** option from the **List** pull-down menu. The port configuration mode (shown in column 7 in Figure 3-20) determines the mode for the link aggregate. In Figure 3-20, the configuration mode for the ports that support HP APA is, by default, set to MANUAL mode. You might need to adjust the horizontal scroll bar to see all the window's fields.

Figure 3-20 Network Physical Ports Supporting APA



- For each port to be configured in the manual link aggregate, verify that the port's configuration mode is set to the desired mode: MANUAL. Choose a group capability number for each port and also for the aggregation. If changes are needed, go to the next step.

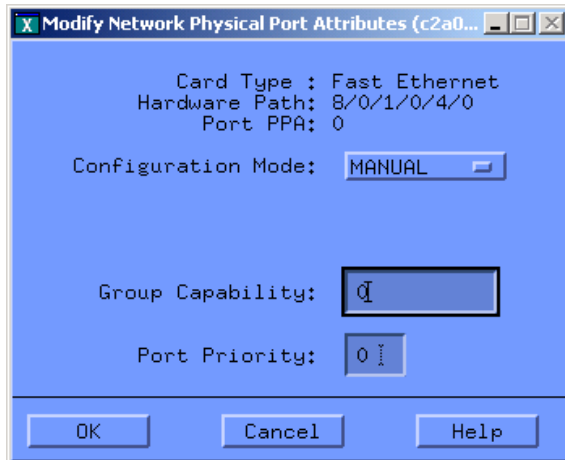


NOTE: Set the group capability to be the same as that of the link aggregate to which it belongs. Ports going to different link aggregates must have different group capability numbers.

For the September 2007 release of HP APA for HP-UX 11i v1 (B.11.11.30), you no longer need to assign a group capability number to ports to be included in a MANUAL mode link aggregate.

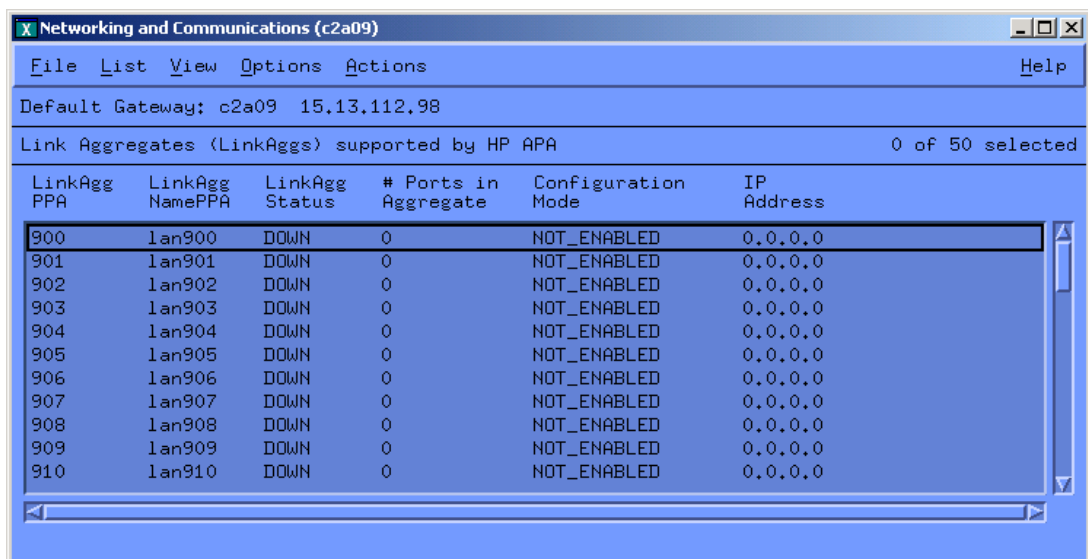
6. Highlight the port to configure by clicking on the port designated by its PPA.
7. In the **Actions** pull-down menu, choose the **Modify Network Physical Port Attributes** option. A window similar to the one in Figure 3-21 appears.

Figure 3-21 Modify Network Physical Port Attributes



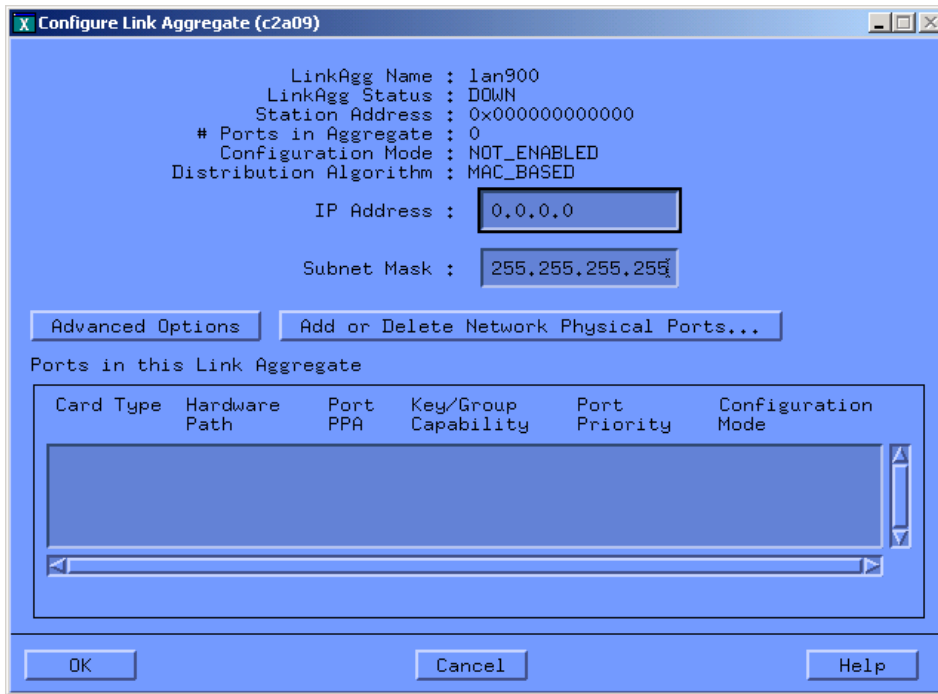
8. In this window make the necessary changes and click **OK**.
9. Repeat steps 4 through 7 to configure the remaining ports to be in the aggregate.
10. To configure the link aggregate characteristics, choose the **Link Aggregates supported by HP APA** option from the **List** pull-down menu. A window similar to Figure 3-22 appears.

Figure 3-22 Display Link Aggregates to Configure



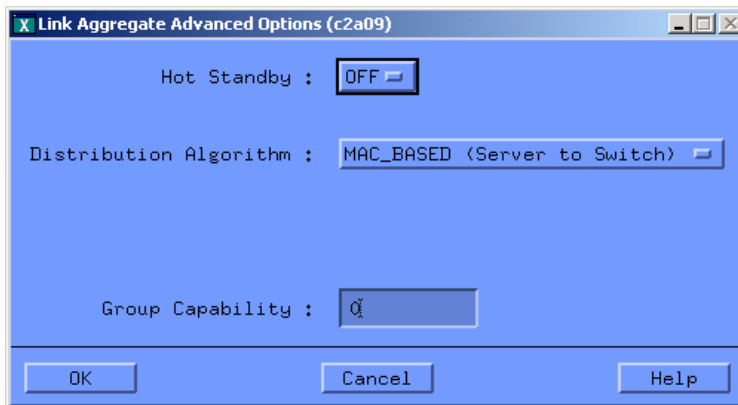
11. Click on the link aggregate being configured. Then, from the **Actions** pull-down menu, choose the **Configure Link Aggregate** option. A window similar to Figure 3-23 appears.

Figure 3-23 Configuring Link Aggregates



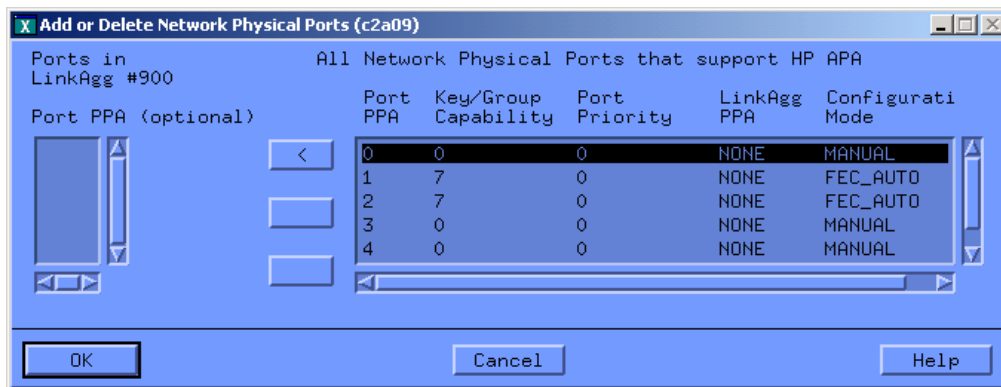
12. Fill in the desired IP address and subnet mask to be used for the link aggregate.
13. Click the **Advanced Options** button to display a window similar to Figure 3-24.

Figure 3-24 Link Aggregate Advanced Options



14. Verify the correct settings for the Group Capability (11i v1), assigned in step 4, and either Hot Standby or the load balancing (distribution) algorithm (not both). Make the necessary changes, if required. Then click **OK**.
15. Click **Add or Delete Network Physical Ports**. A window similar to Figure 3-25 appears.

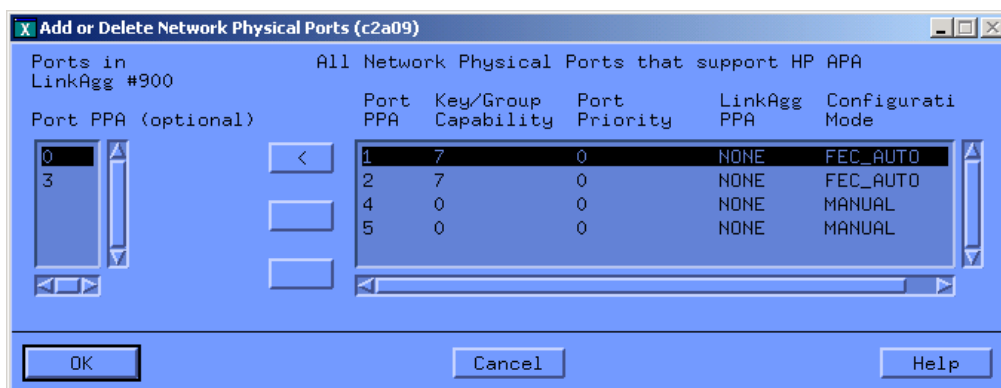
Figure 3-25 Adding Ports to or Deleting Ports from Link Aggregate



16. Highlight a port to be included in the link aggregate. Then use < to move it into the link aggregate.

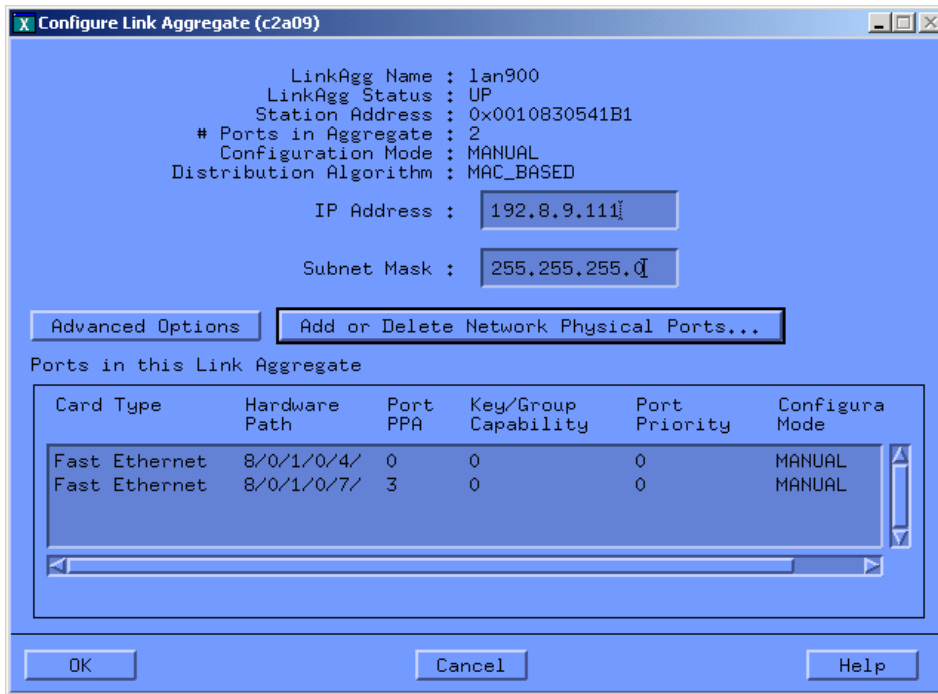
Figure 3-26 shows the result of moving 1an0 and 1an3 into the link aggregate, 1an900.

Figure 3-26 Adding Ports to or Deleting Ports from Link Aggregate



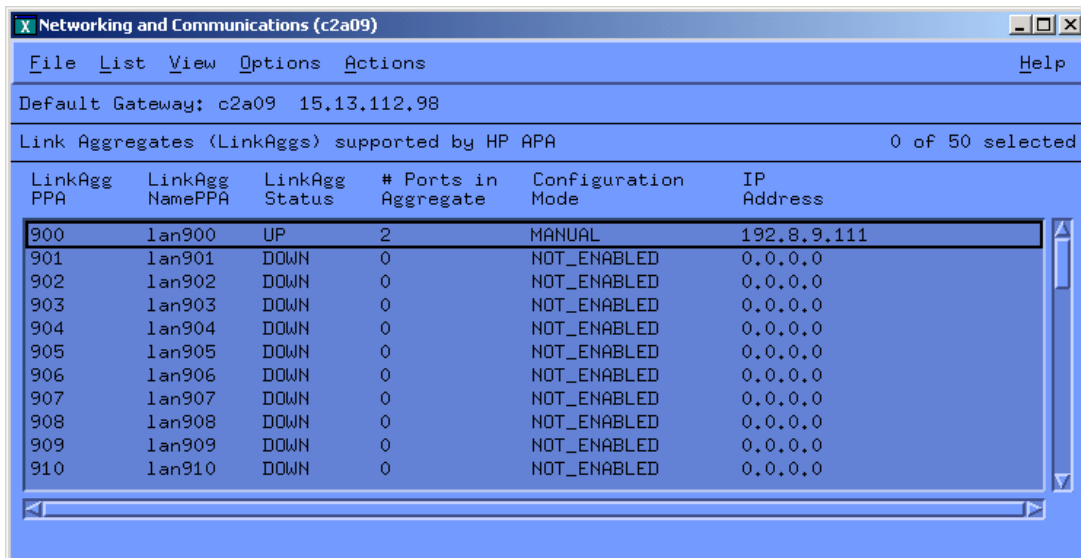
17. Click **OK** to see the Configure Link Aggregates window (Figure 3-27) with all the link aggregate information filled in.

Figure 3-27 Configured Link Aggregates Display



- Clicking **OK** displays the original window (Figure 3-28). It now shows lan900 configured as a MANUAL mode link aggregate.

Figure 3-28 Link Aggregate Displays with Status UP



- The link aggregate is configured. Configure the next MANUAL mode link aggregate, or exit by choosing the **Exit** option from the **File** pull-down menu.

SAM permanently saves the HP APA configuration values in the `/etc/rc.config.d/hp_apaconf` and `/etc/rc.config.d/hp_apaportconf` files, which maintains the values across reboots.

Configuring a Failover Group

Edit the configuration files to configure a failover group. For more information, see “Editing Configuration Files for Failover Groups” (page 107).

Configuring an IP Address

After you configure HP APA, you must configure an IP address on the interface. To configure an IP address for a link aggregate, use the following command:

```
# ifconfig lanxxx IP_address up
```

Where *xxx* is the link aggregate PPA number.

To make this change permanent, edit the `/etc/rc.config.d/netconf` file and include the appropriate entry. For more information, see *ifconfig(1M)*.

For failover groups, you must configure an IP address on the interface that is to be the primary link before running the `lanqueryconf` and `lanapplyconf` commands to configure the failover group. For more information, see “Editing Configuration Files for Failover Groups” (page 107).

Configuring the Link Partner

HP APA also requires that you configure your switches' trunking mode (AUTO or MANUAL) to match the mode being used on the server (for example, Cisco Fast EtherChannel (FEC), IEEE 802.3ad Link Aggregation Control Protocol (LACP), or MANUAL).

If you selected `HOT_STANDBY` as the load distribution algorithm for a MANUAL mode link aggregate or configured a failover group, do not configure the switch ports for an aggregation. See Appendix E (page 119) for additional switch information.

Configuring HP Serviceguard

HP recommends that you configure HP Serviceguard after configuring HP APA. You can then use the link aggregates or failover groups in your HP Serviceguard configuration. See the HP Serviceguard documentation for more information.



NOTE: Do not configure HP Serviceguard with ports that are part of a link aggregate or failover group.

Creating VLANs Over APA

To create VLANs over link aggregates or failover groups, complete the following steps:

1. Decide what ports are to be part of the link aggregate or failover group. Then, decide on the VLANs that will be created over the link aggregate or failover group.
2. Configure the trunks and VLANs on the switch according to the switch's documentation. If you want to enable a VLAN on a link aggregate, its trunk on the switch side must be tagged with the VLAN's ID.

If you want to enable a VLAN on a failover group, the member ports of the failover group on the switch side must be tagged with the VLAN's ID.

3. On the server side, create the link aggregates or failover groups. Then, create the VLANs over the link aggregate or failover group.

After a link aggregate is in use, you can create, modify, and delete VLANs over it. Users can leave behind VLANs after the link aggregate or failover group has been cleared. If the link aggregate or failover group has been cleared, users can neither create VLANs nor modify any VLANs on the link aggregate or failover group. Users can only delete the VLANs.

See Appendix D (page 113) for examples of configuring VLANs over APA using HP Procurve switches.

Verifying the Configuration

HP APA configuration is complete when you can verify that a link aggregate has been formed. To verify the HP APA configuration, complete the following steps:

1. To verify which link aggregates have been configured, enter either of the following commands:

```
# lanscan
```

```
# lanscan -v
```

The `Hardware Path` column contains the link aggregates. Link aggregate names begin with `LinkAgg`. The `Hdw State` column shows the link aggregate state. `UP` indicates the link aggregate is operational. `DOWN` indicates the link aggregate was initialized but not configured.

2. To verify that a link aggregate was formed correctly, use the link aggregate PPA from the `Crđ In#` column preceding step and enter the following command:

```
# lanadmin -x -i linkAggPPA
```

For example, to verify the physical ports associated with link aggregate 901, enter:

```
# lanadmin -x -i 901
```

3. To verify all physical ports in all configured link aggregates, enter:

```
# lanscan -q
```

This command lists the card instance number for each physical port and for the link aggregates. Output similar to the following is displayed:

```
900          5 6 8 7
901
902
903
```

The preceding example shows that link aggregate 900 contains four ports: `lan5`, `lan6`, `lan8`, and `lan7`.

If no link aggregates are formed, see [Chapter 6 \(page 67\)](#).

For more information on the `lanscan` command, see *lanscan(1M)*. For more information on the `lanadmin` command, see *lanadmin(1M)* and [Chapter 4 \(page 51\)](#).

What Happens During Start Up?

During the system boot-up, the following events occur:

1. HP APA software initializes

All the internal housekeeping initialization (for example, allocation of memory) for the software is done. During this step, the default values are assigned for all the properties on each port and link aggregate.

2. `hp_apaportconf` file is processed

Contains customization variables for each physical port. The features that can be set on each port are Group Capability, Port Priority, and Configuration Mode. If no value is specified for a given feature for a given port, the software assumes a default value for the same. The port's mode is set at this stage.

3. `hp_apaconf` file is processed

The `/etc/rc.config.d/hp_apaconf` file contains customization variables for each link aggregate. The features that can be set on each link aggregate are Load Balancing mode, Hot Standby mode, and ports in a Manual link aggregate. The last feature allows manual configuration of a link aggregate with the port(s) specified.

4. HP APA software starts

Cisco's FEC or IEEE 802.3ad LACP protocol is started on the ports that have been marked as such. No action is taken for the ports that have Cisco's FEC or IEEE 802.3ad LACP turned off.

5. LAN Monitor ASCII file is processed

Process `/etc/lanmon/lanconfig.ascii` to create failover groups. If this file has not been created, no action is taken.

After the system is up and running, you can distinguish a link aggregate from a normal (unaggregated) port by running the `lanscan` command. For more information, see "Verifying the Configuration" (page 47).

4 Using the lanadmin Command

You can use the `lanadmin` command to administer HP APA. The command enables you to do the following tasks from the command line:

- Display HP APA settings (-x option (lowercase x) with options)
- Change the HP APA configuration temporarily (-X option (uppercase X) with options)

You can also use `lanadmin` interactively.



CAUTION: The `lanadmin` command does not preserve changes across reboots. Use SAM or edit the configuration files to permanently save the changes.



NOTE: HP APA also requires that you configure your switches' trunking mode (AUTO or MANUAL) to match the mode being used on the server: Cisco's Fast EtherChannel (FEC), IEEE 802.3ad Link Aggregation Control Protocol (LACP), or MANUAL mode.

Table 4-1 summarizes the `lanadmin` options and their use.

Table 4-1 Summary of lanadmin -x and -X Options

Option	Link/Port Specific	-x (Set Options)	-x (Display Options)
-a	Link	Add ports to a link aggregate.	N/A
-c	Link	Clear a link aggregate (remove all ports).	N/A
-d	Both	Delete ports from link aggregate.	N/A
-g	Port	Set the group capability.	Display the group capability.
-h	N/A	Display help.	Display help.
-H	N/A	Display extended help.	Display extended help.
-i	Port	N/A	Display link aggregate port status.
-k	Port	Set the LACP_AUTO Administrative Key.	Display the LACP_AUTO Administrative Key.
-l	Link	Set the load distribution algorithm.	Display the load distribution algorithm.
-m	Link	N/A	Display link aggregate status.
-n	Port	N/A	Display status of all APA capable ports.
-o	Link	Clear data flows for link aggregates.	N/A
-p	Port	Set the port mode.	Display the port status.
-q	Port	N/A	Display the extended port status.
-s	Port	Set the LACP_AUTO port system priority.	Display the LACP_AUTO port system priority.
-t	Port	Set the port priority.	Display the port priority.
-v	Link	N/A	Display status for a specific link aggregate.
-y	Link	Turn Hot Standby on or off	Display Hot Standby status.
vmtu	Link	N/A	Display the TSO status of link aggregate or failover group.

This chapter describes the `lanadmin` command set options and display options, and provides command-line and interactive examples.

Set Options

To manage link aggregates and add ports to a link aggregate, use the following syntax and options with the `-X` (uppercase) option:

```
lanadmin [-X -a portPPA [portPPA]]
[-X -c linkAggregatePPA]
[-X -d portPPA [portPPA]... linkAggregatePPA]
[-X -g portPPA group_capability anyLinkAggregatePPA]
[-X [-h | -H] anyLinkAggregatePPA]
[-X -k portPPA admin_key anyLinkAggregatePPA]
[-X -l load_balance_algorithm linkAggregatePPA ]
[-X -o linkAggregatePPA]
[-X -p portPPA config_mode anyLinkAggregatePPA]
[-X -s portPPA system_priority anyLinkAggregatePPA]
[-X -t portPPA port_priority anyLinkAggregatePPA]
[-X -y on|off linkAggregatePPA]
```

Where:

`-a -X -a portPPA [portPPA]... linkAggregatePPA`

Adds a port or ports with the specified `portPPA` to the link aggregate with the specified `linkAggregatePPA` number.



CAUTION: Be careful when using the `-a` suboption. This might lead to an invalid link aggregate. This command gives you full control over forming any link aggregate that you want.

`-c -X -c linkAggregatePPA`

Clears (removes all) ports from a link aggregate with the specified `linkAggregatePPA` number. This option fully deconfigures the link aggregate. After removal from a link aggregate, the port's mode is set to MANUAL. The Administrative Key (LACP) or `group_capability` (FEC_AUTO and MANUAL) is not changed.

`-d -X -d portPPA [portPPA]... linkAggregatePPA`

Deletes ports with the specified PPAs from the link aggregate with the specified `linkAggregatePPA` number.



CAUTION: Failure to fully deconfigure a link aggregate (using the the `-c` suboption) can result in some properties being retained in the link aggregate. Subsequently, when new ports are added onto the link aggregate, they might not aggregate properly.

`-g -X -g portPPA group_capability anyLinkAggregatePPA`

Sets the group capability for a port with the specified `portPPA`. Ports going to different link aggregates must have different group capabilities. The valid values for `group_capability` are integer numbers starting at 0. This is applicable to MANUAL and FEC_AUTO ports.

`-h -X -h anyLinkAggregatePPA`

Displays the `-X` and `-x` options help screen.

`-H -X -H anyLinkAggregatePPA`

Displays the extended `-X` and `-x` options help screen, which includes a detailed description and syntax of the `-X` and `-x` options.

- k `-X -k portPPA admin_key anyLinkAggregatePPA`
 Sets the Administrative Key for an LACP_AUTO port or LACP_AUTO link aggregate. Applies to LACP_AUTO only. An Administrative Key and Operational Key are associated with each port. The Operational Key is used for forming aggregations in autonegotiation. The Administrative Key can be set at anytime. At the port level, the Operational Key only copies the Administrative Key value when the LACP protocol is not running. At the link aggregate level, the Operational Key only copies the Administrative Key when the link aggregate is not configured (no ports have joined the link aggregate).
 For example: An LACP_AUTO port is in an aggregation. The *admin_key* and *oper_key* are 1234. Use `lanadmin -X -k admin_key anyLinkAggregatePPA` to modify the *admin_key* to 5432. The *oper_key* is not changed immediately. You must stop LACP_AUTO for the port and then restart it for both keys to have the new value of 5432.
- l `-X -l load_balance_algorithm linkAggregatePPA`
 Sets the load-balancing algorithm for a link aggregate with the specified *linkAggregatePPA* number.
 The following choices are valid for *load_balance_algorithm*:
- LB_MAC
 - LB_IP
 - LB_PORT
- For a description of these parameters, see the load distribution algorithms in “Link Aggregate Advanced Parameters” (page 34).
- o `-X -o linkAggregatePPA`
 Clears data flows for a link aggregate specified by *linkAggregatePPA*. This rebalances the link aggregate outbound traffic across the ports in the link aggregate.
- p `-X -p portPPA config_mode anyLinkAggregatePPA`
 Sets mode for a port with the specified *portPPA* number. The following values are valid:
- LACP_AUTO
 - FEC_AUTO
 - MANUAL
 - LAN_MONITOR
- For a description of these parameters, see the mode descriptions in “Preparing for Configuration” (page 31).
- s `-X -s portPPA system_priority anyLinkAggregatePPA`
 Sets the system priority for an LACP_AUTO port. The default value is 0. This has no affect on a MANUAL or FEC_AUTO port.
- t `-X -t portPPA port_priority anyLinkAggregatePPA`
 Sets the *port_priority* for the port with the specified PPA Number. For LACP_AUTO, this sets the priority value for the port. The `lanapplyconf` command assigns port priority according to settings in `lanconfig.ascii`. You can change the priority of primary and standby ports, but the primary port must have a higher priority. By default a primary port is 5; standby is 3. This option is not applicable to PAgP. If the port is not in a standalone state, attempting to set the port priority will fail. Check the port status using the `lanadmin -x -p` command.
 The valid values for *port_priority* are integral numbers starting at 0.
 For HOT_STANDBY: The bigger the number, the higher the priority.
 For LACP ports: The smaller the number, the higher the priority.

`-y -X -y on | off linkAggregatePPA`

Turns Hot Standby on or off for the link aggregate with the specified *linkAggregatePPA* number. For a description of Hot Standby, see the load distribution algorithms in “Link Aggregate Advanced Parameters” (page 34) and the the description of `HP_APA_HOT_STANDBY` in “hp_apaconf File” (page 97).

Turn on sets link aggregate load-balancing mode to `LB_HOT_STANDBY`. Turn off sets link aggregate load-balancing mode to `LB_MAC`.

Display Options

To display HP APA information, use the following syntax and options with the `-x` (lowercase) option:

```
lanadmin [-x -g portPPA anyLinkAggregatePPA]
[-x [-h -H] anyLinkAggregatePPA]
[-x -i linkAggregatePPA]
[-x -k portPPA anyLinkAggregatePPA]
[-x -l linkAggregatePPA]
[-x -m anyLinkAggregatePPA ]
[-x -n anyLinkAggregatePPA ]
[-x -p portPPA anyLinkAggregatePPA]
[-x -q portPPA anyLinkAggregatePPA]
[-x -s portPPA anyLinkAggregatePPA]
[-x -t portPPA anyLinkAggregatePPA]
[-x -v linkAggregatePPA]
[-x -y linkAggregatePPA]
[-x vmtu linkAggregatePPA]
```

Where:

`-g -x -g portPPA anyLinkAggregatePPA`

Displays the current group capability number of the specified port or link aggregate. This applies to `MANUAL` and `FEC_AUTO` ports.

`-h -x -h anyLinkAggregatePPA`

Displays the help screen.

`-H -x -H anyLinkAggregatePPA`

Displays the extended help screen, which includes a list of the `-x` and `-X` options and the syntax.

`-i -x -i linkAggregatePPA`

Displays the port status associated with the link aggregation or failover group. Following is the information displayed for this option.

- Link aggregation or failover group PPA number.
- Link aggregation mode.
- Load-balancing mode used by the link aggregation.
- The port or ports of the link aggregation or failover group actively involved in sending and receiving data traffic.
- For failover groups, the ports that are in state ready to takeover data traffic in case the current active port fails.

- The ports that are not ready to be used in a link aggregation or failover group. A port can be in this list due to:
 - The link state of the NIC is down.
 - The NIC is experiencing a hardware problem, which is causing unexpected failures.
 - The NIC has been configured to run an APA auto protocol and it has not reached a stable state.
- For failover groups, a list of the ports in the "ready" list that have connectivity to the current active port. A port in the ready list might not be displayed in this field because connectivity might have been lost after forming the failover group.



NOTE: This field might not be accurate after a link state change until `POLL_INTERVAL * DEAD_COUNT` seconds have expired.

Following is sample output for link aggregation:

```
Link Aggregate PPA #           : 900
Link Aggregation Mode         : MANUAL
Load Balance Mode             : IP Address based (LB_IP)
Active Ports PPA #           : 3 4
Port(s) not ready             : 5 6
```

Following is sample output for a failover group (LAN Monitor):

In this example, 3, 4, 5 are in same subnet and 6, 7 are in different subnet, and port 5 is down.

```
Link Aggregate PPA #           : 901
Link Aggregation Mode         : LAN_MONITOR
Load Balance Mode             : Hot Standby (LB_HOT_STANDBY)
Active Ports PPA #           : 3
Port(s) ready                 : 4 6 7
Port(s) not ready             : 5
Port(s) connected to active port : 4
```

`-k -x -k portPPA lnyLinkAggregatePPA`

Displays the Administrative and Operational Key for an LACP_AUTO port or link aggregate. Applies to LACP_AUTO only.

`-l -x -l linkAggregatePPA`

Displays the current load-balancing algorithm for the link aggregate with the specified `linkAggregatePPA` number.

`-m -x -m anyLinkAggregatePPA`

Displays the status for all link aggregates using any link aggregate in the command.

Sample results:

```
Number of elements=50
[0] ppa      : 900
[0] index    : 0
[0] num_ports : 1
[0] ports    : 4
-----
[1] ppa      : 901
[1] index    : 1
[1] num_ports : 3
[1] ports    : 1 2 3
-----
[2] ppa      : 902
[2] index    : 2
[2] num_ports : 0
[2] ports    : -----
.
```

- .
- .
- n `-x -n anyLinkAggregatePPA`
- Displays the status for all APA capable ports using any link aggregate in the command.
For example:
- ```
Number of elements=5
[0] ppa : 1
[0] reserved2 value : -1
[0] state : 1
```
- p `-x -p portPPA anyLinkAggregatePPA`
- Displays the present status of a port with the specified `portPPA` number. For example:
- ```
**** PORT NUMBER: 3 ****
Port FEC Mode      : FEC_AUTO
Port State        : UP
Port Group Capability : 901
Port Priority      : 0
```
- q `-x -q portPPA anyLinkAggregatePPA`
- Displays the present status of a port with the specified `portPPA` in the extended format.
For example:
- ```
**** PORT NUMBER: 3 ****
pagpEnabled : ENABLED
ppMyData.deviceId : 00108318b907
ppMyData.distReq : LEARNCAP_AGPORT
ppMyData.portPriority : 0
ppMyData.sentPortIfIndex : 3
ppMyData.groupCapability : 901
ppMyData.groupIfIndex : 8
ppNoPagpTimerI : 0
ppNoTransTimerQ : 0
ppTHToTATimerS : 0
ppSlowHelloTimerA : 1
ppPartnerCount : 1
+++++++ PARTNER DATA ++++++
PARTNER 0
ppPartnerData.deviceId : 000883756600
ppPartnerData.distReq : LEARNCAP_AGPORT
ppPartnerData.portPriority : 188
ppPartnerData.sentPortIfIndex : 188
ppPartnerData.groupCapability : 3
ppPartnerData.groupIfIndex : 211
ppTimerP : 902
Port LACP Mode : 1
+++++++ PARTNER DATA ++++++
ppAutoMode.myAutoMode : 0
ppAutoMode.yourRequest : 0
ppMySlowHello : 1
portState : PAGP_STATE_UPPAGP
portNextState : PAGP_STATE_UPPAGP
portNextEvent : PAGP_EVENT_NULL
portXmitState : PAGP_XMIT_STATE_SLOW_U6
portXmitNextState : PAGP_XMIT_STATE_SLOW_U6
portXmitNextEvent : PAGP_XMIT_EVENT_NULL
```
- s `-x -s portPPA anyLinkAggregatePPA`
- Displays the system priority for an LACP\_AUTO port. This has no affect on a MANUAL or FEC\_AUTO port.



- t     -x -t *portPPA anyLinkAggregatePPA*
- Displays the current port priority for the port with the specified *portPPA* number. For LACP\_AUTO, this shows the priority value for the port. For HOT\_STANDBY, this shows which port is used for traffic and which for standby. This option is not applicable to PAgP (FEC\_AUTO).
- v     -x -v *linkAggregatePPA*
- Displays the status for a given link aggregate with the specified *linkAggregatePPA* number. For example:
- ```
Link Aggregate PPA #      : 901
Number of Ports          : 3
Ports PPA                : 2 1 3
Link Aggregation State   : LINKAGG AUTO
Group Capability         : 901
Load Balance Mode        : MAC Address based (LB_MAC)
```
- y -x -y *linkaggregatePPA*
- Displays the Hot Standby status for the link aggregate with the specified *linkAggregatePPA* number.
- vmtu [-x vmtu *linkaggregatePPA*]
- Displays the TSO status for a given link aggregate with the specified *linkAggregatePPA* number. For example:
- ```
lanadmin -x vmtu 903
Driver/Hardware does not support TCP Segmentation Offload
#
lanadmin -x vmtu 905
Driver/Hardware supports TCP Segmentation Offload, Current VMTU = 32160
#
```
- The following option is supported, but with a different meaning:
- a     Displays the current station address of link aggregate with the specified *linkAggregatePPA* number.

## Invoking lanadmin from the Command Line



**NOTE:** Remember that the starting PPA number for link aggregates varies with the operating system you have installed: for HP-UX 11.00, it is 100; and for 11i v1 and 11i v2, it is 900. The following example uses HP-UX 11i.

- To obtain additional information on options for the `lanadmin` command, enter the following command:  
**lanadmin -X -H *linkAggregatePPA***  
Where *linkAggregatePPA* can be any valid link aggregate PPA value.
- To form a link aggregate of ports automatically using the Cisco Fast EtherChannel protocol on that port, set the port configuration mode to FEC\_AUTO. For example, if port 2 must be trunked automatically, enter the following command:  
**lanadmin -X -p 2 FEC\_AUTO 900**  
900 is the PPA of the first link aggregate. When the protocol completes successfully, HP APA determines the link aggregate into which port 2 best fits and adds the port to an aggregate based on the *group\_capability* of ports and link aggregate. Ports in the same link aggregate must be connected to the same host and in the same trunk.
- To form a link aggregate of ports automatically using the LACP protocol, use LACP\_AUTO in place of FEC\_AUTO. In this case, *key* is used instead of *group\_capability*.

- To manually configure ports with PPAs 6, 7, 8, and 9 into a link aggregate lan901, enter the following command:

```
lanadmin -X -a 6 7 8 9 901
```

---



**CAUTION:** Be careful when using the `-a` suboption. This might lead to an invalid link aggregate. This command gives you full control over forming any link aggregate that you want. This example configures ports with PPAs 6, 7, 8, and 9 into a single link aggregate, even if they are connected to different switches, which is an invalid configuration, and could lead to problems.

---

- Before you can remove a port from an automatically formed link aggregate, you must turn off Cisco's Fast EtherChannel or LACP protocol on that port. If a port with a PPA number of 2 belongs to link aggregate lan900 (PPA number of 900), enter one of the following two commands:

```
lanadmin -X -d 2 900
```

or

```
lanadmin -X -p 2 MANUAL 900
```

- To deconfigure FEC\_AUTO (or LACP\_AUTO) mode link aggregate 903, which has ports with PPAs 6, 7, 8, and 9, enter the following commands in succession:

```
lanadmin -X -p 6 MANUAL 903
lanadmin -X -p 7 MANUAL 903
lanadmin -X -p 8 MANUAL 903
lanadmin -X -p 9 MANUAL 903
```

Alternatively, the following single command achieves the same result:

```
lanadmin -X -d 6 7 8 9 903
```

- To fully deconfigure a link aggregate, enter the following command:

```
lanadmin -X -c 903
```

---



**IMPORTANT:** Failure to fully deconfigure a link aggregate can result in some properties being retained in the link aggregate. Subsequently, when you add new ports onto the link aggregate, they might not aggregate properly.

---

- To delete a single port (for example, 8) from link aggregate 901, enter the following command:

```
lanadmin -X -d 8 901
```

To delete ports 6 and 9, enter:

```
lanadmin -X -d 6 9 901
```

- To deconfigure the link aggregate 901 completely, enter:

```
lanadmin -X -c 901
```

This deletes the remaining port, 7, from link aggregate 901 and clears all the properties from the link aggregate; it becomes clean.

---



**IMPORTANT:** After you delete all the ports from link aggregate 901, (after using, for example, `lanadmin -X -d 7 901`), use the `-c` suboption. Otherwise, some properties are retained in link aggregate 901. Subsequently, when you add new ports to link aggregate 901, they inherit old properties of the link aggregate and might not aggregate properly.

---

## Configuring an FEC\_AUTO Mode Link Aggregation using lanadmin

The following example works for all versions of 11i (link aggregate begins at 900).

To add ports lan1 and lan2 (which are not aggregated) to link aggregate lan901 (which is not enabled), with the group capability set to 901, do the following:

1. Configure the switch.

Configure your switches' trunking mode to match the mode being used on the server. The mode is Cisco Fast EtherChannel (FEC).

2. Configure the server:

- a. Set the link aggregate's group capability to 901. Enter:

```
lanadmin -X -g 901 901 900
```

- b. Change the port's group capability to be the same as the link aggregate's group capability (901).

```
lanadmin -X -g 1 901 900
lanadmin -X -g 2 901 900
```

- c. Change ports lan1 and lan2 mode to FEC\_AUTO.

```
lanadmin -X -p 1 FEC_AUTO 900
lanadmin -X -p 2 FEC_AUTO 900
```



---

**NOTE:** By default, the *group\_capability* of each physical link is set to 5.

---

## Using lanadmin Interactively

When you enter the lanadmin command either by itself or with the -t option, the command becomes interactive. The following example illustrates the interactive use of lanadmin:

```
lanadmin
LOCAL AREA NETWORK ONLINE ADMINISTRATION, Version 1.0
 Tue , Oct 1,2007 14:05:56

 Copyright 1994 Hewlett Packard Company.
 All rights are reserved.

Test Selection mode.

lan = LAN Interface Administration
menu = Display this menu
quit = Terminate the Administration
terse = Do not display command menu
verbose = Display command menu

Enter command: lan

LAN Interface test mode. LAN Interface PPA Number = 1

clear = Clear statistics registers
display = Display LAN Interface status and statistics registers
end = End LAN Interface Administration, return to Test Selection
menu = Display this menu
ppa = PPA Number of the LAN Interface
quit = Terminate the Administration, return to shell
reset = Reset LAN Interface to execute its selftest
specific = Go to Driver specific menu

Enter command: ppa
Enter PPA Number. Currently 1: 901

LAN Interface test mode. LAN Interface PPA Number = 901

clear = Clear statistics registers
display = Display LAN Interface status and statistics registers
end = End LAN Interface Administration, return to Test Selection
menu = Display this menu
ppa = PPA Number of the LAN Interface
quit = Terminate the Administration, return to shell
```

reset = Reset LAN Interface to execute its selftest  
specific = Go to Driver specific menu

Enter command: **display**

LAN INTERFACE STATUS DISPLAY  
Tue , Oct 1,2002 14:07:10

PPA Number = 901  
Description = lan901 Hewlett-Packard LinkAggregate Interface  
Type (value) = ethernet-csmacd(6)  
MTU Size = 1500  
Speed = 300000000  
Station Address = 0x108318b927  
Administration Status (value) = up(1)  
Operation Status (value) = up(1)  
Last Change = 102502046

For link-aggregate MIB statistics, press <Return> to continue

Inbound Octets = 46821  
Inbound Unicast Packets = 0  
Inbound Non-Unicast Packets = 424  
Inbound Discards = 1  
Inbound Errors = 0  
Inbound Unknown Protocols = 72  
Outbound Octets = 41446  
Outbound Unicast Packets = 346  
Outbound Non-Unicast Packets = 346  
Outbound Discards = 0  
Outbound Errors = 0  
Outbound Queue Length = 0  
Specific = 0

LAN Interface test mode. LAN Interface PPA Number = 901

clear = Clear statistics registers  
display = Display LAN Interface status and statistics registers  
end = End LAN Interface Administration, return to Test Selection  
menu = Display this menu  
ppa = PPA Number of the LAN Interface  
quit = Terminate the Administration, return to shell  
reset = Reset LAN Interface to execute its selftest  
specific = Go to Driver specific menu

Enter command: **specific**

Link Aggregation specific test mode. Valid LAN Interface PPAs: 2 1 3

linkagg = Link Aggregate status  
port = Port's APA status  
end = End Driver Specific Test Mode, return to Lan Interface  
test mode.  
menu = Display this menu  
quit = Terminate the Administration, return to shell

Enter command: **linkagg**

Link Aggregate PPA # : 901  
Number of Ports : 3  
Ports PPA : 2 1 3  
Link Aggregation State : LINKAGG AUTO  
Group Capability : 901  
Load Balance Mode : MAC Address based (LB\_MAC)

Link Aggregation specific test mode. Valid LAN Interface PPAs: 2 1 3

linkagg = Link Aggregate status  
port = Port's APA status  
end = End Driver Specific Test Mode, return to Lan Interface  
test mode.  
menu = Display this menu

quit = Terminate the Administration, return to shell

Enter command: **port**

Enter Port PPA number: **1**

\*\*\*\* PORT NUMBER: 1 \*\*\*\*

```
pagpEnabled : ENABLED
ppMyData.deviceId : 00108318b907
ppMyData.distReq : LEARNCAP_AGPORT
ppMyData.portPriority : 0
ppMyData.sentPortIfIndex : 1
ppMyData.groupCapability : 901
ppMyData.groupIfIndex : 1
ppNoPagpTimerI : 0
ppNoTransTimerQ : 0
ppTHToTATimerS : 0
ppSlowHelloTimerA : 7
ppPartnerCount : 1
```

\*\*\*\*\* PARTNER DATA \*\*\*\*\*

PARTNER 0

```
ppPartnerData.deviceId : 000883756600
ppPartnerData.distReq : LEARNCAP_AGPORT
ppPartnerData.portPriority : 190
ppPartnerData.sentPortIfIndex : 190
ppPartnerData.groupCapability : 3
ppPartnerData.groupIfIndex : 211
ppTimerP : 85
ppSlowHelloRequestP : 1
```

\*\*\*\*\* PARTNER DATA \*\*\*\*\*

```
ppAutoMode.myAutoMode : 0
ppAutoMode.yourRequest : 0
ppMySlowHello : 1
portState : PAGP_STATE_UPPAGP
portNextState : PAGP_STATE_UPPAGP
portNextEvent : PAGP_EVENT_NULL
portXmitState : PAGP_XMIT_STATE_SLOW_U6
portXmitNextState : PAGP_XMIT_STATE_SLOW_U6
portXmitNextEvent : PAGP_XMIT_EVENT_NULL
```

Link Aggregation specific test mode. Valid LAN Interface PPAs: 2 1 3

```
linkagg = Link Aggregate status
port = Port's APA status
end = End Driver Specific Test Mode, return to Lan Interface
test mode.
menu = Display this menu
quit = Terminate the Administration, return to shell
```

Enter command: **quit**



---

# 5 Administering HP APA

Administering HP APA consists of performing the following tasks:

- “Modifying HP APA Global Parameters” (page 63)
- “Logging Messages to the syslog.log File” (page 63)

## Modifying HP APA Global Parameters

The following HP APA global parameters are stored in the `/etc/rc.config.d/hp_apaconf` file:

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Default Port Mode   | The default configuration mode for link aggregates. The supported values are as follows:<br><br>MANUAL      Disables FEC and IEEE 802.3ad LACP on all ports that support HP APA. You must manually add or remove them from the specific link aggregate. This is the default.<br><br>FEC_AUTO    Starts FEC on all ports that support HP APA.<br>LACP_AUTO   Starts IEEE 802.3ad LACP on all ports that support HP APA.<br><br>LAN_MONITOR   Disables FEC and IEEE 802.3ad LACP on all ports that support HP APA. The ports will be used for a failover group. |
| MAX Link Aggregates | Sets the maximum number of link aggregates for the server. The valid range is from 5 to 50, inclusive. The default value is 50. This value takes effect only after a reboot.                                                                                                                                                                                                                                                                                                                                                                                  |
| LACP SYSID Mode     | LACP_AUTO only. Directs APA how to set up the LACP System ID. The supported values are as follows:<br><br>FIRST_APA_PORT      Sets the LACP System ID to the first supported HP APA port. This is the default.<br><br>FIRST_LACP_PORT     Sets the LACP System ID to the first active (UP) port that starts LACP.                                                                                                                                                                                                                                             |
| LACP Timeout        | For the September 2007 release of HP APA for HP-UX 11i v1 and v2 this specifies an interval of time between LACP Protocol Data Units (PDUs) after which the server considers the LACP link partner to be down. The supported values are as follows:<br><br>0      Specifies a slow timeout. This is approximately 30 seconds. This is the default.<br><br>1      Specifies a fast timeout. This is approximately 3 seconds.                                                                                                                                   |
| Use Syslog          | Enables (1) or disables (0) the logging of status messages to the <code>syslog.log</code> file (for example, when a link aggregate or port fails or comes up). The default value is 0. See Section (page 63) for sample <code>syslog.log</code> messages and their meaning.                                                                                                                                                                                                                                                                                   |

To change a global parameter, edit the `/etc/rc.config.d/hp_apaconf` and make the necessary changes. For more information, see “`hp_apaconf` File” (page 97).

## Logging Messages to the syslog.log File

For the May 2005 release of HP APA for HP-UX 11i v1 (B.11.11.20) and later, the PHNE\_33116 (B.11.11.17) release, and the December 2005 release for HP-UX 11i v2 (B.11.23.10), you can enable the logging of APA and LAN Monitor status messages to the `syslog.log` file. The status

messages are a subset of the messages APA logs to the `net1` log file, but are reworded for readability and understandability.

For information on configuring APA to log status messages to the `/var/adm/syslog/syslog.log` file, see “Modifying HP APA Global Parameters” (page 63).

## Examples

This section contains sample status messages that might appear in the `syslog.log` file. In these examples, a link is considered UP:

- If its Operation Status (`ifOper`) is UP (the link can carry network traffic) and
- If the link is part of a link aggregate and it has successfully negotiated via the protocol with the link partner to become a member of the link aggregate.

A link is considered DOWN:

- Anytime its Operation Status (`ifOper`) status is DOWN (the link cannot carry network traffic) or
- If the link is part of an automatic link aggregate and the protocol has failed to maintain the membership of the port in the link aggregate.

```
Mar 3 08:49:54 hpserver1 vmunix: APA/LM: Product is now running. 1
Mar 3 08:49:54 hpserver1 vmunix: APA/LM: Product is now stopped. 2
Mar 3 08:50:20 hpserver1 vmunix: APA/LM: LA:lan900 - lan7 is up 3
Mar 3 08:50:20 hpserver1 vmunix: APA/LM: LA:lan900 is up
Mar 3 08:50:20 hpserver1 vmunix: APA/LM: LA:lan900 - lan8 is up
Mar 3 08:50:20 hpserver1 vmunix: APA/LM: LA:lan900 - lan9 is up
Mar 3 08:51:34 hpserver1 vmunix: APA/LM: LA:lan900 - lan8 is down 4
Mar 3 08:50:26 hpserver1 vmunix: APA/LM: LA:lan900 - lan9 is removed 5
Mar 3 08:52:05 hpserver1 vmunix: APA/LM: LA:lan900 - lan7 is down 6
Mar 3 08:52:05 hpserver1 vmunix: APA/LM: LA:lan900 is down
.
.
.
Mar 3 08:50:26 hpserver1 vmunix: APA/LM: LA:lan900 - lan8 is removed 7
Mar 3 08:50:26 hpserver1 vmunix: APA/LM: LA:lan900 - lan7 is removed
Mar 3 08:50:26 hpserver1 vmunix: APA/LM: LA:lan900 is cleared
```

**1** The `/sbin/init.d/hpapa start` command was issued, for example, at system boot time.

**2** The `/sbin/init.d/hpapa stop` command was issued.

**3** Link aggregate (LA) 900 was created with three links 7, 8, and 9.

**4** Link 8 is not operational.

**5** Link 9 was removed from `lan900`; for example, by issuing the following command:

```
lanadmin -X -d 9 900
```

**6** Link 7 and link aggregate 900 are not operational.

**7** Link aggregate 900 was cleared; for example, by issuing the following command:

```
nwmgr -X -c 900
```

If link aggregate 900 is a failover group, `lan900` has a FOG: prefix instead of LA: as shown in the previous example.

For failover groups and Hot-standby mode link aggregates, the current active link is also displayed as in the following example:

```
Mar 3 08:58:03 hpserver1 vmunix: APA/LM: FOG:lan900 - lan1 is up (lan1 is active)
Mar 3 08:58:03 hpserver1 vmunix: APA/LM: FOG:lan900 is up (lan1 is active)
Mar 3 08:58:03 hpserver1 vmunix: APA/LM: FOG:lan900 - lan2 is up (lan1 is active)
.
.
.
Mar 3 08:58:03 hpserver1 vmunix: APA/LM: FOG:lan900 - lan2 isn't receiving poll 1
Mar 3 08:58:03 hpserver1 vmunix: APA/LM: FOG:lan900 - lan2 now receiving poll \
```



```
packets (lan1 is active) 2
Mar 3 08:58:03 hpserver1 vmunix: APA/LM: FOG:lan900 - Proactive Failover Occurred \
(lan901 is active) 3
```

- 1 Connectivity among links in the failover group was lost.
- 2 The link in the failover group started receiving poll packets; it has recovered connectivity.
- 3 Proactive failover occurred in the failover group.

For detailed log messages, use the NetTL subsystem. See *nettl*(1M) for more information.

## Viewing HP APA Statistics

The link aggregate software keeps a counter for each statistic defined in RFC 1213 MIB II for 32-bit statistics or RFC 2863 for 64-bit statistics. Each counter is set to the negative of the sum of all the physical ports in the link aggregate when it is created. When reporting the value of a statistic, the sum of all the physical ports corresponding statistic counter is added to the link aggregates counter.

For a detailed description of the statistics fields, see RFC 1213 for 32-bit statistics and RFC 2863 for 64-bit statistics.

When a physical port is removed from a link aggregate, each of its statistics is added to the corresponding link aggregate statistic. When a physical port is added to a link aggregate, its current statistics are subtracted from the link aggregates statistics.



**NOTE:** Cisco's Fast EtherChannel (FEC) packets are not counted in the link aggregate statistics. This is required because the FEC packets never traverse the link aggregate, they only traverse the port.

---

For the September 2004 release (B.11.23.05) and later of HP APA for HP-UX 11i v2 and the May 2005 release (B.11.11.20) and later of HP APA for HP-UX 11i v1, link aggregates support 64-bit statistics based on the following rules:

- Aggregates support the 64-bit MIB (Management Information Base) if all the member links are capable of 64-bit statistics when the aggregate is created.
- The 64-bit statistics capability will be downgraded to 32 bits if the aggregate membership changes to include one or more links that are not 64-bit MIB capable. After the aggregate's 64-bit MIB capability is downgraded, it will never be upgraded again for the life of the aggregate.

To display statistics, use the `lanadmin -g linkAggPPA` command. Example 5-1 shows 32-bit MIB statistics returned from this command.

## Example 5-1 Sample Link Aggregate 32-Bit Statistics

---

```
lanadmin -g 900
```

```
LAN INTERFACE STATUS DISPLAY
Fri, Jul 30, 2007 12:20:23
```

```
PPA Number = 900
Description = lan900 Hewlett-Packard LinkAggregate Interface
Type (value) = other(1)
MTU Size = 1500
Speed = 100 Mbps
Station Address = 0x00306E5FF047
Administration Status (value) = up(1)
Operation Status (value) = down(2)
Last Change = Thu Sep 28 18:35:11 2006
Inbound Octets = 1353732
Inbound Unicast Packets = 0
Inbound Non-Unicast Packets = 22064
Inbound Discards = 0
Inbound Errors = 0
Inbound Unknown Protocols = 22064
Outbound Octets = 0
Outbound Unicast Packets = 0
Outbound Non-Unicast Packets = 0
Outbound Discards = 0
Outbound Errors = 0
Outbound Queue Length = 0
Specific = 0
```

---

Example 5-2 shows 64-bit MIB statistics.

## Example 5-2 Sample Link Aggregate 64-Bit Statistics

---

```
lanadmin -g mibstats_ext 901
```

```
LAN INTERFACE STATUS DISPLAY
Fri, Jul 30, 2007 12:20:23
```

```
Interface Name = lan901
PPA Number = 901
Description = lan901 Hewlett-Packard LinkAggregate Interface
Interface Type (value) = other(1)
MTU Size = 1500
Speed = 3 Gbps
Station Address = 0x0012794371B4
Administration Status = up
Operation Status = down
Last Change = Thu Sep 28 18:35:11 2006
Inbound Octets = 1353732
Inbound Unicast Packets = 0
Inbound Multicast Packets = 0
Inbound Broadcast Packets = 0
Inbound Discards = 0
Inbound Errors = 0
Inbound Unknown Protocols = 22064
Outbound Octets = 0
Outbound Unicast Packets = 0
Outbound Multicast Packets = 0
Outbound Broadcast Packets = 0
Outbound Discards = 0
Outbound Errors = 0
Counter Discontinuity Time = Thu Sep 28 18:35:10 2006
Physical Promiscuous Mode = invalid
Physical Connector Present = false
Interface Alias =
Link Up/Down Trap Enable = enabled
```

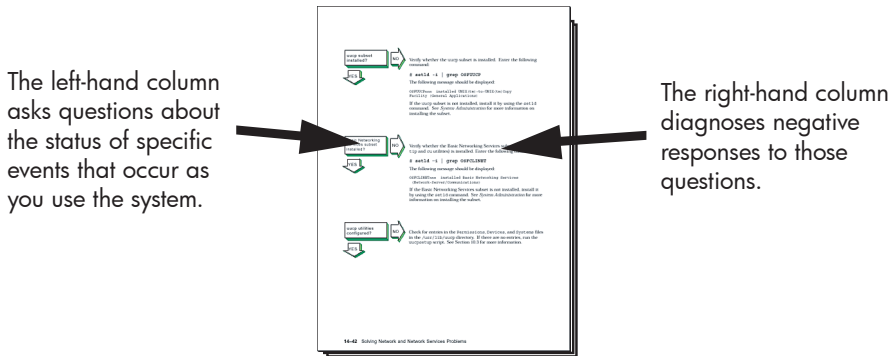
---

# 6 Troubleshooting HP APA

This chapter contains a diagnostic map to help you solve problems that might occur when you use HP APA. Use this chapter with the appropriate HP and third-party switch documentation to solve as many problems as possible at your level.

## Operation

Network problems can occur for a number of reasons. The diagnostic map in this chapter help you to isolate the problem. The following figure explains how to use the diagnostic map:



After you isolate the problem, the map refers you to other chapters for instructions on using the various problem solving tools and utilities. The map also refers you to other manuals for more complete diagnostic information for particular devices and software products.

You might experience problems that are not documented in this manual when you use the HP APA software with other products. See the documentation for the other products for additional information.

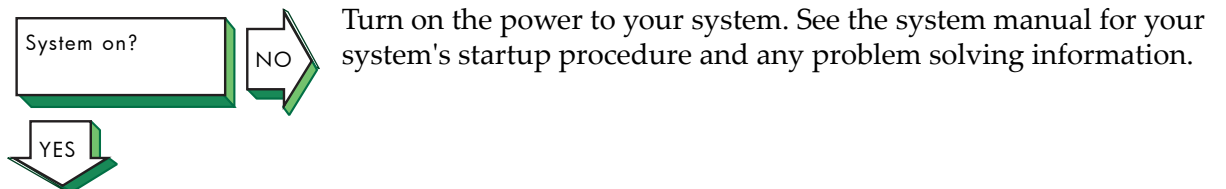
## Getting Started

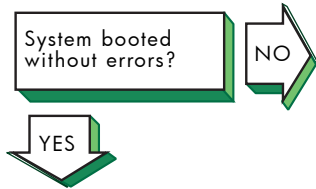
Before you start troubleshooting, ensure that the communications hardware is ready for use. Verify the following:

- The system's physical cable connections (the Ethernet connection and the transceiver connection) are properly installed. See the documentation for your system and the NIC.
- Event logging is enabled in order to monitor network events. For information about the Network Tracing and Logging (NetTL) tool, see "nettl Tracing and Logging Tool" (page 90). For information about logging messages to `syslog`, see "Logging Messages to the `syslog.log` File" (page 63).

Also see the product release notes for up-to-date information on known problems.

## Solving HP APA Problems





Edit the `/etc/rc.log` file and search for the string `hpapa`. This takes you to the beginning of the HP APA start-up section. If there are failover groups configured on your system, the following message indicates an error:

```
ERROR: lanapplyconf failed
```

If there are no failover groups configured on your system, you can ignore the error message.

If you see error messages about link aggregate attributes, do the following:

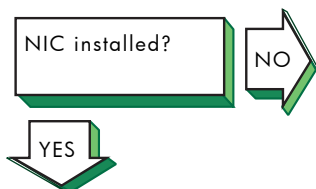
1. Stop HP APA with the following commands:
 

```
/sbin/init.d/hplm stop
/sbin/init.d/hpapa stop
```
2. Correct the attribute in the appropriate configuration file.
3. Restart HP APA with the following commands:
 

```
/sbin/init.d/hpapa start
/sbin/init.d/hplm start
```

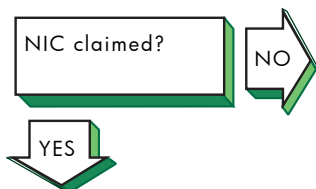
Search for the string `hplm` in the `/etc/rc.log` file. If there are failover groups configured on your system, the preceding message indicates an error. If there are no failover groups configured on your system, you can ignore the error message.

Also look for any driver and network errors.



Do the following:

1. Verify that the network card is seated correctly and that it is operational.
2. Check that your network physical port connectors between the NIC and the switch (or wall plug) are fully connected.



Verify that the NIC has been claimed by the operating system. Issue the following command:

```
ioscan -fkC lan
```

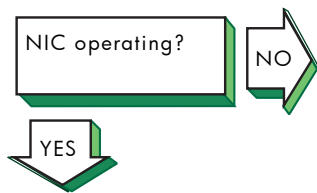
If the driver has been claimed, the driver name appears in the `Driver` column and `CLAIMED` appears in the `S/W State` column for the `lan` class and hardware path. See “Scanning the System Hardware” (page 89) for more information on `ioscan`.

If the software state is `UNCLAIMED`, do the following:

1. If the class is unknown and driver is `UNKNOWN`, the interface driver has not been generated into the kernel. Verify that the `/stand/vmunix` file contains the appropriate keyword for the NIC you are using with the following command:
 

```
what /stand/vmunix | grep -i driver-name
```

For example, if you are using the 1000Base-T NIC, the `igelan` keyword appears. If it does not, you must edit the file and create a new kernel. For information on how to do this, see the *Installing and Administering LAN/9000 Software* manual.
2. Verify that the NIC is seated correctly and that it is operational.
3. Reboot the system.



Verify that the NIC is operating. Enter the following command:

```
lanscan
```

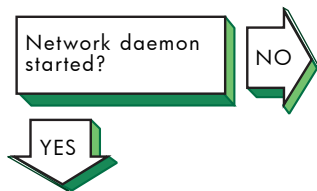
If the Hardware State is DOWN, do the following:

1. Check the status of the Link LED.

If the LED is off, check the connection to the switch. Make sure that the switch is configured in the correct mode and is autonegotiating, if necessary. Reset the NIC with following command:

```
lanadmin -r linkAggPPA
```

2. Make sure the link speed and duplex mode match the settings on the switch. If they do not, set the correct link speed and duplex mode and enable autonegotiating, if necessary. Then, reset the NIC with the `lanadmin` command
3. Verify that your hardware state is UP by issuing the `lanscan` command with no arguments. If it is not up, perform the steps for **NIC claimed?**.

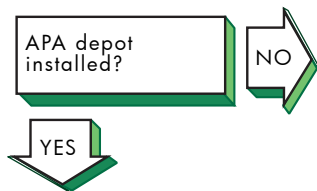


Verify that the network daemon (`inetd`) is running. Enter the following command:

```
ps -e | grep inetd
```

If no `inetd` daemon is running, start it using the following command:

```
/sbin/init.d/inetd start
```



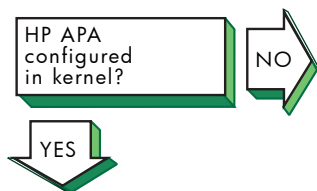
Verify that the HP APA depot is installed by issuing the following command:

```
swlist | grep J4240AA
```

If the product is installed, the following message is displayed:

```
J4240AA B.11.23.40 Auto-Port Aggregation Software
```

If the product is not installed, install it by using the `swinstall` command. See [Chapter 2 \(page 19\)](#) and the Release Notes for more information.



Verify that the software is configured in the kernel by issuing the following command:

```
what /stand/vmunix | egrep -i hp_apa
```

Output similar to the following displays:

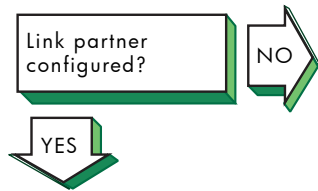
```
$Revision: hp_apa: HP Auto-Port Aggregation (APA): B.11.31.20
Aug 10 2008 11:30
```

If nothing is displayed, rebuild the kernel.

Go to “Solving Link Aggregate Problems (MANUAL Mode)” for MANUAL mode link aggregates, “Solving Link Aggregate Problems (LACP Mode)” (page 74) for LACP\_AUTO mode link aggregates, “Solving Link Aggregate

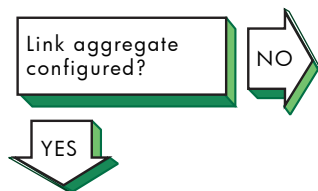
Problems (FEC Mode)” (page 79) for FEC\_AUTO mode link aggregates, or “Solving Failover Group Problems” (page 83) for failover groups.

## Solving Link Aggregate Problems (MANUAL Mode)



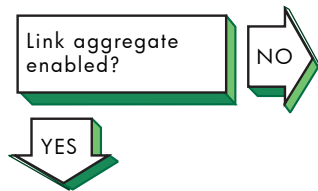
Do the following:

- Verify that the switch is configured correctly with the appropriate ports enabled. See the appropriate switch documentation to determine if the switch ports connected to the server are configured correctly for manual link aggregation (trunking) and do not run FEC or LACP.



Verify that the link aggregate is configured by issuing the `lanscan` command. Link aggregate names begin with `LinkAgg`.

If the link aggregate is not configured, use the SAM to configure it. See “Configuring a Link Aggregate” (page 36) for more information.



Verify that the link aggregate is enabled by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

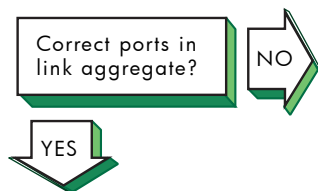
If the aggregate is enabled, the Link Aggregation Mode is `MANUAL`.

If the aggregate is not enabled, do the following:

1. Check the cabling between the NIC and the switch.
2. Verify that the link partner is configured to run manual trunks. Make any changes, if necessary. Then, verify that the link aggregate is enabled.
3. Verify that all ports in the aggregate are set to the same `MANUAL` mode by using the following command for each port:

```
lanadmin -x -p portPPA linkAggPPA
```

If they are not, use the SAM to modify the link aggregate.



Verify the ports in the link aggregate by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

The `Active Ports PPA #` entry shows the ports that compose the link aggregate.

If the link aggregate contains ports that you do not want in the aggregate, delete the ports by issuing the following command:

```
lanadmin -x -d portPPA linkAggPPA
```

where `portPPA` can be a list of multiple ports numbers separated by a space.

If any ports you wanted in the link aggregate are members of another link aggregate, delete the ports in the other aggregate by issuing the following command:

```
lanadmin -X -d -portPPA linkAggPPA
```

If there are ports you wanted in the link aggregate that are not members of the link aggregate, do the following:

1. If FEC or LACP is enabled on the port, stop autonegotiation with the following command:

```
lanadmin -X -p portPPA MANUAL linkAggPPA
```

2. Verify the type, speed (including duplex), and MTU size of each port you want with the following command:

```
lanadmin -g portPPA
```

All ports must have the same values. If they do not, make any changes as necessary on the server and the switch.

3. Add each port to the aggregate with the following command:

```
lanadmin -X -a portPPA linkAggPPA
```

where *portPPA* can be a list of multiple ports numbers separated by a space.

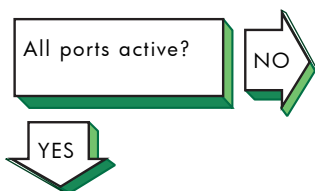


---

**NOTE:** Use SAM or edit the configuration files to make the configuration changes permanent.

---

4. Check if there is an IP address or a VLAN on the port.



Verify the active ports in the link aggregate by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

The `Active Ports PPA #` field lists the active ports.

If there are ports in the `Port(s) not ready` field, verify the port's operation status by issuing the following command:

```
lanadmin -g portPPA
```

If the `Operation Status` is up, check the speed (including duplex) and MTU for the port and another active port in the link aggregate with the following command:

```
lanadmin -s -m portPPA
```

If they do not match, correct the settings on the server and the switch. See the steps for `Link partner configured?`. If they match, reset the port.

If the status is DOWN, check the cabling from the NIC to the switch and see the steps for `NIC operating?`.

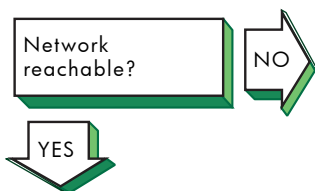
On the switch, verify that all ports you expect to be in the link aggregate are in the same `MANUAL` trunk.



---

**NOTE:** If you are using the `HOT_STANDBY` load distribution algorithm, be sure the switch side port is not in any trunk.

---

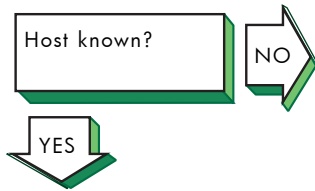


If a remote host's network is not reachable, the following message is displayed in response to the `ping` command:

```
network is unreachable
```

Complete the following steps:

1. Ensure that the network devices are configured properly on the local host, using the `netstat -i` command.
2. Verify that the routing tables on the local host are correct, using the `netstat -r` command.

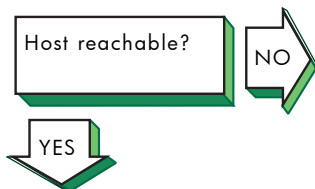


If a host is not known, the following message is displayed:

unknown host

Complete the following steps:

1. Verify that the user is trying to reach the remote host using a valid host name.
2. Verify that the remote host is in another name domain and that the user specified the full domain name.
3. If your site uses the Domain Name System (DNS) for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis` is specified as a service for the `hosts` database entry. If it is not, add it. Also, verify that the DNS service has information about the remote host.
4. If your site uses the NIS name service for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis` is specified as a service for the `hosts` database entry. If it is not, add it. Also, verify if the NIS service has information about the remote host.
5. If your `/etc/nsswitch.conf` file lists `files` as the only name-to-address translation mechanism, the `/etc/hosts` file does not have information on the remote host. See `nsswitch.conf(4)` for more information.



If a remote host is not reachable, the following message is displayed:

host is unreachable

Complete the following steps:

1. Inspect the cabling between the local host and the link partner.
2. Perform a loopback test on your own system by using the `ping` command. If this is successful, your system is operating properly to the Network Layer (OSI Layer 3).
3. Verify the remote host is running, using the `ping` command. If the remote host does not respond, ask the host's system administrator to start the host. For additional information about the `ping` command, see "Testing Access to Internet Network Hosts" (page 89).
4. Verify that an entry exists for the remote host in your system's ARP cache by entering the following command:

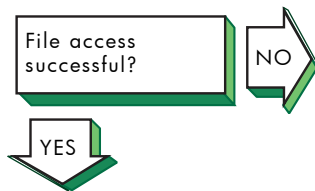
```
arp hostname
```

If the entry is wrong or incomplete, enter the correct station address by using the `arp` command. See `arp(1M)` for more information.

5. Make sure the network devices are configured properly on the local host, using the `netstat -i` command.
6. Verify that the routing tables on the local host are correct, using the `netstat -r` command. Use the `ping` command to determine whether the IP router is reachable.



7. Verify that the local host's address-to-name translation for the remote host is correct by using the `nslookup` command.
8. Inspect the routers along the path to the remote host to determine whether they have security features enabled that prevent you from reaching the remote host.

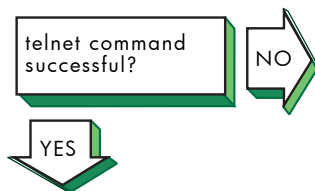


If a file cannot be accessed using the `rcp` or `rsh` command, the following message is displayed:

`permission denied`

Complete the following steps:

1. Verify that the user is intended to have access to the remote host. The remote host might be intentionally preventing remote access.
2. Verify that the correct host and user definitions exist in the user's `.rhosts` file on the remote host.
3. Verify that the `/etc/hosts.equiv` file is set up correctly.
4. Verify that the directory and file protection on the files to be copied or the `.rhosts` file on the remote system are correct.
5. If you are using NFS, see the appropriate NFS documentation.



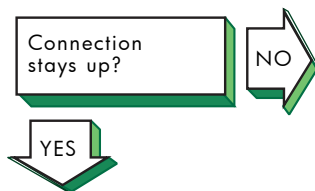
If the `telnet` command is not successful, there is a problem with the Transport Layer (OSI Layer 4). Do the following:

1. Verify whether you have a problem with a pseudoterminal driver (`pty`) on your system by issuing the `ftp` command to the remote host. If the command is successful, there is a problem with a `pty` on your system. Contact your HP representative. See "Reporting Problems" (page 92) for more information.
2. Check the `/etc/protocols` file on both hosts to ensure that TCP is installed and configured. Neither `telnet` nor `ftp` will work if TCP is not configured on both sides of the connection.

If it is not, install TCP and issue the `telnet` command again.

3. Transfer a file to a different remote host on the network. Use the `netstat` command to check for lost packets.

If network congestion does not appear to be the cause, contact your HP representative. See "Reporting Problems" (page 92) for more information.



If the connection terminates abnormally or a network application appears to hang, complete the following steps:

1. Test the network to determine whether the problem is on the local host, remote host, or a host on the path between the two.

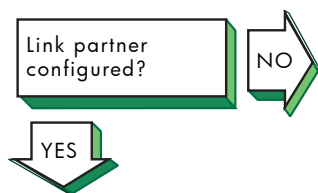


Problem still exists?  
Report your problem to  
HP. See “Reporting  
Problems ” (page 92).

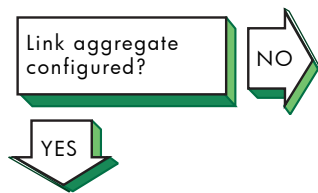
2. After you identify the host with the problem, do the following:
  - a. Confirm that the NIC is properly configured. Verify that the broadcast address and address mask for the local host are correct.
  - b. Make sure the local host's `/etc/hosts` file has the correct IP address for the local host.
  - c. Make sure the cabling from the local host to the network is intact and properly connected.
  - d. If connected over a local area network (LAN), verify that the Address Resolution Protocol (ARP) entries are correct and that the system is properly connected to the LAN.
  - e. Check the `/var/adm/nett1.LOG000` file to see if there are any errors (for example, cable disconnection messages). Format the `nett1.LOG000` file using the following command:

```
netfmt -N nett1.LOG000
```

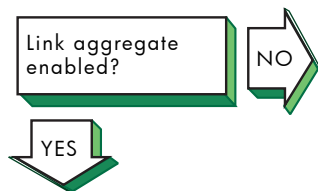
## Solving Link Aggregate Problems (LACP Mode)



Verify that the switch is configured correctly with the appropriate ports enabled and autonegotiation set to ON. See the appropriate switch documentation to determine if the switch ports connected to the server are configured correctly for link aggregation (trunking) and support LACP.



Verify that the link aggregate is configured by issuing the `lanscan` command. Link aggregate names begin with `LinkAgg`.  
If the link aggregate is not configured, use SAM to configure it. See “Configuring a Link Aggregate” (page 36) for more information.

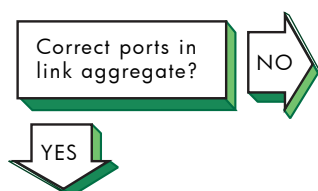


Verify that the link aggregate is enabled by issuing the following command:

If the aggregate is enabled, the `Link Aggregation Mode` is `LACP_AUTO`. This also indicates that any LACP automatic protocol negotiation was successful.

If the aggregate is not enabled, do the following:

1. Check the cabling between the NIC and the switch.
2. Verify that the link partner is configured to run the IEEE 802.3ad LACP protocol. Make any changes, if necessary, and wait 10 seconds. Then, verify that the link aggregate is enabled.
3. Verify that all ports in the aggregate are set to the same mode by using the following command for each port:  
If they are not, use the SAM to modify the link aggregate.



Verify the ports in the link aggregate by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

The `Active Ports PPA #` field shows the ports that compose the link aggregate.

If the link aggregate contains ports that you do not want in the aggregate, delete the ports by issuing the following command:

```
lanadmin -X -d portPPA linkAggPPA
```

where `portPPA` can be a list of multiple ports numbers separated by a space.

If any ports you wanted in the link aggregate are members of another link aggregate, delete the ports in the other aggregate by issuing the following command:

```
lanadmin -X -d -portPPA linkAggPPA
```

If there are ports you wanted in the link aggregate that are not members of the link aggregate, do the following:

1. Verify the type, speed (including duplex), MTU size, and checksum offload of each port you want with the following command:

```
lanadmin -g portPPA
```

All ports must have the same values.



**NOTE:** You cannot aggregate a port that has no CKO capability with a port that has CKO capability, even if its CKO capability is currently disabled.

---

To change an attribute, do the following:

- a. Stop LACP on the port with the following command:

```
lanadmin -X -p MANUAL portPPA
```

- b. Set the attribute value with the `lanadmin` command.
- c. Start LACP on the port with the following command:

```
lanadmin -X -p LACP_AUTO portPPA
```

- d. Verify that the port is in LACP mode with the following command:

```
lanadmin -g portPPA
```

If the port is not in LACP mode, possible reasons are:

- The port has IP addresses or VLANs configured on it. Unconfigure them from the port and start LACP again.
- The port is not in full-duplex mode. Make sure the port on the server and on the switch are set to full-duplex or to autonegotiate. Start LACP again.
- The port is already in a link aggregate, failover group, or in `FEC_AUTO` mode. Find another port to use.
- The port is not an Ethernet port or is not supported by HP APA.
- The port is down. Wait for the port to come up. Verify that the port is connected to the switch correctly. If it is, reset the port.

- e. Save the current configuration either by using SAM or editing the configuration files.
2. Verify that the link aggregate has a key value specified with the `lanadmin -x -k linkAggPPA` command. If it does not, set it with the following command:

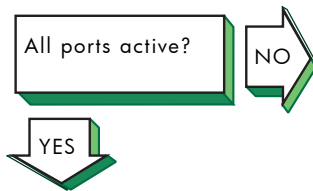
```
lanadmin -X -k value linkAggPPA
```

3. Verify that the port's key value matches the value of the link aggregate. If it does not, do the following:
  - a. Set the port mode to MANUAL with the following command:

```
lanadmin -X -p MANUAL portPPA
```
  - b. Set the key value and mode with the following commands:

```
lanadmin -X -k value portPPA
lanadmin -X -p LACP_AUTO portPPA
```

The ports then negotiate with the link partner (approximately 10 seconds) and join the link aggregate. Repeat this step for each port you want in the aggregate.
  - c. Verify that the ports are in the link aggregate with the `lanadmin -x -i` command.
  - d. Save the current configuration either by using SAM or editing the configuration files.



Verify the active ports in the link aggregate by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

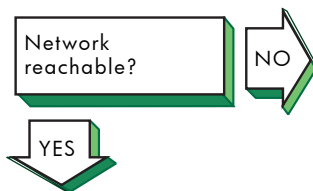
The Active Ports PPA # field lists the active ports.

If there are ports in the Port(s) not ready field, verify the port's operation status by issuing the following command:

```
lanadmin -g portPPA
```

If the Operation Status is up, see the steps for Link partner configured?.

If the status is down, check the cabling from the NIC to the switch and see the steps for NIC operating?.

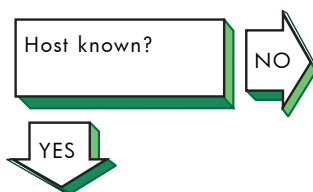


If a remote host's network is not reachable, the following message is displayed in response to the ping command:

```
network is unreachable
```

Complete the following steps:

1. Ensure that the network devices are configured properly on the local host, using the `netstat -i` command.
2. Verify that the routing tables on the local host are correct, using the `netstat -r` command.



If a host is not known, the following message is displayed:

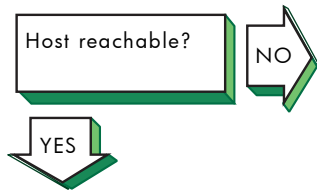
```
unknown host
```

Complete the following steps:

1. Verify that the user is trying to reach the remote host using a valid host name.
2. Verify that the remote host is in another name domain and that the user specified the full domain name.
3. If your site uses the Domain Name System (DNS) for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis` is specified as a service for the `hosts` database

entry. If it is not, add it. Also, verify that the DNS service has information about the remote host.

4. If your site uses the NIS name service for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis` is specified as a service for the `hosts` database entry. If it is not, add it. Also, verify if the NIS service has information about the remote host.
5. If your `/etc/nsswitch.conf` file lists `files` as the only name-to-address translation mechanism, the `/etc/hosts` file does not have information on the remote host. See *nsswitch.conf(4)* for more information.



If a remote host is not reachable, the following message is displayed:

```
host is unreachable
```

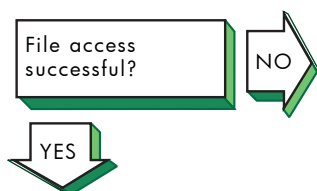
Complete the following steps:

1. Inspect the cabling between the local host and the link partner.
2. Perform a loopback test on your own system by using the `ping` command. If this is successful, your system is operating properly to the Network Layer (OSI Layer 3).
3. Verify the remote host is running, using the `ping` command. If the remote host does not respond, ask the host's system administrator to start the host. For additional information about the `ping` command, see "Testing Access to Internet Network Hosts" (page 89).
4. Verify that an entry exists for the remote host in your system's ARP cache by entering the following command:

```
arp hostname
```

If the entry is wrong or incomplete, enter the correct station address by using the `arp` command. See *arp(1M)* for more information.

5. Make sure the network devices are configured properly on the local host, using the `netstat -i` command.
6. Verify that the routing tables on the local host are correct, using the `netstat -r` command. Use the `ping` command to determine whether the IP router is reachable.
7. Verify that the local host's address-to-name translation for the remote host is correct by using the `nslookup` command.
8. Inspect the routers along the path to the remote host to determine whether they have security features enabled that prevent you from reaching the remote host.



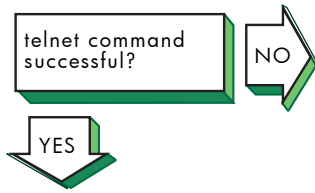
If a file cannot be accessed using the `rcp` or `rsh` command, the following message is displayed:

```
permission denied
```

Complete the following steps:

1. Verify that the user is intended to have access to the remote host. The remote host might be intentionally preventing remote access.
2. Verify that the correct host and user definitions exist in the user's `.rhosts` file on the remote host.
3. Verify that the `/etc/hosts.equiv` file is set up correctly.

4. Verify that the directory and file protection on the files to be copied or the `.rhosts` file on the remote system are correct.
5. If you are using NFS, see the appropriate NFS documentation.



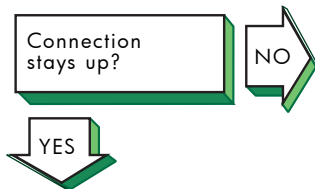
If the `telnet` command is not successful, there is a problem with the Transport Layer (OSI Layer 4). Do the following:

1. Verify whether you have a problem with a pseudoterminal driver (`pty`) on your system by issuing the `ftp` command to the remote host. If the command is successful, there is a problem with a `pty` on your system. Contact your HP representative. See "Reporting Problems" (page 92) for more information.
2. Check the `/etc/protocols` file on both hosts to ensure that TCP is installed and configured. Neither `telnet` nor `ftp` will work if TCP is not configured on both sides of the connection.

If it is not, install TCP and issue the `telnet` command again.

3. Transfer a file to a different remote host on the network. Use the `netstat` command to check for lost packets.

If network congestion does not appear to be the cause, contact your HP representative. See "Reporting Problems" (page 92) for more information.



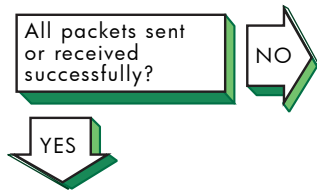
If the connection terminates abnormally or a network application appears to hang, complete the following steps:

1. Confirm that the NIC is properly configured.
2. Make sure the cabling from the local host to the network is intact and properly connected.
3. Test the network connectivity between the link aggregate and other hosts on the same subnet using the `ping` command.
4. Verify the link aggregate membership. See the steps for **Link aggregate enabled?**
5. Verify that there is an IP address configured on the link aggregate and that the IP interface is up with the `ifconfig` command. If it is not up, bring it up with the following command:

```
ifconfig interface-name up
```

Test the connection with the `ping` command.

6. Test the network connectivity between another interface on the server and other hosts on the same subnet. If this fails, there is a network problem.
7. Examine the traffic over the link aggregate. Heavy traffic might cause the LACP system to lose communication, which can cause the link aggregate to lose connection with other ports or cause the LACP link aggregate to go down temporarily. Reduce the traffic on the link aggregate.

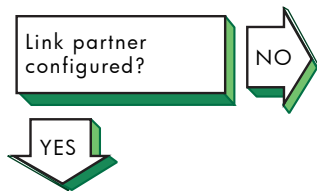


Problem still exists?  
Report your problem to HP. See “Reporting Problems ” (page 92).

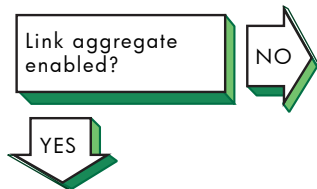
If you suspect or know that you are experiencing packet loss over your connection, do the following:

1. LACP mode link aggregates require time to negotiate with the switch. You might drop some packets during this time.
2. Check the trunk is configured correctly on the switch. Make sure that ports connected to the ports on the server are assigned to the LACP trunk. If the LACP trunk is assigned to any other ports on the server, this can cause packets to be dropped.
3. Check the switch port configuration. Remove any port that is not supposed to be in the trunk.
4. Verify the link aggregate membership. See the steps for **Link aggregate enabled?**. If the number of ports in the link aggregate is greater than the maximum number of ports in the LACP trunk on the switch, delete the extra ports from the LACP link aggregate.

## Solving Link Aggregate Problems (FEC Mode)



Verify that the switch is configured correctly. See the appropriate switch documentation to determine if the switch ports connected to the server are configured correctly for link aggregation (trunking) and support the FEC protocol.



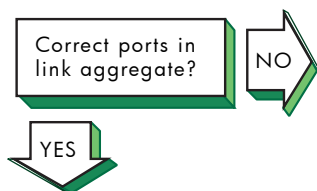
Verify that the link aggregate is enabled by issuing the following command:

If the aggregate is enabled, the Link Aggregation Mode is `FEC_AUTO`. This also indicates that any FEC automatic protocol negotiation was successful.

If the aggregate is not enabled, do the following:

1. Check the cabling between the NIC and the switch.
2. Verify that the link partner is configured to run the Cisco Fast EtherChannel protocol. Make any changes, if necessary, and wait 10 seconds. Then, verify that the link aggregate is enabled.
3. Verify that all ports in the aggregate are set to the same mode by using the following command for each port:

If they are not, use the SAM to modify the link aggregate.



Verify the ports in the link aggregate by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

The Active Ports PPA # entry shows the ports that compose the link aggregate.

If the link aggregate contains ports that you do not want in the aggregate, delete the ports by issuing the following command:

```
lanadmin -X -d portPPA linkAggPPA
```

where *portPPA* can be a list of multiple ports numbers separated by a space.

If any ports you wanted in the link aggregate are members of another link aggregate, delete the ports in the other aggregate by issuing the following command:

```
lanadmin -X -d portPPA linkAggPPA
```

If there are ports you wanted in the link aggregate that are not members of the link aggregate, do the following:

1. Verify the type, speed (including duplex), MTU size, and checksum offload of each port you want with the following command:

```
lanadmin -g portPPA
```

All ports must have the same values.

---



**NOTE:** You cannot aggregate a port that has no CKO capability with a port that has CKO capability, even if its CKO capability is currently disabled.

---

To change an attribute, do the following:

- a. Stop FEC on the port with the following command:

```
lanadmin -X -p MANUAL portPPA
```

- b. Set the attribute value with the `lanadmin` command.

- c. Start FEC on the port with the following command:

```
lanadmin -X -p FEC_AUTO portPPA
```

- d. Verify that the port is in FEC mode with the following command:

```
lanadmin -g portPPA
```

If the port is not in FEC mode, possible reasons are:

- The port has IP addresses or VLANs configured on it. Unconfigure them from the port and start FEC again.
- The port is not in full-duplex mode. Make sure the port on the server and on the switch are set to full-duplex or to autonegotiate. Start FEC again.
- The port is already in a link aggregate, failover group, or in LACP\_AUTO mode. Find another port to use.
- The port is not an Ethernet port or is not supported by HP APA.
- The port is down. Wait for the port to come up. Verify that the port is connected to the switch correctly. If it is, reset the port.

- e. Save the current configuration either by using SAM or editing the configuration files.

2. Verify that the link aggregate has a group capability value specified with the `lanadmin -x -g linkAggPPA` command. If it does not, set it with the following command:

```
lanadmin -X -g value linkAggPPA
```

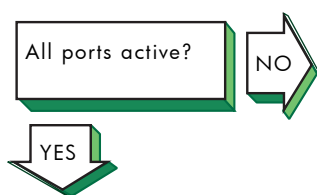


3. Verify that the port's group capability value matches the value of the link aggregate. If it does not, do the following:
  - a. Set the port mode to MANUAL with the following command:
 

```
lanadmin -X -p MANUAL portPPA
```
  - b. Set the group capability and mode values with the following commands:
 

```
lanadmin -X -g value portPPA
lanadmin -X -p FEC_AUTO portPPA
```

 The ports then negotiate with the link partner (approximately 10 seconds) and join the link aggregate. Repeat this step for each port you want in the aggregate.
  - c. Verify that the ports are in the link aggregate with the `lanadmin -x -i` command.
  - d. Save the current configuration either by using SAM or editing the configuration files.



Verify the active ports in the link aggregate by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

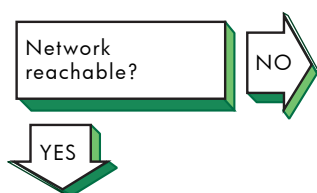
The `Active Ports PPA #` field lists the active ports.

If there are ports in the `Port(s) not ready` field, verify the port's operation status by issuing the following command:

```
lanadmin -g portPPA
```

If the `Operation Status` is up, see the steps for `Link partner configured?`.

If the status is down, check the cabling from the NIC to the switch and see the steps for `NIC operating?`.

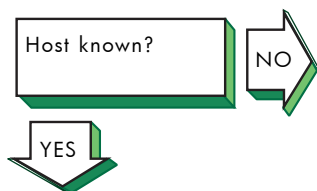


If a remote host's network is not reachable, the following message is displayed in response to the ping command:

```
network is unreachable
```

Complete the following steps:

1. Ensure that the network devices are configured properly on the local host, using the `netstat -i` command.
2. Verify that the routing tables on the local host are correct, using the `netstat -r` command.



If a host is not known, the following message is displayed:

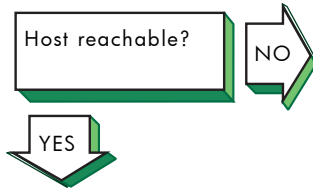
```
unknown host
```

Complete the following steps:

1. Verify that the user is trying to reach the remote host using a valid host name.
2. Verify that the remote host is in another name domain and that the user specified the full domain name.
3. If your site uses the Domain Name System (DNS) for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis` is specified as a service for the `hosts` database.

entry. If it is not, add it. Also, verify that the DNS service has information about the remote host.

4. If your site uses the NIS name service for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis` is specified as a service for the `hosts` database entry. If it is not, add it. Also, verify if the NIS service has information about the remote host.
5. If your `/etc/nsswitch.conf` file lists `files` as the only name-to-address translation mechanism, the `/etc/hosts` file does not have information on the remote host. See `nsswitch.conf(4)` for more information.



If a remote host is not reachable, the following message is displayed:

```
host is unreachable
```

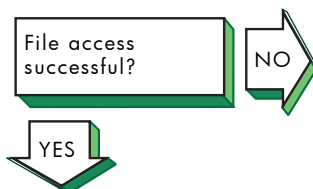
Complete the following steps:

1. Inspect the cabling between the local host and the link partner.
2. Perform a loopback test on your own system by using the `ping` command. If this is successful, your system is operating properly to the Network Layer (OSI Layer 3).
3. Verify the remote host is running, using the `ping` command. If the remote host does not respond, ask the host's system administrator to start the host. For additional information about the `ping` command, see "Testing Access to Internet Network Hosts" (page 89).
4. Verify that an entry exists for the remote host in your system's ARP cache by entering the following command:

```
arp hostname
```

If the entry is wrong or incomplete, enter the correct station address by using the `arp` command. See `arp(1M)` for more information.

5. Make sure the network devices are configured properly on the local host, using the `netstat -i` command.
6. Verify that the routing tables on the local host are correct, using the `netstat -r` command. Use the `ping` command to determine whether the IP router is reachable.
7. Verify that the local host's address-to-name translation for the remote host is correct by using the `nslookup` command.
8. Inspect the routers along the path to the remote host to determine whether they have security features enabled that prevent you from reaching the remote host.



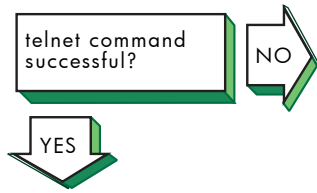
If a file cannot be accessed using the `rcp` or `rsh` command, the following message is displayed:

```
permission denied
```

Complete the following steps:

1. Verify that the user is intended to have access to the remote host. The remote host might be intentionally preventing remote access.
2. Verify that the correct host and user definitions exist in the user's `.rhosts` file on the remote host.
3. Verify that the `/etc/hosts.equiv` file is set up correctly.

4. Verify that the directory and file protection on the files to be copied or the `.rhosts` file on the remote system are correct.
5. If you are using NFS, see the appropriate NFS documentation.



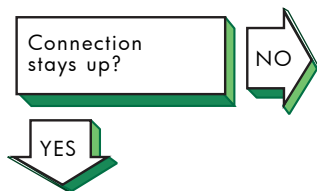
If the `telnet` command is not successful, there is a problem with the Transport Layer (OSI Layer 4). Do the following:

1. Verify whether you have a problem with a pseudoterminal driver (`pty`) on your system by issuing the `ftp` command to the remote host. If the command is successful, there is a problem with a `pty` on your system. Contact your HP representative. See "Reporting Problems" (page 92) for more information.
2. Check the `/etc/protocols` file on both hosts to ensure that TCP is installed and configured. Neither `telnet` nor `ftp` will work if TCP is not configured on both sides of the connection.

If it is not, install TCP and issue the `telnet` command again.

3. Transfer a file to a different remote host on the network. Use the `netstat` command to check for lost packets.

If network congestion does not appear to be the cause, contact your HP representative. See "Reporting Problems" (page 92) for more information.



If the connection terminates abnormally or a network application appears to hang, complete the following steps:

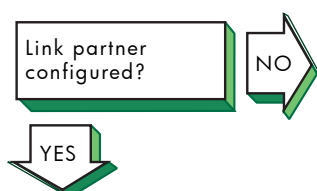
1. Test the network to determine whether the problem is on the local host, remote host, or a host on the path between the two.
2. After you identify the host with the problem, do the following:
  - a. Confirm that the NIC is properly configured. Verify that the broadcast address and address mask for the local host are correct.
  - b. Make sure the local host's `/etc/hosts` file has the correct IP address for the local host.
  - c. Make sure the cabling from the local host to the network is intact and properly connected.
  - d. If connected over a local area network (LAN), verify that the Address Resolution Protocol (ARP) entries are correct and that the system is properly connected to the LAN.
  - e. Check the `/var/adm/nett1.LOG000` file to see if there are any errors (for example, cable disconnection messages). Format the `nett1.LOG000` file using the following command:



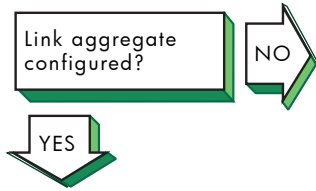
Problem still exists?  
Report your problem to HP. See "Reporting Problems" (page 92).

```
netfmt -N nett1.LOG000
```

## Solving Failover Group Problems



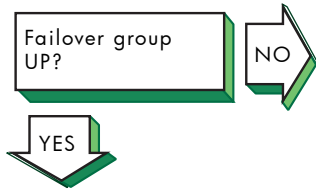
Verify that the switch is configured correctly. Refer to the appropriate switch documentation to determine if the switch ports connected to the server are configured correctly for link aggregation (trunking).



Verify that the failover group is configured by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

If the failover group is not configured (Link Aggregation Mode is `MODE_UNDEFINED`), edit the configuration files to configure it. For more information, see “Editing Configuration Files for Failover Groups” (page 107).



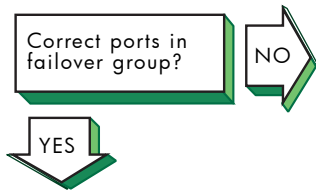
Verify that the failover group is up by issuing the following command:

```
lanadmin -g linkAggPPA
```

If the failover group (LAN\_MONITOR mode) is enabled, the Operation Status is up.

If the Operation Status is down, do the following:

1. Check that all ports in the failover group are connected to the switch.
2. Verify that the link partner is configured for no trunking. Make any changes, if necessary, and wait 10 seconds. Then, verify that the failover group is up.



Verify the ports in the failover group by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

The Active Port PPA #, Port (s) ready, and Port (s) not ready fields show the ports that compose the failover group.

If the failover group contains ports that you do not want, edit the configuration files and delete the ports from the failover group. For more information, see “Editing Configuration Files for Failover Groups” (page 107).

If any ports you wanted in the failover group are members of another link aggregate, delete the ports in the other aggregate by editing the configuration files and removing the ports from the link aggregate. For more information, see “Editing Configuration Files for Failover Groups” (page 107).

If there are ports in the failover group that are not members of the failover group, verify the type, speed, duplex mode, MTU size, and checksum offload capability of each port you want with the following command:

```
lanadmin -x -g portPPA
```

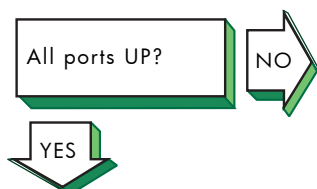
All ports must have the same values. To change a port attribute, edit the configuration file and make any changes. For more information, see “Editing Configuration Files for Failover Groups” (page 107).

Verify that the port is in LAN\_MONITOR mode with the following command:

```
lanadmin -x -p portPPA linkAggPPA
```

If the port is not in LAN\_MONITOR mode, possible reasons are:

- The port has IP addresses or VLANs configured on it. Unconfigure them from the port and start LAN\_MONITOR again.
- The port is not in full-duplex mode. Make sure the port on the server and on the switch are set to full-duplex or to autonegotiate. Start LAN\_MONITOR again.
- The port is already in a link aggregate or failover group. Find another port to use.
- The port is not an Ethernet port or is not supported by HP APA.
- The port is down. Wait for the port to come up. Verify that the port is connected to the switch correctly. If it is, reset the port.



Verify the active port in the failover group by issuing the following command:

```
lanadmin -x -i linkAggPPA
```

where *linkAggPPA* is the failover group instance number.

The Active Port PPA # field lists the active port.

If there are ports in the Port(s) not ready field, verify the port's operation status by issuing the following command:

```
lanadmin -x -p portPPA linkAggPPA
```

If the Operation Status is up, wait 30 seconds to see if the port becomes ready or active. If it does not, see the steps for *Link partner configured?*. Then, reset the port with the following command and wait 30 seconds:

```
lanadmin -r portPPA
```

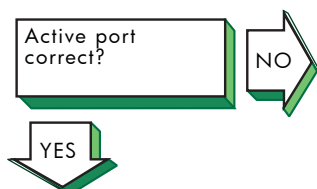


**NOTE:** Only reset physical ports, not link aggregates that are members of the failover group.

If the port does not appear in the Port(s) ready list, edit the configuration files and make any changes. For more information, see *“Editing Configuration Files for Failover Groups”* (page 107).

If the Operation Status is down, do the following:

1. If the port is a link aggregate, see the appropriate troubleshooting section for the specific type of link aggregate to resolve the problem.
2. Check the cabling from the NIC to the switch. If the cable is disconnected, reconnect it.
3. Verify that the NIC is operating. See the steps for *NIC operating?*.
4. Check the `nettl` log for any other messages.
5. Remove the port from the failover group.



Verify that the active port is the one you intended by using the following command:

```
lanadmin -x -i linkAggPPA
```

where *linkAggPPA* is the failover group instance number.

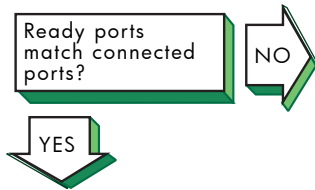
If the active port is not the intended one and the intended port is listed in the Port(s) connected to the active port field, the intended port is connected to the current active port. For priority-based failover groups, edit the configuration files and verify the port priority or port cost for both ports.

For cost-based failover groups, edit the configuration files and verify the port cost for both ports.

If the active port priority is greater than the intended port priority, modify the priority value for the intended port (making it greater than the current active port).

If the active port cost is less than the intended port cost, modify the cost value for the intended port (making it less than the current active port).

For more information, see “Editing Configuration Files for Failover Groups” (page 107).



Verify that the ready ports are identical to the connected ports by using the following command:

```
lanadmin -x -i linkAggPPA
```

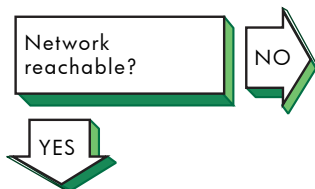
where *linkAggPPA* is the failover group instance number.

If the ready ports are different from the connected ports, some ports are disconnected from the current active port. If the current active port is not the intended active port, do the following:

1. Edit the configuration file and remove the port.
2. Issue the following commands:

```
lanqueryconf -s
lanapplyconf
```

For more information, see “Editing Configuration Files for Failover Groups” (page 107).

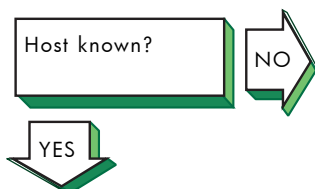


If a remote host's network is not reachable, the following message is displayed in response to the ping command:

```
network is unreachable
```

Complete the following steps:

1. Ensure that the network devices are configured properly on the local host, using the `netstat -i` command.
2. Verify that the routing tables on the local host are correct, using the `netstat -r` command.



If a host is not known, the following message is displayed:

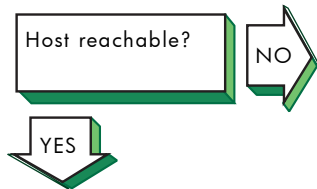
```
unknown host
```

Complete the following steps:

1. Verify that the user is trying to reach the remote host using a valid host name.
2. Verify that the remote host is in another name domain and that the user specified the full domain name.
3. If your site uses the Domain Name System (DNS) for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis` is specified as a service for the `hosts` database entry. If it is not, add it. Also, verify that the DNS service has information about the remote host.
4. If your site uses the NIS name service for name-to-address translation, look in the `/etc/nsswitch.conf` file to see if `nis`

is specified as a service for the `hosts` database entry. If it is not, add it. Also, verify if the NIS service has information about the remote host.

5. If your `/etc/nsswitch.conf` file lists `files` as the only name-to-address translation mechanism, the `/etc/hosts` file does not have information on the remote host. See *nsswitch.conf(4)* for more information.



If a remote host is not reachable, the following message is displayed:  
`host is unreachable`

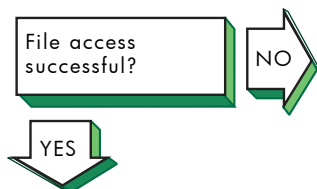
Complete the following steps:

1. Inspect the cabling between the local host and the link partner.
2. Perform a loopback test on your own system by using the `ping` command. If this is successful, your system is operating properly to the Network Layer (OSI Layer 3).
3. Verify the remote host is running, using the `ping` command. If the remote host does not respond, ask the host's system administrator to start the host. For additional information about the `ping` command, see "Testing Access to Internet Network Hosts" (page 89).
4. Verify that an entry exists for the remote host in your system's ARP cache by entering the following command:

```
arp hostname
```

If the entry is wrong or incomplete, enter the correct station address by using the `arp` command. See *arp(1M)* for more information.

5. Make sure the network devices are configured properly on the local host, using the `netstat -i` command.
6. Verify that the routing tables on the local host are correct, using the `netstat -r` command. Use the `ping` command to determine whether the IP router is reachable.
7. Verify that the local host's address-to-name translation for the remote host is correct by using the `nslookup` command.
8. Inspect the routers along the path to the remote host to determine whether they have security features enabled that prevent you from reaching the remote host.

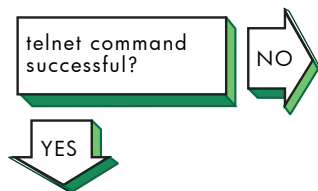


If a file cannot be accessed using the `rcp` or `rsh` command, the following message is displayed:

```
permission denied
```

Complete the following steps:

1. Verify that the user is intended to have access to the remote host. The remote host might be intentionally preventing remote access.
2. Verify that the correct host and user definitions exist in the user's `.rhosts` file on the remote host.
3. Verify that the `/etc/hosts.equiv` file is set up correctly.
4. Verify that the directory and file protection on the files to be copied or the `.rhosts` file on the remote system are correct.
5. If you are using NFS, see the appropriate NFS documentation.



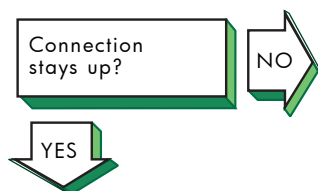
If the `telnet` command is not successful, there is a problem with the Transport Layer (OSI Layer 4). Do the following:

1. Verify whether you have a problem with a pseudoterminal driver (`pty`) on your system by issuing the `ftp` command to the remote host. If the command is successful, there is a problem with a `pty` on your system. Contact your HP representative. See “Reporting Problems” (page 92) for more information.
2. Check the `/etc/protocols` file on both hosts to ensure that TCP is installed and configured. Neither `telnet` nor `ftp` will work if TCP is not configured on both sides of the connection.

If it is not, install TCP and issue the `telnet` command again.

3. Transfer a file to a different remote host on the network. Use the `netstat` command to check for lost packets.

If network congestion does not appear to be the cause, contact your HP representative. See “Reporting Problems” (page 92) for more information.



If the connection terminates abnormally or a network application appears to hang, complete the following steps:

1. Test the network to determine whether the problem is on the local host, remote host, or a host on the path between the two.
2. After you identify the host with the problem, do the following:
  - a. Confirm that the NIC is properly configured. Verify that the broadcast address and address mask for the local host are correct.
  - b. Make sure the local host's `/etc/hosts` file has the correct IP address for the local host.
  - c. Make sure the cabling from the local host to the network is intact and properly connected.
  - d. If connected over a local area network (LAN), verify that the Address Resolution Protocol (ARP) entries are correct and that the system is properly connected to the LAN.
  - e. Check the `/var/adm/nettl.LOG000` file to see if there are any errors (for example, cable disconnection messages).



Problem still exists?  
Report your problem to HP. See “Reporting Problems” (page 92).

Format the `nettl.LOG000` file using the following command:  
# `netfmt -N nettl.LOG000`

## Troubleshooting Tools Overview and Usage

To help you resolve problems with HP APA, the operating system provides tools you can use to complete the following tasks:

- Test access to network hosts on the Internet
- Scan the system hardware
- Display the `nettl` log and trace files
- Report problems to HP

The following sections contain information about using the tools associated with these tasks.



## Testing Access to Internet Network Hosts

Use the `ping` command to test your system's ability to reach a host on the Internet network. The `ping` command has the following syntax:

```
/usr/sbin/ping [options] [hostname]
```

The `ping` command sends an Internet Control Message Protocol (ICMP) echo request to the host specified. When the request is successful, the remote host sends the data back to the local host where is printed to `stdout`. If the remote host does not respond to the request, the `ping` command does not display any results.

To terminate the `ping` command output, press **Ctrl+c**. When terminated, the `ping` command displays statistics on packets sent, packets received, the percentage of packets lost, and the minimum, average, and maximum round-trip packet times.

You can use the output from the `ping` command to help determine the cause of direct and indirect routing problems such as an unreachable host, a timed-out connection, or an unreachable network.

When using the `ping` command for fault isolation, first test the local host to verify it is running. If the local host returns the data correctly, use the `ping` command to test remote hosts farther and farther away from the local host.

If you do not specify command options, the `ping` command displays the results of each ICMP request in sequence, the number of bytes received from the remote host, and the round-trip time.

If the output indicates lost packets, note the percentage. If you are losing ten percent or more, this might indicate the network or remote host is extremely busy.

Also note the round-trip transmission times. Periodically high transmission times might indicate the network or remote host is extremely busy. Consistently high transmission times might indicate the local host is extremely busy.

See `ping(1M)` for more information on the command and its options.

## Scanning the System Hardware

Use the `iocan` command to scan the system hardware and list the results. If you enter `iocan -f`, output similar to the following is displayed:

## Example 6-1 Sample `ioscan -f` Output

```
ioscan -f
Class I H/W Path Driver S/W State H/W Type Description

bc 0 root CLAIMED BUS_NEXUS
bc 1 8 ccio CLAIMED BUS_NEXUS I/O Adapter
ba 0 8/4 GSCToPCI CLAIMED BUS_NEXUS PCI Bus Bridge - GSCToPCI
lan 4 8/4/1/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
lan 5 8/4/2/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
ba 1 8/8 GSCToPCI CLAIMED BUS_NEXUS PCI Bus Bridge - GSCToPCI
lan 6 8/8/1/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
lan 7 8/8/2/0 igelan CLAIMED INTERFACE PCI(10110009) -- Built-in #2
ba 2 8/12 GSCToPCI CLAIMED BUS_NEXUS PCI Bus Bridge - GSCToPCI
lan 8 8/12/1/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
lan 9 8/12/2/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
bc 2 10 ccio CLAIMED BUS_NEXUS I/O Adapter
ext_bus 0 10/0 c720 CLAIMED INTERFACE GSC built-in Fast/Wide SCSI
target 0 10/0.6 tgt CLAIMED DEVICE
disk 0 10/0.6.0 sdisk CLAIMED DEVICE HP C2490WD
target 1 10/0.7 tgt CLAIMED DEVICE
ctl 0 10/0.7.0 sctl CLAIMED DEVICE Initiator
bc 3 10/4 bc CLAIMED BUS_NEXUS Bus Converter
tty 0 10/4/0 mux2 CLAIMED INTERFACE MUX
lanmux 0 10/4/4 lanmux0 CLAIMED INTERFACE HP J2146A - 802.3 LAN
lan 1 10/4/4.1 lan3 CLAIMED INTERFACE
ba 3 10/8 GSCToPCI CLAIMED BUS_NEXUS PCI Bus Bridge - GSCToPCI
lan 2 10/8/1/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
lan 3 10/8/2/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
ba 4 10/12 bus_adapter CLAIMED BUS_NEXUS Core I/O Adapter
ext_bus 1 10/12/5 c720 CLAIMED INTERFACE Built-in SCSI
target 2 10/12/5.2 tgt CLAIMED DEVICE
target 3 10/12/5.7 tgt CLAIMED DEVICE
ctl 1 10/12/5.7.0 sctl CLAIMED DEVICE Initiator
lan 0 10/12/6 lan2 CLAIMED INTERFACE Built-in LAN
ps2 0 10/12/7 ps2 CLAIMED INTERFACE Built-in Keyboard/Mouse
processor 0 32 processor CLAIMED PROCESSOR Processor
processor 1 34 processor CLAIMED PROCESSOR Processor
memory 0 49 memory CLAIMED MEMORY Memory
ba 0 8/4 GSCToPCI CLAIMED BUS_NEXUS PCI Bus Bridge - GSCToPCI
lan 4 8/4/1/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
lan 5 8/4/2/0 igelan CLAIMED INTERFACE HP PCI 1000Base-T Core
```

If there are multiple network physical ports installed in the system, one line for each port is displayed. The example shows multiple 1000Base-T cards installed. See `ioscan(1M)` for more information.

## nettl Tracing and Logging Tool

The `nettl` command captures network events and packets. The logging portion captures state changes, errors, and connection establishment. The tracing portion capture inbound and outbound packets going through the network and loopback and header information. Log messages are written to the `/var/adm/nettl.LOG000` file. To format and view the contents of this file, enter the following command:

```
netfmt -v -f /var/adm/nettl.LOG000 | more
```

Look for Error and Disaster messages.

APA also supports the logging of status messages to the `syslog.log` file. See “Logging Messages to the `syslog.log` File” (page 63) for information on enabling this feature.

You can access the logging and tracing utility using either the graphical user interface (GUI) version or the command line interface. The GUI version does the following:

- Guides you through logging and tracing tasks.
- Enables you to create and format reports.
- Collects logging and tracing information specific to a subsystem.
- Displays report screens that are updated instantaneously with current logging and tracing information by the subsystem.
- Provides context-sensitive on-line help.

To access the GUI version of the logging and tracing utility, enter the following command:

```
nettladm
```

There are three levels of logging:

- At link aggregate level
- At Cisco's FEC level
- At IEEE 802.3ad LACP level

The following examples show how to perform different tasks from the command line:

- To turn on all logging at link aggregate level, enter:  

```
nettl -log 0xf -e HP_APA
```
- To turn on all logging at Cisco's FEC level, enter:  

```
nettl -log 0xf -e HP_APAPORT
```
- To turn on all logging at IEEE 802.3ad level, enter:  

```
nettl -log 0xf -e HP_APALACP
```
- To examine the log file with cause and action descriptions, enter:  

```
netfmt -v -f /var/adm/nettl.LOG00 | more
```
- To examine just the log messages in the log file, enter:  

```
netfmt -f /var/adm/nettl.LOG00
```
- To check network logging and tracing status, enter:  

```
nettl -status
```
- To start Cisco's FEC tracing to the file /tmp/tracefile.TRC0, enter:  

```
nettl -tracemon all -entity HP_APAPORT -file /tmp/tracefile
```
- To stop Cisco's FEC tracing, enter:  

```
nettl -tracemon off all -entity HP_APAPORT
```
- To start LACP tracing to the file /tmp/tracefile.TRC0, enter:  

```
nettl -tracemon all -entity HP_APALACP -file /tmp/tracefile
```
- To stop LACP tracing, enter:  

```
nettl -tracemon off all -entity HP_APALACP
```
- To format the tracefile into the file /tmp/traceout, enter:  

```
nettl -f /tmp/tracefile.TRC0 > /tmp/traceout
```

Whenever the TSO status of a link aggregate or failover group changes, a warning message is logged in the nettl.LOG000 file. For example, when the TSO capability is disabled on an aggregate, a WARNING message similar to the following is logged:

```
-----Auto-Port Aggregation/9000 Networking-----@#%
Timestamp : Wed Aug 18 PDT 2004 09:37:56.600031
Process ID : [ICS] Subsystem : HP_APA
User ID (UID) : -1 Log Class : WARNING
Device ID : 903 Path ID : 0
Connection ID : 0 Log Instance : 0

<3014> HP Auto-Port Aggregation product disabled TCP Segmentation Offload
 capability for link aggregation 903.
```

When the TSO capability is enabled on an aggregate, an INFORMATIVE message similar to the following is logged:

```
-----Auto-Port Aggregation/9000 Networking-----@#%
Timestamp : Wed Aug 18 PDT 2004 09:37:53.020072
```

```

Process ID : [ICS] Subsystem : HP_APA
User ID (UID) : -1 Log Class : INFORMATIVE
Device ID : 903 Path ID : 0
Connection ID : 0 Log Instance : 0

```

```

~~~~~
<4015> HP Auto-Port Aggregation product enabled TCP Segmentation Offload
      capability for link aggregation 903. VMTU = 32160.

```

For more information on using the command line interface and the GUI version, see *nettl(1M)* and *nettladm(1M)*, respectively. See *netfmt(1M)* for information on creating a filter for trace formatting.

## Reporting Problems

If you are unable to solve a problem with HP APA, do the following:

1. Read the release notes for HP APA to see if the problem is known. If it is, follow the solution offered to solve the problem.
2. Determine whether the product is still under warranty or whether your company purchased support services for the product. Your operations manager can supply you with the necessary information.
3. Access <http://www.itrc.hp.com> and search the technical knowledge databases to determine if the problem you are experiencing has already been reported. The type of documentation and resources you have access to depend on your level of entitlement.




---

**NOTE:** The ITRC resource forums at <http://www.itrc.hp.com> offer peer-to-peer support to solve problems and are free to users after registration.

---

If this is a new problem or if you need additional help, log your problem with the HP Response Center, either on line through the support case manager at <http://www.itrc.hp.com>, or by calling HP Support. If your warranty has expired or if you do not have a valid support contract for your product, you can still obtain support services for a fee, based on the amount of time and material required to solve your problem.

4. If you are requested to supply any information pertaining to the problem, gather the necessary information and submit it. The following section describes the information that you might be asked to submit.

## Gathering Information

To gather information to report a problem, complete the following steps:

1. Write a complete description of the problem. Describe the events leading up to and including the problem. Attempt to describe the source and symptoms of the problem.

Include in your description: HP-UX commands used; communication subsystem commands used; job streams; result codes and messages; and data that can reproduce the problem. Also provide a network map with the host name, IP (Internet address), and station address of each system connected to the HP system.

Illustrate as clearly as possible the context of any message(s). Prepare copies of information displayed at the system console and user terminal.

2. Obtain the version, update, and fix information for all software. To check the HP APA version number, enter the following command:

```
# what /stand/vmunix | grep -i -e hp_apa -e pagp -e lacp
```

To check the version of your kernel, enter `uname -r`.

This information enables HP to determine if the problem is already known and if the correct software is installed at your site.

3. Prepare copies of the following files:

- `/etc/rc.config.d/netconf`
  - `/etc/rc.config.d/hp_apaconf`
  - `/etc/rc.config.d/hp_apaportconf`
  - `/etc/lanmon/lanconfig.ascii`
4. Enter the `dmesg` command and record messages about the status of the NIC.
  5. Enter the `lanscan -v` command and record the output.
  6. Enter the `display` command of the `lanadmin` diagnostic on the HP APA interface and record the output.
  7. Record all error messages and numbers that appear at the user terminal and the system console.
  8. Save all network log files. Make sure that `Error` and `Disaster` log classes are enabled when log files are collected.  
Prepare the formatted output and a copy of the log file for your HP representative to further analyze.
  9. Prepare a listing of the HP-UX I/O configuration you are using for your HP representative to further analyze. Use the `ioscan` command to help collect this information.
  10. Prepare a list of your switch trunking configuration related to this problem.
  11. Try to determine the general area within the software where you think the problem exists. See the appropriate reference manual and follow the guidelines on gathering information for that product.
  12. Document your interim or workaround solution. You can typically find the cause of the problem by comparing the circumstances in which it occurs with the circumstances in which it does not occur.
  13. Create copies of any Internet or HP APA link trace files that were active when the problem occurred for your HP representative to further analyze.
  14. In the event of a system failure, a full memory dump must be taken. Use the HP-UX `savecore` utility to save a core dump. Send the output to your HP representative.



# A Product Specifications

Table A-1 summarizes the capabilities of HP APA and LAN Monitor.

**Table A-1 HP APA and LAN Monitor Capabilities**

|                                              | FEC_AUTO, LACP_AUTO, MANUAL <sup>1</sup> Modes                         | LAN_MONITOR Mode                          | Integration with HP Serviceguard in MANUAL <sup>1</sup> , FEC_AUTO, LACP_AUTO, and LAN_MONITOR Modes Only |
|----------------------------------------------|------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Minimum Number of Ports per Link Aggregate   | FEC_AUTO (1)<br>LACP_AUTO (1)<br>MANUAL (1)                            | 2                                         | 2                                                                                                         |
| Maximum Number of Ports per Link Aggregate   | FEC_AUTO (8) <sup>2</sup><br>MANUAL (8) <sup>2</sup><br>LACP_AUTO (32) | 32                                        | See "Interoperability with HP Serviceguard" (page 17)                                                     |
| Active Ports per Link Aggregate              | MANUAL (HS) (1)<br>Others (N/A)                                        | 1                                         | MANUAL (HS) (1)<br>LAN_MONITOR (1)<br>Others (N/A)                                                        |
| Standby Ports per Link Aggregate             | MANUAL (HS) (0 - 7)<br>Others (N/A)                                    | 1 - 31                                    | MANUAL (HS) (1 - 3)<br>LAN_MONITOR (1 - 3)<br>Others (N/A)                                                |
| Maximum Number of Link Aggregates per System | 50                                                                     | 50                                        | 50                                                                                                        |
| Load Balancing (LB) or Hot Standby (HS)      | FEC_AUTO (LB)<br>LACP_AUTO (LB)<br>MANUAL (LB and HS)                  | HS                                        | MANUAL (LB and HS) <sup>3</sup><br>FEC_AUTO (LB)<br>LACP_AUTO (LB)<br>LAN_MONITOR (HS)                    |
| MIB Monitor Support                          | Yes                                                                    | Yes                                       | Yes                                                                                                       |
| Buses                                        | PCI                                                                    | PCI                                       | PCI                                                                                                       |
| Links <sup>45</sup>                          | 100BT, Gigabit                                                         | 100BT, Gigabit, 10 GbE Fiber <sup>6</sup> | 100BT, Gigabit, 10 GbE Fiber (LAN_MONITOR)                                                                |
| Workstation Support                          | Yes                                                                    | Yes                                       | Yes                                                                                                       |
| Switches and Hubs                            | See "Supported Switches" (page 19)                                     | See "Supported Switches" (page 19)        | See "Supported Switches" (page 19)                                                                        |
| Starting PPA#                                | 900 <sup>7</sup>                                                       | 900 <sup>7</sup>                          | 900 <sup>7</sup>                                                                                          |
| HP Serviceguard Version                      |                                                                        |                                           | See "Interoperability with HP Serviceguard" (page 17)                                                     |
| Configuration Methods                        | SAM or edit files                                                      | lan*conf commands                         | Edit files                                                                                                |
| Instant Ignition                             | Yes                                                                    | Yes                                       | N/A                                                                                                       |
| Full and half-duplex <sup>8</sup>            | Yes <sup>5</sup>                                                       | Yes                                       | Yes                                                                                                       |

- 1 MANUAL mode: Can be Load Balancing or Non-Load Balancing
  - Load Balancing: MAC, IP, or LB\_PORT algorithm
  - Non-Load Balancing: Hot Standby mode
- 2 For HP-UX 11.0 and 11i v1, the maximum is 4.
- 3 Load Balancing is configurable for outbound traffic on Ethernet links only.
- 4 Links must be of the same speed and type (100Base-T or 1000Base-T).
- 5 LACP requires full duplex (FD) operation of the links.
- 6 You cannot reset the speed, duplex mode, or MTU size over a link aggregate.
- 7 For HP-UX 11.0, the starting number is 100.
- 8 This is for the total of link aggregates and failover groups combined.



## B HP APA Configuration Files

HP APA uses the following configuration files:

- `/etc/rc.config.d/hp_apaconf`
- `/etc/rc.config.d/hp_apaportconf`
- `/etc/lanmon/lanconfig.ascii`

The following sections describe each file and its parameters. For configuration examples that describe editing these files, see Appendix C (page 105).

### hp\_apaconf File

The `/etc/rc.config.d/hp_apaconf` file contains the following general HP APA configuration parameters for link aggregates. You must set each of the supported parameters on a specific link aggregate prior to aggregating any physical ports. All of the link aggregate configuration parameters begin with the prefix `HP_APA_`.

`HP_APA_DEFAULT_PORT_MODE` The default way to configure link aggregates is through MANUAL port configuration mode. Ensure that switch ports and server ports are set to the same trunking mode (MANUAL or AUTO), duplex mode, and speed. Disable PAgP or LACP on any switch ports not intended to be used with APA. There are two variables governing the mode of ports:

- `HP_APA_DEFAULT_PORT_MODE` in the `/etc/rc.config.d/hp_apaconf` file. Sets the default APA configuration mode for all ports. The recommended mode is MANUAL. The APA product is shipped with the entry in the `hp_apaconf` file set to: `HP_APA_DEFAULT_PORT_MODE=MANUAL`.
- `HP_APAPORT_CONFIG_MODE` in the `/etc/rc.config.d/hp_apaportconf` file. Sets the APA configuration mode for a single port. This variable takes precedence.

A port's mode is set to the value of `HP_APA_DEFAULT_PORT_MODE`, unless you specify its mode using the `HP_APAPORT_CONFIG_MODE` variable.

#### Example 1:

If the configuration mode of a port is not set with `HP_APAPORT_CONFIG_MODE` and `HP_APA_DEFAULT_PORT_MODE` is not set, the port's configuration mode is MANUAL for HP-UX 11i v1, and `FEC_AUTO` for HP-UX 11i v2.

#### Example 2:

If the configuration mode of a port is not set with `HP_APAPORT_CONFIG_MODE` and `HP_APA_DEFAULT_PORT_MODE` is set to MANUAL, the port's configuration mode is MANUAL.

#### Example 3:

If the configuration mode of a port is set to `FEC_AUTO` with `HP_APAPORT_CONFIG_MODE` and `HP_APA_DEFAULT_PORT_MODE` is set to MANUAL, the port's configuration mode is `FEC_AUTO`.

`HP_APA_GROUP_CAPABILITY` For `FEC_AUTO` (11i v1 and 11i v2) and MANUAL (11i v1) only. An integer value used to determine which network

physical ports can be aggregated into a common PAgP link aggregate. Set the `group_capability` to be the same for all network physical ports in the same link aggregate. Ports going to different link aggregates must have different group capabilities. This value must match the value of `HP_APAPORT_GROUP_CAPABILITY` in the `/etc/rc.config.d/hp_apaportconf` file.

`HP_APA_HOT_STANDBY`

Configure a link aggregate for Hot Standby mode. This parameter is mutually exclusive with the `HP_APA_LOAD_BALANCE_MODE` parameter. In addition, `HP_APA_HOT_STANDBY` takes precedence over the `HP_APA_LOAD_BALANCE_MODE` parameter. The permissible values are `on` and `off`. The default is `off`.



**CAUTION:** For most versions of HP-UX, use lowercase text when specifying `on` or `off` for `HP_APA_HOT_STANDBY` in `/etc/rc.config.d/hp_apaconf`. Using uppercase text might cause errors. This does not apply to HP APA running on HP-UX 11i v2.

`HP_APA_INTERFACE_NAME`

Name of the link aggregate. For example, `lan900` and `lan901`.

`HP_APA_KEY`

For `LACP_AUTO` only. An integer value that determines which network physical ports can be aggregated into a common LACP link aggregate. Set the *key* to be the same for all network physical ports in the same link aggregate. Ports going to different link aggregates should have different keys. Must match the value of `HP_APAPORT_KEY` in the `/etc/rc.config.d/hp_apaportconf` file.

`HP_APA_LACP_SYSTEM_ID_MODE`

For `LACP_AUTO` only, and for the May 2005 and later releases of HP APA for HP-UX 11i v1 (B.11.11.20), PHNE\_33116 (B.11.11.17) patch release, and December 2005 and later releases of HP APA for HP-UX 11i v2 (B.11.23.10) only. Directs APA how to set up the LACP System ID. The supported values are as follows:

`FIRST_APA_PORT` Sets the LACP System ID to the first supported HP APA port. This is the default.

`FIRST_LACP_PORT` Sets the LACP System ID to the first active (UP) port that starts LACP.

`HP_APA_LACP_TIMEOUT`

For `LACP_AUTO` mode only. Specifies the length of the LACP timeout. This is also a global parameter. For a description of this parameter, see “Modifying HP APA Global Parameters” (page 63).

`HP_APA_LOAD_BALANCE_MODE`

Defines the load-balancing mode for the specified link aggregate (`HP_APA_INTERFACE_NAME`). The supported values are as follows:

- `LB_MAC`
- `LB_IP`
- `LB_PORT`

For a description of these parameters, see the load distribution algorithms in “Link Aggregate Advanced Parameters” (page 34).



**NOTE:** Some IP applications might not have TCP/UDP port numbers, or the TCP/UDP port numbers are encrypted. For such cases, even if you choose LB\_PORT, it will fall back to the default LB\_MAC.

HP\_APA\_MANUAL\_LA

Manually set ports for the specified link aggregate. Specify the ports with PPA numbers. Separate each port by a comma (,).

HP\_APA\_MAX\_LINKAGGS

Sets the maximum number of link aggregates for the server. The valid range is from 5 to 50. The default value is 50. This value takes effect only after a reboot.

HP\_APA\_USE\_SYSLOG

Enables (1) or disables (0) the logging of status messages to the `syslog.log` file (for example, when a link aggregate or port fails or comes up). The default value is 0. See Section for sample `syslog.log` messages and their meaning. For the May 2005 and later releases of HP APA for HP-UX 11i v1 (B.11.11.20), PHNE\_33116 (B.11.11.17) patch release, and December 2005 and later releases of HP APA for HP-UX 11i v2 (B.11.23.10) only.

## Examples

- To set the load-balancing mode to port based (LB\_PORT) on lan900:

```
HP_APA_INTERFACE_NAME[0]="lan900"
HP_APA_LOAD_BALANCE_MODE[0]="LB_PORT"
HP_APA_HOT_STANDBY[0]="off"
```

- To create a manually formed link aggregate having ports with PPAs 2, 3, and 4:

```
HP_APA_INTERFACE_NAME[1]="lan900"
HP_APA_LOAD_BALANCE_MODE[1]="LB_PORT"
HP_APA_HOT_STANDBY[1]="off"
HP_APA_MANUAL_LA[1]="2,3,4"
```



**NOTE:** Ensure that the server and switch are set to the same mode—MANUAL.

## hp\_apaportconf File

The `/etc/rc.config.d/hp_apaportconf` file contains the following parameters that you can specify for individual ports. All configuration parameters for physical ports begin with the prefix `HP_APAPORT_`.

HP\_APAPORT\_CONFIG\_MODE

Set the configuration mode for a physical port. The supported values are as follows:

- FEC\_AUTO
- LACP\_AUTO
- LAN\_MONITOR
- MANUAL

For a description of these parameters, see the mode descriptions in “Preparing for Configuration” (page 31).

HP\_APAPORT\_GROUP\_CAPABILITY

For FEC\_AUTO only. An integer value used to determine which network physical ports can be aggregated into a common PAgP link aggregate. Set the **group capability** to be the same for all network physical ports. The group capability must match the group capability of the desired aggregate that the user wants the port to join. This value is set in the `/etc/rc.config.d/hp_apaportconf` file. “Link Aggregate Advanced Parameters” (page 34) describes how

to choose the group capability for link aggregates. Ports going to different link aggregates should have different group capabilities.

The default group capability is 5.

HP\_APAPORT\_INTERFACE\_NAME  
HP\_APAPORT\_KEY

Name of physical interface. For example, lan0 and lan1. For LACP\_AUTO only. An integer value that determines which network physical ports can be aggregated into a common LACP link aggregate. Set the **key** to be the same for all network physical ports. The key must match the key of the desired aggregate that the user wants the port to join. This value is set in the `/etc/rc.config.d/hp_apaconf` file. “Configuring a Link Aggregate” (page 36) describes how to choose the key.

The default administrative key is 0.

HP\_APAPORT\_PRIORITY

Set the port priority for the port. The port priority determines which port in a link aggregate will be the interface when the link aggregate is set to Hot Standby mode (`HP_APA_HOT_STANDBY=on`).

The default port priority is 0.

HP\_APAPORT\_SYSTEM\_PRIORITY

For LACP\_AUTO only. Set the port system priority for the port specified by `HP_APAPORT_INTERFACE_NAME`. The system priority gives control to the system to resolve waiting ports to be added in a link aggregate.

The default system priority is 0.

## lanconfig.ascii File

Example B-1 shows a sample `/etc/lanmon/lanconfig.ascii` ASCII configuration file. This file contains configuration information that LAN Monitor uses for failover groups.

## Example B-1 Sample lanconfig.ascii Configuration File

```
*****
#***** LAN MONITOR CONFIGURATION FILE
#*** For complete details about the parameters and how
#*** to set them, consult the lanqueryconf(lm) manpage
#*** or your manual.
#*** All timeout values are microseconds; they are rounded up
#*** or down appropriately.
#*****

#*****
# The valid range for POLLING_INTERVAL: 500,000-10,000,000 usec
# Default value for POLLING_INTERVAL: 10,000,000 usec
# Minimum value for DEAD_COUNT: 2
# Default value for DEAD_COUNT: 3
#*****
POLLING_INTERVAL      10000000
DEAD_COUNT            3
#*****
# By default, LM_RAPID_ARP is on.
# If LM_RAPID_ARP is on, the valid ranges are:
# LM_RAPID_ARP_INTERVAL: 1000000-4000000 (default:1000000 usec
# LM_RAPID_ARP_COUNT:    5 - 60          (default is 10)
# (LM_RAPID_ARP_INTERVAL * LM_RAPID_ARP_COUNT) <= 60s
#*****
LM_RAPID_ARP          off
LM_RAPID_ARP_INTERVAL 1000000
LM_RAPID_ARP_COUNT    10
# *****
#                               Note:                **
#                               **
# In Proactive Failover, the active port of a fail-over group **
# is the port with the minimum normalized port cost. This means **
# a fail-over group will change its active port to a ready port **
# having a lower normalized port cost, even when the current **
# active port remains up. You must use cost-based fail-over **
# groups in order to get the Proactive Failover behavior.     **
# **
# To define a cost-based fail-over group, all the ports in the **
# fail-over group must have a cost defined. Cost has a valid **
# range of between 1 and 100, inclusive. The value must be **
# preceded by a colon (:) character.                          **
# **
# If one of the ports in a fail-over group does not have a cost **
# defined, the fail-over group is invalid.                    **
# **
# If all ports in a fail-over group have no cost defined, the **
# default failover behavior is used. The available port with **
# the highest priority becomes the active port.               **
# **
# By default, the lanqueryconf -s command creates only **
# priority-based fail-over groups.                            **
# **
# Example with cost defined:                                  **
# FAILOVER_GROUP lan903 **
# STATIONARY_IP 195.55.55.55 **
# # Pri/Stdby I/f Pri Cost **
# PRIMARY lan900 7 : 1 **
# STANDBY lan901 6 : 2 **
# **
# For more information on how to use proactive fail-over, see **
# the HP Auto Port Aggregation Administrator's Guide at **
# http://docs.hp.com. **
# *****
```

```

FAILOVER_GROUP                lan900
  STATIONARY_IP                193.33.33.33
  STANDBY                      lan9    3
  PRIMARY                      lan6    5

FAILOVER_GROUP                lan901
  STATIONARY_IP                195.55.55.55
  PRIMARY                      lan4    5
  STANDBY                      lan1    3
  STANDBY                      lan2    3
  STANDBY                      lan3    3

FAILOVER_GROUP                lan902
  STATIONARY_IP                fe80::2
  PRIMARY                      lan11   5
  STANDBY                      lan10   3

```

---

The `lanconfig.ascii` configuration file contains the following fields:

**NODE\_NAME** The name of the system as obtained by `gethostname`. This must be the first line in the file.

**FAILOVER\_GROUP** The name for a single LAN Monitor failover group. You must specify a name for each LAN Monitor failover group on the system. If the group consists of multiple ports (multiple PPAs), the name format is `lan9XX`, where `XX` is a decimal number starting with 00 (for example, `lan900`).

Each **FAILOVER\_GROUP** can have the following keywords:

**STATIONARY\_IP** The IPv4 or IPv6 (December 2005 and later releases of HP-APA for HP-UX 11i v2 (B.11.23.10)) address dedicated to the failover group. This is a required field; you must set it for each failover group before running `lanapplyconf`.

**PRIMARY** Specifies the active port for the **FAILOVER\_GROUP**. Each failover group must have one port. This port is typically assigned the highest priority or lowest cost value so it will be the port that initially carries traffic. The port must also have IP addresses configured. After `lanapplyconf` creates the failover group, the IP addresses on the port (if present) are moved to the failover group.

HP recommends that you always assign the port the highest priority or the lowest cost in a failover group.

**STANDBY** Specifies a standby port for the **FAILOVER\_GROUP**. A standby port is a port that replaces the active port when the active is incapable of carrying traffic. Specify this keyword only if the failover group has more than one port. A failover group must have one or more standby ports.

Both the **PRIMARY** and **STANDBY** keywords have the following fields:

- The LAN interface name (for example, `lan0` and `lan1`).
- The port priority that will be assigned to the port. The port with the highest priority is the port.
- A cost value for the LAN interface preceded by a colon (:). This is an optional field. See “Proactive Failover” (p. 15) for more information.

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>POLLING_INTERVAL</code>      | The number of microseconds between polling messages. You can specify this keyword multiple times in the configuration file. A link aggregate's polling interval is set to the last specified interval. For a description of this parameter, see “Failover Group Advanced Parameters” (page 35).                                                                                                                               |
| <code>DEAD_COUNT</code>            | The number of polling packets that are missed before LAN Monitor sends a <code>nettl</code> log message to the user that indicates the link might have problems and the network should be checked. For a description of this parameter, see “Failover Group Advanced Parameters” (page 35).                                                                                                                                   |
| <code>LM_RAPID_ARP</code>          | Enables (on) or disables (off) the ability to transmit gratuitous ARP messages at intervals shorter than 5 seconds. By default, <code>LM_RAPID_ARP</code> is off. For a description of this parameter, see “Failover Group Advanced Parameters” (page 35).                                                                                                                                                                    |
| <code>LM_RAPID_ARP_INTERVAL</code> | The number of microseconds between rapid gratuitous ARP messages. If the value is out of the valid range and <code>LM_RAPID_ARP</code> is on, the interval value last processed with the <code>lanapplyconf</code> command is used. If <code>LM_RAPID_ARP</code> is off, this value is ignored for the corresponding failover group. For a description of this parameter, see “Failover Group Advanced Parameters” (page 35). |
| <code>LM_RAPID_ARP_COUNT</code>    | The number of gratuitous ARP packets sent rapidly. If the value is not in the valid range and <code>LM_RAPID_ARP</code> is on, the count value last processed with the <code>lanapplyconf</code> is used. If <code>LM_RAPID_ARP</code> is off, this value is ignored for the corresponding failover group. For a description of this parameter, see “Failover Group Advanced Parameters” (page 35).                           |

If you specify the `POLLING_INTERVAL`, `DEAD_COUNT`, `LM_RAPID_ARP_INTERVAL`, and `LM_RAPID_ARP_COUNT` fields once in the `lanconfig.ascii` file before all failover, the values apply to all failover groups. If you specify them multiple times in the file, the values apply only to those failover groups that follow these fields; you can set different values for failover groups.

## lanconfig File

The `/etc/lanmon/lanconfig` file is a binary file that stores the current snapshot of the aggregates. Because you cannot modify the aggregates using the `lanadmin` command, and you cannot edit this file. It correctly represents the current configuration.



**CAUTION:** Do not edit the binary file because you can corrupt the data. Do not change the name or directory location. Doing so can make the product malfunction.





---

# C Configuring HP APA by Editing Files

This appendix provides information about editing the different configuration files to configure the following:

- Link aggregates
- Failover groups

## Editing Configuration Files for Link Aggregates

This section shows how to configure the three modes associated with port aggregation.

For release-specific information, see the release notes on your system in the `/opt/networkdocs` directory or on the web at:

<http://www.docs.hp.com>



**IMPORTANT:** The following information applies to each of the `hpapa start` and `hpapa stop` sequences listed on the following pages.

If you are configuring more than one of the four port-configuration modes described here, minimize the number of times you must enter `hpapa stop` (which can interrupt traffic on existing link aggregates) by editing all configuration files first. You then only need to enter one series of `hplm stop` (optional), `hpapa stop`, `hpapa start`, and `hplm start` (optional) commands to activate the link aggregates and failover groups.



**NOTE:** HP APA also requires that you configure the trunking mode (AUTO or MANUAL) of your switches to match the mode being used on the server: Cisco Fast EtherChannel (FEC), IEEE 802.3ad Link Aggregation Control Protocol (LACP), or MANUAL mode.

---

## Editing Files for MANUAL, FEC\_AUTO, or LACP\_AUTO Mode

1. Ensure that the switch ports and the HP LAN card ports are set to the same APA (or trunking) mode (MANUAL or AUTO), speed, and duplex mode.
2. Use the `lanadmin` command, if you need to verify that all HP LAN card ports intended for aggregation are connected to the LAN.
3. Remember that APA instance numbers begin with 900 (all versions of HP-UX 11i) or 100 (HP-UX 11.0).

### MANUAL Port Configuration Mode

To configure `lan1` and `lan2` in link aggregate 900 with MAC-based load balancing, do the following:

1. Edit the `/etc/rc.config.d/hp_apaconf` file and add the following entries:

```
HP_APA_INTERFACE_NAME[0]=lan900
HP_APA_LOAD_BALANCE_MODE[0]=LB_MAC
HP_APA_MANUAL_LA[0]="1,2"
```

2. Edit the `/etc/rc.config.d/hp_apaportconf` file and add the following entries. If this is the first-time configuration, the configuration mode is already set to the default of MANUAL:

```
HP_APAPORT_INTERFACE_NAME[0]=lan1
HP_APAPORT_CONFIG_MODE[0]=MANUAL
HP_APAPORT_INTERFACE_NAME[1]=lan2
HP_APAPORT_CONFIG_MODE[1]=MANUAL
```

3. Activate the new configuration by entering:

```
# /sbin/init.d/hplm stop 1
# /sbin/init.d/hpapa stop 2
# /sbin/init.d/hpapa start
# /sbin/init.d/hplm start 3
```

- 1 If failover groups are also configured.
- 2 This can interrupt traffic on existing link aggregates.
- 3 For configuring failover groups.

## FEC\_AUTO Port Configuration Mode

To configure load balancing and group capability for link aggregate 901 with MAC-based load balancing, do the following:

1. Edit the `/etc/rc.config.d/hp_apaconf` file and add the following entries:

```
HP_APA_INTERFACE_NAME[0]=lan901
HP_APA_LOAD_BALANCE_MODE[0]=LB_MAC
HP_APA_GROUP_CAPABILITY[0]=901
```

2. Edit the `/etc/rc.config.d/hp_apaportconf` file and add the following entries to put `lan1` and `lan2` into link aggregate 901:

```
HP_APAPORT_INTERFACE_NAME[0]=lan1
HP_APAPORT_GROUP_CAPABILITY[0]=901
HP_APAPORT_CONFIG_MODE[0]=FEC_AUTO
```

```
HP_APAPORT_INTERFACE_NAME[1]=lan2
HP_APAPORT_GROUP_CAPABILITY[1]=901
HP_APAPORT_CONFIG_MODE[1]=FEC_AUTO
```

3. Activate the new configuration by entering:

```
# /sbin/init.d/hplm stop 1
# /sbin/init.d/hpapa stop 2
# /sbin/init.d/hpapa start
# /sbin/init.d/hplm start 3
```

- 1 If failover groups are also configured.
- 2 This can interrupt traffic on existing link aggregates.
- 3 For configuring failover groups.



**NOTE:** Set the group capability in the previous examples to be the same as that of the link aggregate to which it belongs. Ports going to different link aggregates should have different group capabilities.

---

## LACP\_AUTO Port Configuration Mode

To configure load balancing and the port key for link aggregate 902 with MAC-based load balancing, do the following:

1. Edit the `/etc/rc.config.d/hp_apaconf` file and add the following entries:

```
HP_APA_INTERFACE_NAME[0]=lan902
HP_APA_LOAD_BALANCE_MODE[0]=LB_MAC
HP_APA_KEY[0]=902
```

2. Edit the `/etc/rc.config.d/hp_apaportconf` file and add the following entries to put `lan1` and `lan2` into link aggregate 902 and set the APA port key and the configuration mode:

```
HP_APAPORT_INTERFACE_NAME[0]=lan1
HP_APAPORT_KEY[0]=902
HP_APAPORT_CONFIG_MODE[0]=LACP_AUTO
HP_APAPORT_INTERFACE_NAME[1]=lan2
```

```
HP_APAPORT_KEY[1]=902
HP_APAPORT_CONFIG_MODE[1]=LACP_AUTO
```



**NOTE:** Set the LACP\_AUTO key in the previous examples to be the same as that of the link aggregate to which it belongs. Ports going to different link aggregates should have different keys.

3. Activate the new configuration by entering:

```
# /sbin/init.d/hplm stop 1
# /sbin/init.d/hpapa stop 2
# /sbin/init.d/hpapa start
# /sbin/init.d/hplm start 3
```

- 1 If failover groups are also configured.
- 2 This can interrupt traffic on existing link aggregates.
- 3 For configuring failover groups.

## Editing Configuration Files for Failover Groups

If you are configuring a failover group for the first time, or if you have changed the failover group configuration, do the following:

1. Connect the physical devices that are to be in the failover group to the same switch, or to different switches or hubs on the same subnet to achieve switch/hub redundancy.



**NOTE:** Be sure that trunking is not enabled on the switch ports.

2. Check that there is link connectivity between the devices (linkloop). If it fails, resolve the physical connection between the devices.
3. Edit the `/etc/rc.config.d/hp_apaportconf` file and assign the and standby physical ports to LAN\_MONITOR mode. For example, the following entries put lan1 and lan2 into a failover group:

```
HP_APAPORT_INTERFACE_NAME[0]=lan1
HP_APAPORT_CONFIG_MODE[0]=LAN_MONITOR
```

```
HP_APAPORT_INTERFACE_NAME[1]=lan2
HP_APAPORT_CONFIG_MODE[1]=LAN_MONITOR
```

4. Activate the configuration by entering:

```
# /sbin/init.d/hplm stop
# /sbin/init.d/hpapa stop
# /sbin/init.d/hpapa start
# /sbin/init.d/hplm start
```

5. If the device to be the link does not have the desired IP address, add the IP address for the port or link aggregation to `/etc/rc.config.d/netconf`. Editing that file or using SAM will preserve the IP address permanently (across reboots).

Alternatively, you can also temporarily assign an IP address to the link and change the mode of the link and all standby links to LAN\_MONITOR. For example, **ifconfig lan1 192.5.5.138**

6. Query the system for possible link failover groups by entering the `lanqueryconf -s -c /tmp/filename` command.



**CAUTION:** Running `lanqueryconf -s` will overwrite the original `/etc/lanmon/lanconfig.ascii` file.

This command queries the system and network for all possible failover groups. The results of the query are placed in the `/tmp/filename` configuration file. This file contains data similar to the following:

```

POLLING_INTERVAL          10000000
DEAD_COUNT                 3
LM_RAPID_ARP              off
LM_RAPID_ARP_INTERVAL    1000000
LM_RAPID_ARP_COUNT        10
FAILOVER_GROUP            lan900
    STATIONARY_IP        192.1.1.1
    STANDBY               lan11    3
    PRIMARY               lan10    5

```

- Compare the `/etc/lanmon/lanconfig.ascii` file with the `/tmp/filename` file. If they are not the same, decide which file you want to use. If you want to use the file in `/tmp`, copy that file to `/etc/lanmon/lanconfig.ascii`.
- Edit the `/etc/lanmon/lanconfig.ascii` file and change the number of ports in the failover groups, the dead count, poll interval, rapid ARP setting, rapid ARP interval, rapid ARP count, and stationary IP address. The following example shows a failover group entry that contains an IPv6 address:

```

FAILOVER_GROUP            lan901
    STATIONARY_IP        fe80::1
    STANDBY               lan11    3
    PRIMARY               lan4     5
    PRIMARY               lan1     3
    PRIMARY               lan2     3
    PRIMARY               lan3     3

```

- Verify that the configuration in `/etc/lanmon/lanconfig.ascii` is still valid by using the `lancheckconf` command.
- Create the failover groups specified in the configuration file by using the `lanapplyconf` command.

This command creates the specified failover groups.

Check the failover groups by using the `lanscan -q` and `netstat -in` commands.




---

**NOTE:** If you later want to delete all the failover groups created, enter the `landeleteconf` command.

---

- The failover group is now operational. A reboot will restart the failover group as long as the `/etc/lanmon/lanconfig.ascii` file is intact.

## Example: Configuring a Failover Group

Suppose you want to configure a simple, two-port LAN Monitor failover group on a K-class system. You enter the `netstat` and `ioscan` commands as follows:

```

# netstat -in
Name Mtu  Network      Address      Ipkts        Opkts
lan1 1500  192.1.1.0   192.1.1.153  9504123     12437048
lan0 1500  191.1.1.0   191.1.1.1    11202       257458
lo0  4136  127.0.0.0   127.0.0.1    417         417

# ioscan -fkC lan
Class  I  H/W Path  Driver      S/W State  H/W Type  Description
-----
lan    1  8/8/1/0  igelan     CLAIMED    INTERFACE  HP PCI 1000Base-T Core
lan    2  8/8/2/0  igelan     CLAIMED    INTERFACE  HP PCI 1000Base-T Core
lan    3  8/12/1/0 igelan     CLAIMED    INTERFACE  HP PCI 1000Base-T Core
lan    4  8/12/2/0 igelan     CLAIMED    INTERFACE  HP PCI 1000Base-T Core
lan    0  10/12/6  lan2       CLAIMED    INTERFACE  Built-in LAN
#

```

The `netstat` output shows that `lan1` is currently configured with IP address `192.1.1.153`. The `ioscan` output shows spare 1000Base-T devices `lan2`, `lan3`, and `lan4`.

You decide that `lan2` will be the standby link for the failover group, with `lan1` as the device.

To configure the failover group, do the following:

1. Connect lan1 and lan2 to the same switch or to different switches or hubs on the same subnet.




---

**NOTE:** Be sure that trunking is not enabled on the switch ports.

---

2. Obtain the station address for lan2 by issuing the lanscan command, as follows:

```
# lanscan
```

| Hardware Path | Station Address | Crd | Hdw  | Net-Interface  | NM ID | MAC Type | HP-DLPI Support | DLPI Mjr# |
|---------------|-----------------|-----|------|----------------|-------|----------|-----------------|-----------|
| 8/8/2/0       | 0x0060B04B7B83  | 2   | UP   | lan2 snap2     | 3     | ETHER    | Yes             | 119       |
| 8/12/2/0      | 0x0060B04B7B82  | 4   | UP   | lan4 snap4     | 4     | ETHER    | Yes             | 119       |
| 8/8/1/0       | 0x080009D43696  | 1   | UP   | lan1 snap1     | 5     | ETHER    | Yes             | 119       |
| 10/12/6       | 0x001083953C1C  | 0   | UP   | lan0 snap0     | 6     | ETHER    | Yes             | 119       |
| 8/12/1/0      | 0x001083953C1D  | 3   | UP   | lan3 snap3     | 7     | ETHER    | Yes             | 119       |
| LinkAgg0      | 0x000000000000  | 900 | DOWN | lan900 snap900 | 9     | ETHER    | Yes             | 119       |
| LinkAgg1      | 0x000000000000  | 901 | DOWN | lan901 snap901 | 10    | ETHER    | Yes             | 119       |
| LinkAgg2      | 0x000000000000  | 902 | DOWN | lan902 snap902 | 11    | ETHER    | Yes             | 119       |
| LinkAgg3      | 0x000000000000  | 903 | DOWN | lan903 snap903 | 12    | ETHER    | Yes             | 119       |
| LinkAgg4      | 0x000000000000  | 904 | DOWN | lan904 snap904 | 13    | ETHER    | Yes             | 119       |

The station address is 0x0060B04B7B83.

3. Verify that there is link connectivity between lan1 and lan2, as follows:

```
# linkloop -i 1 0x0060B04B7B83
Link connectivity to LAN station: 0x0060B04B7B83
-- OK
#
```

If there is no link connectivity, resolve the connectivity issue between the devices.

4. Verify that an entry exists in the /etc/rc.config.d/hp\_apaportconf file for the and standby interfaces that sets the interfaces' port configuration mode to LAN\_MONITOR.

```
HP_APAPORT_INTERFACE_NAME[0]=lan1
HP_APAPORT_CONFIG_MODE[0]=LAN_MONITOR
```

```
HP_APAPORT_INTERFACE_NAME[1]=lan2
HP_APAPORT_CONFIG_MODE[1]=LAN_MONITOR
```

5. Activate the configuration by entering:

```
# /sbin/init.d/hplm stop
# /sbin/init.d/hpapa stop
# /sbin/init.d/hpapa start
# /sbin/init.d/hplm start
```

6. If the device to be the link does not have the desired IP address, enter ifconfig to assign the IP address. Also add an entry to the /etc/rc.config.d/netconf file to assign the IP address permanently (or use SAM to do it).

```
# ifconfig lan1 192.1.1.153
```

7. Enter the lanqueryconf -s command to query the system for possible failover groups.

```
# lanqueryconf -s
```

ASCII output is in the /etc/lanmon/lanconfig.ascii file.

- a. Verify that the content of the ASCII file is valid. Enter lancheckconf:

```
# lancheckconf
```

- b. View the contents of the /etc/lanmon/lanconfig.ascii file and verify that it contains the configuration information you want.

```
# cat /etc/lanmon/lanconfig.ascii
```

See "lanconfig.ascii File" (page 100) for an example of this file.

- c. Verify that /etc/lanmon/lanconfig.ascii has the failover group configured, as planned.

```
# cat /etc/lanmon/lanconfig.ascii
```

- d. Edit the file, if needed, and enter lancheckconf again.

- Use the `lanapplyconf` command to build the failover group, and check it with the `lanscan -q` and `netstat -in` commands:

```
# lanapplyconf
Reading ASCII file /etc/lanmon/lanconfig.ascii
Creating Fail-Over Group lan900
# lanscan -q
4
0
3
900      1 2
901
902
903
904
# netstat -in
Name      Mtu Network      Address      Ipkts      Opkts
lan0      1500 191.1.1.0    191.1.1.1    1794      1173
lo0       4136 127.0.0.0    127.0.0.1    390       390
lan900    1500 192.1.1.0    192.1.1.153 0         0
```



---

**NOTE:** If `lanapplyconf` encounters an invalid failover group, it stops reading the `/etc/lanmon/lanconfig.ascii` file. Any failover groups created prior to this error are unaffected.

---

- The failover group is now operational. A reboot will restart the failover group as long as the `/etc/lanmon/lanconfig.ascii` file is intact and the port or link aggregation has an IP address in `/etc/rc.config.d/netconf` that matches the failover group's Stationary IP entry in `/etc/lanmon/lanconfig.ascii`.

If `lan1` fails, `lan2` becomes the active port. Similarly, if the failover group consists of two link aggregates, failover from the link aggregate to the standby link aggregate occurs only when all ports in the link aggregate failed. However, the examples in the next section show how proactive failover gives you greater control of the failover.

## Proactive Failover Examples

For the May 2005 and later releases of HP APA for HP-UX 11i v1 (B.11.11.20) and PHNE\_33116 (B.11.11.17) patch release, proactive failover relies on measuring and calculating efficiency. The efficiency of a link aggregate or individual port in a failover group is affected by the following:

- The number of ports in each member of the failover group
- The effective throughput of the switch or router to which the failover group members are connected

The following examples show how each affects the proactive failover operation.

### Example 1

You want to configure a failover group (`lan902`) for proactive failover. You decide that failover group consists of two link aggregates: `lan900` and `lan901`. The `lan900` aggregate consists of ports 1, 2, and 3; the `lan901` aggregate consists of ports 4 and 5. Ports 1, 2, 3, 4, and 5 have speeds of 100 Mb/s. In addition, you want the link aggregate with the most operational ports at any point in time to be the active link in the failover group.



---

**NOTE:** You can apply the methodology in this example to failover groups consisting of any number of link aggregates and ports.

---

To configure the failover group for proactive failover, do the following:

- Determine network efficiency.

In this example, you assign both `lan900` and `lan901` a cost of 1.

2. Assign a priority to the aggregates.

If you prefer lan900 to be the active port when both link aggregates have the same number of operational ports, assign lan900 a higher priority. If you do not, the active port changes when one of the link aggregates becomes more efficient (has more operational ports or higher bandwidth). In this example, you assign lan900 a priority of 5 and lan901 a priority of 3.

3. Edit the lanconfig.ascii configuration file.

```

FAILOVER_GROUP                lan902

      STATIONARY_IP    192.19.20.2
#   Primary/Standby      Interface    Priority : Cost
# -----+-----+-----
      PRIMARY          lan900    5 : 1
      STANDBY          lan901    3 : 1

```

Table C-1 lists lan900 events for this example and how proactive failover determines the active port for lan902.

**Table C-1 lan900 Events and Proactive Failover (Equal Network Costs)**

| lan900 Event                            | lan900 Normalized Port Cost | lan901 Normalized Port Cost | Active Port         |
|-----------------------------------------|-----------------------------|-----------------------------|---------------------|
| Failover group constructed <sup>1</sup> | 1/300, or .003              | 1/200, or .005              | lan900 <sup>2</sup> |
| 1 port fails                            | 1/200, or .005              | 1/200, or .005              | lan900 <sup>3</sup> |
| 1 port fails                            | 1/100, or .01               | 1/200, or .005              | lan901 <sup>4</sup> |
| DOWN port becomes active                | 1/200, or .005              | 1/200, or .005              | lan900 <sup>5</sup> |

1 All ports in the link aggregates are operational.

2 Normalized port cost is lower than lan901.

3 Normalized port cost is the same, but it has a higher priority than lan901.

4 Normalized port cost is lower than lan900.

5 Normalized port cost is the same, but it has a higher priority than lan901.

If the priorities were the same, lan901 would continue as the active port until the third port in lan900 became active.

## Example 2

You want to configure a failover group (lan902) for proactive failover. You decide that the failover group consists of two link aggregates: lan900 and lan901. The lan900 aggregate consists of ports 2 and 3; the lan901 aggregate consists of ports 4 and 5. Ports 2, 3, 4, and 5 have speeds of 100 Mb/s. In addition, the link aggregates are connected to different routers using different speeds to connect to the network.

To configure the failover group for proactive failover, do the following:

1. Determine network efficiency.

In this example, you determine that the router connected to lan900 is 1.5 times more efficient at delivering traffic to the network than the router connected to lan901. You assign lan900 a cost of 1 and lan901 a cost of 1.5. However, you must express cost values in the lanconfig.ascii file using whole numbers (no decimal points). The ratio of 1 to 1.5 is the same as the ratio of 2 to 3. Therefore, lan900 has a cost of 2 and lan901 has a cost of 3.

2. Assign a priority to the aggregates.

Because you prefer lan900 over lan901, you assign lan900 a priority of 8 and lan901 a priority of 7. That way, if both ports have the same normalized port cost, lan900 has precedence over lan901.

### 3. Edit the configuration file.

```

FAILOVER_GROUP                               lan902

        STATIONARY_IP   10.0.1.60
#   Primary/Standby      Interface      Priority : Cost
# -----+-----+-----
        PRIMARY         lan900   8 : 2
        STANDBY         lan901   7 : 3

```

Table C-2 lists lan900 events for this example and how proactive failover determines the active port for lan902.

**Table C-2 lan900 Events and Proactive Failover (Unequal Network Costs)**

| Event                                   | lan900 Normalized Port Cost | lan901 Normalized Port Cost | Active Port         |
|-----------------------------------------|-----------------------------|-----------------------------|---------------------|
| Failover group constructed <sup>1</sup> | 2/200, or .010              | 3/200, or .015              | lan900 <sup>2</sup> |
| Port 2 on lan900 is DOWN                | 2/100, or .020              | 3/200, or .015              | lan901 <sup>3</sup> |
| Port 2 on lan900 is UP                  | 2/200, or .010              | 3/200, or .015              | lan900 <sup>4</sup> |
| Port 4 on lan901 is DOWN                | 2/200, or .010              | 3/100, or .030              | lan900 <sup>5</sup> |
| Port 4 on lan901 is UP                  | 2/200, or .010              | 3/200, or .015              | lan900 <sup>6</sup> |
| Ports 2 and 3 on lan900 are DOWN        | 0                           | 3/200, or .015              | lan901 <sup>7</sup> |

- 1 All ports in the link aggregates are operational.
- 2 Normalized port cost is lower than lan901.
- 3 Normalized port cost is lower than lan900.
- 4 Normalized port cost is lower than lan901.
- 5 Normalized port cost is lower than lan901.
- 6 Normalized port cost is lower than lan901.
- 7 This behavior is the same as if lan902 were a priority-based failover group.



# D VLANs over APA Using HP Procurve Switches

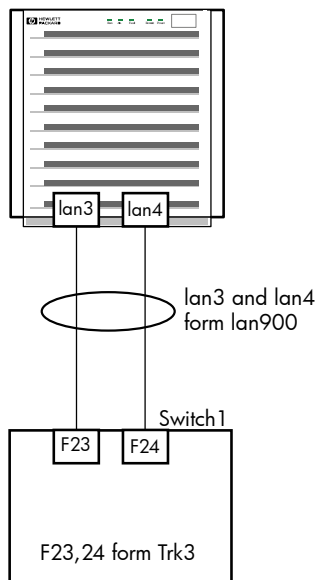
For the September 2006 and later releases of HP APA for HP-UX 11i v2 (B.11.23.20), this appendix describes how to create VLANs over trunks and ports on an HP Procurve switch. For more information about creating VLANs on HP Procurve switches, see *Procurve, Series 6400cl Switches, Series 5300xl Switches, Series 3400cl Switches, Advanced Traffic Management Guide* at:

<ftp://ftp.hp.com/pub/networking/software/6400-5300-3400-AdvTrafficMgmt-Oct2005-59906051.pdf>

## Configuring VLANs over Link Aggregates

Figure D-1 (page 113) shows a configuration with a VLAN with ID 333 over lan900 using ports lan3 and lan4, with lan3 and lan4 connected to ports F23 and F24 on the switch, respectively.

**Figure D-1 VLAN over a Link Aggregate**



To configure the VLAN on the switch, complete the following steps:

1. Create the trunk on the switch side. Enter:

```
HP ProCurve Switch 5308xl#  
HP ProCurve Switch 5308xl# configure  
HP ProCurve Switch 5308xl (config)# trunk F23,F24 Trk3 trunk  
HP ProCurve Switch 5308xl (config)# exit
```

F23 and F24 are configured to be a MANUAL trunk at trunk name Trk3.

2. Create the VLAN with ID 333 (vlan\_333). Enter:

```
HP ProCurve Switch 5308xl#  
HP ProCurve Switch 5308xl# configure  
HP ProCurve Switch 5308xl (config)# vlan 333 name vlan_333  
HP ProCurve Switch 5308xl (config)# exit
```

3. Tag the trunk Trk3 with the VLAN IDs to be used, in this case the ID is 333. Enter:

```
HP ProCurve Switch 5308xl (config)# vlan 333 tagged Trk3  
HP ProCurve Switch 5308xl (config)# exit
```

4. Verify that the VLAN with ID 333 is tagged to Trk3. Enter:

```
HP ProCurve Switch 5308xl# show vlan 333
Status and Counters - VLAN Information - Ports - VLAN 333

802.1Q VLAN ID : 333
Name : vlan_333
Status : Port-based
Voice : No

Port Information Mode      Unknown VLAN Status
-----
Trk3                Tagged   Learn      Up
```

VLAN 333 has been successfully tagged to Trk3.

On the server side, complete the following steps:

1. Create link aggregate lan900 using ports lan3 and lan4. Enter:

```
# lanadmin -a 3 4 900
Added ports:3 4 to lan900
```

2. Create the VLAN with ID 333 over lan900. Enter:

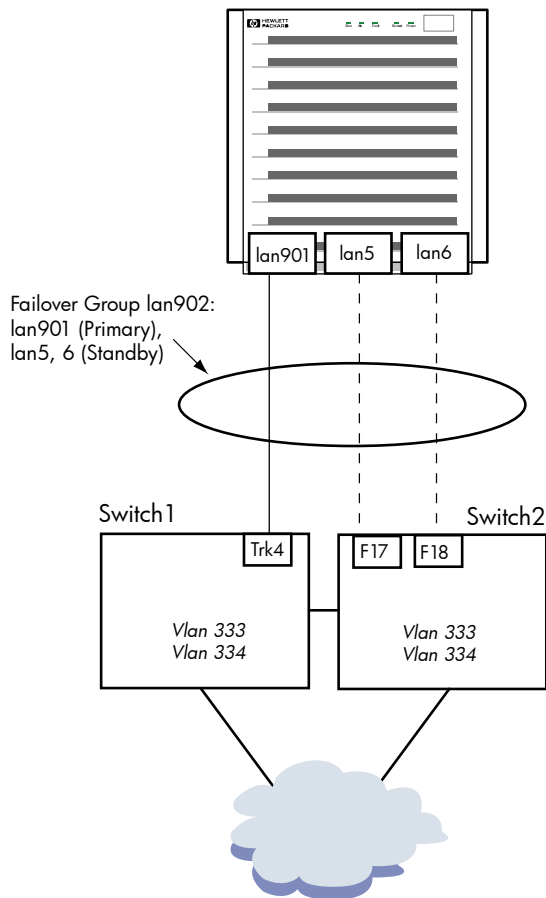
```
# lanadmin -v create vlanid 333 900
Successfully configured.
lan5000: vlanid 333 name UNNAMED pri 0 tos 0 tos_override
IP_HEADER pri_override CONF_PRI ppa 900
```

## Configuring VLANs over Failover Groups

You can improve the availability of VLANs by configuring VLANs over a failover group. To ensure success, each port (or link aggregate) used in the failover group must be tagged with the IDs of the VLANs to be created over it. Before creating the failover group, you must decide the ports to include in the failover group.

Figure D-2 (page 115) shows the failover group lan902 consisting of MANUAL link aggregate lan901 as the port with ports lan5 and lan6 as the standby ports. To protect against switch failures, link aggregate lan901 is connected through Switch 1, and ports lan5 and lan6 are connected to Switch 2. Switches 1 and 2 are connected to each other as well as the outgoing network. Two VLANs, with IDs 333 and 334, operate over failover group lan902.

**Figure D-2 VLAN over a Failover Group**



As the first step in creating the failover group, associate the ports in link aggregate lan901 to Trk4 on Switch 1; set the trunk type to `trunk (MANUAL trunking)`. Connect ports lan5 and lan6 to ports F17 and F18, respectively, on Switch 2.

To create the VLANs on Switch 1, complete the following steps:

1. Create the VLANs with IDs 333 and 334. Enter:

```
Switch 1#  
Switch 1# configure  
Switch 1(config)# vlan 333 name vlan_333  
Switch 1(config)# vlan 334 name vlan_334
```

2. Tag Trk4 to VLANs 333 and 334. Enter:

```
Switch 1(config)# vlan 333 tagged Trk4  
Switch 1(config)# vlan 334 tagged Trk4  
Switch 1(config)# exit
```

3. Verify that the VLANs with IDs 333 and 334 are tagged correctly. Enter:

```
Switch 1# show vlan 333
Status and Counters - VLAN Information - Ports - VLAN 333

802.1Q VLAN ID : 333
Name : vlan_333
Status : Port-based
Voice : No

Port Information Mode      Unknown VLAN Status
-----
Trk4                    Tagged   Learn      Up
Switch 1# show vlan 334
Status and Counters - VLAN Information - Ports - VLAN 334

802.1Q VLAN ID : 334
Name : vlan_334
Status : Port-based
Voice : No

Port Information Mode      Unknown VLAN Status
-----
Trk4                    Tagged   Learn      Up
```

To create the VLANs on Switch 2, complete the following steps:

1. Create the VLANs with IDs 333 and 334. Enter:

```
Switch 2#
Switch 2# configure
Switch 2(config)# vlan 333 name vlan_333
Switch 2(config)# vlan 334 name vlan_334
```

2. Tag ports F17 and F18 to VLANs 333 and 334. Enter:

```
Switch 2(config)# vlan 333 tagged F17
Switch 2(config)# vlan 333 tagged F18
Switch 2(config)# vlan 334 tagged F17
Switch 2(config)# vlan 334 tagged F18
Switch 2(config)# exit
```

3. Verify that the VLANs with IDs 333 and 224 are tagged correctly. Enter:

```
Switch 2# show vlan 333
Status and Counters - VLAN Information - Ports - VLAN 333

802.1Q VLAN ID : 333
Name : vlan_333
Status : Port-based
Voice : No

Port Information Mode      Unknown VLAN Status
-----
F17                    Tagged   Learn      Up
F18                    Tagged   Learn      Up
Switch 2# show vlan 334
Status and Counters - VLAN Information - Ports - VLAN 334

802.1Q VLAN ID : 334
Name : vlan_334
Status : Port-based
Voice : No

Port Information Mode      Unknown VLAN Status
-----
F17                    Tagged   Learn      Up
F18                    Tagged   Learn      Up
```

On the server side, complete the following steps:

1. Create link aggregate lan901.
2. Create failover group lan902. For HP-UX 11i v2 and earlier versions, the primary port in the failover group must have an IP address configured on it.
3. Create VLANs 333 and 334 over lan902. Enter:

```
# lanadmin -V create vlanid 333 902
Successfully configured.
lan5000: vlanid 333 name UNNAMED pri 0 tos 0 tos_override
IP_HEADER pri_override CONF_PRI ppa 902
# lanadmin -V create vlanid 334 902
Successfully configured.
lan5000: vlanid 334 name UNNAMED pri 0 tos 0 tos_override
IP_HEADER pri_override CONF_PRI ppa 902
```



# E Switch Configuration Information

This appendix provides some information on how to configure the following switches for use with HP APA:

- Alteon
- Cisco
- Extreme
- Procurve

See your switch documentation for complete information.

## Alteon Switches

Alteon switches have 8 ports. Fiber blades support 1500 and 9000 MTU (jumbo frames). The following interactive dialog describes how to establish a console connection:

```
switchname 1
Username>username 2
switchname(37)>> sh po all 3
switchname(37)>> c alteon1 4
Password: password 5
```

- |   |                        |   |                          |   |                                   |
|---|------------------------|---|--------------------------|---|-----------------------------------|
| 1 | Open a Console window. | 3 | Find the service name.   | 5 | Enter the administrator password. |
| 2 | Log in to the switch.  | 4 | Link to the serial port. |   |                                   |

## Cisco 6509 Switches

The throughput on the Cisco switch is different for fiber and copper ports. The fiber ports are fabric enabled. This means that they hand off frames to one another with a throughput of 256 Gb/s. This is the equivalent of 64 GigE cards continuously transmitting and receiving at their theoretical limits with no overhead. This section describes the following tasks:

- Configure a single port
- Show a single link
- Create an LACP link aggregation
- Create a PAgP link aggregation



---

**NOTE:** The information in this section pertains to Cisco IOS Version 12.2.

---

## Configuring a Single Port

```
Router1#config term
config command 1
.
.
Ctrl+z
Switch1#interface gigabitethernet 9/5
Switch1(config-if)#switchport
Switch1(config-if)#no shutdown
Switch1(config-if)#end
```

- 1 Enter configuration commands, one per line. End with **Ctrl+z** or end.

## Showing a Single Port

```
Router1#show interface gigabitethernet 7/1
GigabitEthernet7/1 is up, line protocol is up (connected)
  Hardware is C6k 1000Mb 802.3, address is 0001.63d1.6016 (bia 0001.63d1.6016)
  MTU 9000 bytes, BW 1000000 Kbit, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
```

## Creating an LACP Link Aggregation

```
Switch1#enable
Password:password
Switch1#config term
config command 1
.
.
Ctrl+z
Switch1 (config-if)#interface range gigabitethernet 3/1 - 3
Switch1 (config-if-range)#no ip address
Switch1 (config-if-range)#channel-protocol lacp
Switch1 (config-if-range)#channel-group 1 mode active

Creating a port-channel interface Port-channel 1
Switch1 (config-if-range)#end
Switch1#config term
config command
.
.
Ctrl+z
Switch1 (config)#interface port-channel 1
Switch1 (config-if)#no shutdown
Switch1 (config-if)#end
```

**1** Enter configuration commands, one per line. End with **Ctrl+z** or end.

## Creating an PAgP Link Aggregation

```
Switch1#enable
Password:password
Switch1#config term
config command 1
.
.
Ctrl+z
Switch1 (config-if)#interface range gigabitethernet 7/1 - 4
Switch1 (config-if-range)#no ip address
Switch1 (config-if-range)#channel-protocol pagp
Switch1 (config-if-range)#channel-group 7 mode desirable

Creating a port-channel interface Port-channel 7
Switch1 (config-if-range)#end
Switch1#config term
config command
.
.
Ctrl+z
Switch1 (config)#interface port-channel 7
Switch1 (config-if)#no shutdown
Switch1 (config-if)#end
```

**1** Enter configuration commands, one per line. End with **Ctrl+z** or end.

## Displaying the Link Aggregation

```
Switch1#show etherchannel port-channel
Channel-group listing:
-----
Group: 1
-----
Port-channels in the group:
-----
```



Port-channel: Po1 (Primary Aggregator)

-----

Age of the Port-channel = 00d:01h:46m:08s  
Logical slot/port = 14/1 Number of ports = 3  
Port state = Port-channel Ag-Inuse  
Protocol = LACP

Ports in the Port-channel:

| Index | Load | Port  | EC state | No of bits |
|-------|------|-------|----------|------------|
| 2     | 49   | Gi3/1 | Active   | 3          |
| 0     | 92   | Gi3/2 | Active   | 3          |
| 1     | 24   | Gi3/3 | Active   | 2          |

Time since last port bundled: 00d:01h:44m:15s Gi3/1

## Displaying a Port in a Link Aggregation

Switch1#**show interface GigabitEthernet 3/3 etherchannel**

Port state = Up Mstr In-Bndl  
Channel group = 1 Mode = Active Gchange = -  
Port-channel = Po1 GC = - Pseudo port-channel = Po1  
Port index = 1 Load = 0xAA Protocol = LACP

Flags: S - Device is sending Slow LACPDUs F - Device is sending fast LACPDUs.  
A - Device is in active mode. P - Device is in passive mode.

Local information:

| Port  | Flags | State | LACP port<br>Priority | Admin<br>Key | Oper<br>Key | Port<br>Number | Port<br>State |
|-------|-------|-------|-----------------------|--------------|-------------|----------------|---------------|
| Gi3/3 | SA    | bndl  | 32768                 | 0x1          | 0x1         | 0x303          | 0x3D          |

Partner's information:

| Port  | Partner<br>System ID    | Partner<br>Port Number | Age | Partner<br>Flags |
|-------|-------------------------|------------------------|-----|------------------|
| Gi3/3 | 00000,0030.6ef4.82380x5 |                        | 19s | SA               |

| LACP Partner<br>Port Priority | Partner<br>Oper Key | Partner<br>Port State |
|-------------------------------|---------------------|-----------------------|
| 0                             | 0x384               | 0x3D                  |

## Displaying More LACP Information

Switch1#**show lacp 1 neighbor**

Flags: S - Device is sending Slow LACPDUs F - Device is sending Fast LACPDUs  
A - Device is in Active mode P - Device is in Passive mode

Channel group 1 neighbors

Partner's information:

| Port  | Partner<br>System ID    | Partner<br>Port Number | Age | Partner<br>Flags |
|-------|-------------------------|------------------------|-----|------------------|
| Gi3/1 | 00000,0030.6ef4.82380x6 |                        | 17s | SA               |

| LACP Partner<br>Port Priority | Partner<br>Oper Key | Partner<br>Port State |
|-------------------------------|---------------------|-----------------------|
| 0                             | 0x384               | 0x3D                  |

Partner's information:

| Partner | Partner | Partner |
|---------|---------|---------|
|---------|---------|---------|

| Port          | System ID               | Port Number | Age        | Flags |
|---------------|-------------------------|-------------|------------|-------|
| Gi3/2         | 00000,0000.0000.00000x0 |             | 297s       | SP    |
| LACP Partner  | Partner                 | Partner     | Partner    |       |
| Port Priority | Oper Key                | Oper Key    | Port State |       |
| 0             | 0x0                     | 0x0         | 0x0        |       |

Partner's information:

| Port          | Partner System ID       | Partner Port Number | Age        | Partner Flags |
|---------------|-------------------------|---------------------|------------|---------------|
| Gi3/3         | 00000,0030.6ef4.82380x5 |                     | 4s         | SA            |
| LACP Partner  | Partner                 | Partner             | Partner    |               |
| Port Priority | Oper Key                | Oper Key            | Port State |               |
| 0             | 0x384                   | 0x384               | 0x3D       |               |

## Deleting a Link Aggregation

```
Switch1(config)#no interface port-channel 1
Switch1(config)#no interface port-channel 5
Switch1(config)#end
```

## Extreme Switches

This section provides information for the Extreme Black Diamond, 7i, and 400-48t switches.



**NOTE:** This switch only supports 100/1000 speeds; it does not support 10 Mb/s speeds. Therefore, you will not be able to test a card with this setting. The speeds are stated on the back of the switch itself.

To configure jumbo frames on all ports, enter:

```
enable jumbo-frame ports all
```

To verify all ports, enter:

```
show ports info
```

## Configuring HP APA Link Aggregates

Before configuring a HP APA in Manual mode, do the following:

1. Verify port connections. Do the following:
  - a. From another system, send test packets to the target LANs. Enter:
 

```
llp lanlocal lan target system | grep OK
```
  - b. Disable ports on switch. Enter:
 

```
disable ports [portlist]
```
  - c. Verify you now cannot send test packets to the target LANs. Enter:
 

```
llp lanlocal lan target system | grep OK
```
  - d. Enable ports on switch. Enter:
 

```
enable ports [portlist]
```
2. Configure Manual aggregation on the switch. Enter:
 

```
enable sharing 7:2 grouping 7:2-7:3
```
3. Save the configuration. Enter:
 

```
save
```

## Configuring LACP Link Aggregates

ExtremeWare v. 7.5 enables you to configure LACP. Use contiguous ports and let the first port be the master. In the following command, port 23 is the master port:

```
enable sharing 23 grouping 23-27 dynamic
```

Then, display the aggregation using the `show ports sharing` command as follows:

```
Switch2 # show ports 23-27 sharing
```

```
Load Sharing Monitor
```

| Config Master | Current Master | Ld Share Type | Ld Share Group | Link Status | Link Ups |
|---------------|----------------|---------------|----------------|-------------|----------|
| 23            | 23             | dy            | 23             | A           | 34       |
|               |                | dy            | 24             | A           | 35       |
|               |                | dy            | 25             | A           | 34       |
|               |                | dy            | 26             | A           | 34       |
|               |                | dy            | 27             | A           | 34       |

Link Status: (A) Active, (D) Disabled, (LB) Loopback, (ND) Not Distributing  
(NP) Not Present, (R) Ready

Ld Share Type: (a) address based, (dy) dynamic

In the previous example, `dy` indicates LACP protocol.

## Procurve Switches

This section describes information for the following Procurve switches:

- Procurve 4000/8000
- Procurve 4108
- Procurve 9304/8

### Procurve 4000/8000

This section provides the following information that you might find useful in using these switches:

- Power cycling the Procurve switch turns flow control off. You must turn flow control on for all ports after power cycling the switch.
- Both the 4000 and 8000 switch have backplane limitation of 3.8 Gb/s. This makes them unsuitable for testing Gigabit Ethernet.
- The Procurve 4000/8000 does not support Jumbo frames.

To configure the switch, do the following:

1. Log in to the switch.
2. Press **Enter** several times to display the Main Menu.
3. Enter 3 (switch configuration).
4. Enter 2 (port configuration).
5. Use the arrow key to select edit.
6. Use the arrow key to select a field; press the space bar to cycle choices.
7. When finished, press **Enter** to return to the action keys.
8. Enter `save`.
9. Enter `save` again to display the Switch Configuration menu.
10. Enter 0 (zero) to display the Main Menu.
11. Enter 0 (zero) to logout. Then, enter Y to confirm.
12. Enter **Ctrl+]**  to exit `telnet`.

### Procurve 4108

The Procurve 4108 does not handle 9000 MTU.

After logging in to the switch, press **Enter** a few times to display the following prompt:

Make sure that the ports you think you are aggregating on the switch are the right ones. This can be combined with the process of creating switch aggregations. Do the following:

1. Log in to the switch.
2. Enter menu at the prompt.
3. Select `Switch Configuration`.
4. Select `Port/Trunk Settings`.
5. Verify which cards or ports are connected to the switch ports that you intend to configure. Do the following:
  - a. On the computer, enter the following command for each port:  
`llp lanx`  
 Verify that it returns OK.
  - b. On the switch, select `Edit`. Use the down arrow key to move to the switch ports you want to disable. Type `N` for each port.
  - c. Press **Enter** to return to the choices at the bottom of the menu. Then, select `Save`.
  - d. On the computer, enter the following command for each port:  
`llp lanx`  
 Verify that it returns an error. Leave the switch ports disabled.
6. Configure an aggregation on the ports. Do the following:
  - a. Use the right arrow key to move to the `Group` column.
  - b. Press the space bar to select `Trk1, 2`, and so on.
  - c. For an LACP or FEC aggregation, use the right arrow key to move to the `Type` column.
  - d. Press the space bar to select `LACP` or `FEC`. Select `Trunk` for a Manual aggregation.
  - e. Press **Enter** to return to the choices at the bottom of the menu. Then, select `Save`. The `Switch Configuration Menu` displays.
  - f. Select `2 Port/Trunk Settings`.
  - g. Select `Edit`. Use the down arrow to move to the switch ports you wish to enable. Enter `Y` for each port.
  - h. Press **Enter** to return to the choices at the bottom of the menu. Then, select `Save`.
7. On the computer, enter the following command for each port:  
`llp lanx`  
 Verify that it returns an error. Leave the switch ports disabled.
8. Configure HP APA for the same aggregation mode on the same ports on the computer.

## Procurve 9304/8

The following information is helpful in working with Procurve 9304/8 switches:

- These switches have four modules. Modules 1, 2, and 3 have 24 100BT ports each. Module 4 has 8 GigE fiber ports.
- SNAP interfaces do not respond to broadcast pings on the Procurve 9304/9308. Unicast SNAP traffic works.
- The Procurve 9304 does not handle GigE Jumbo frames.

After logging in to the switch, do the following:

1. Wait a short while, then press **Enter**. The following displays:  
`HP9304>`
2. Enter the following:  
`HP9304>enable`
3. Enter the following:  
`HP9304#configure terminal`

4. The following prompt displays:

```
HP9304 (config) #
```



---

**TIP:** Enter [command name] ? to display the syntax for a command.

---

## Configuring HP APA

To configure HP APA to use the Procurve 9304/8 switch, do the following:

1. Verify port connections before configuring APA. Do the following:
  - a. Log in to the switch using the previous steps.
  - b. Enter the interface `e [slot]/[port]` command. For example:  

```
HP9304 (config) #interface e 2/1
```
  - c. Enter the following:  

```
HP9304 (config-if-e100-2/1) #disable
```
  - d. On the server system, verify the LAN is down with the following command:

```
llp lanx
```

The command displays output similar to the following:

```
=====
CMD: linkloop -i 17 0x00306E04945F for hpatm247:lan17 ...
-----
error: expected primitive 0x30, got DL_ERROR_ACK
      dl_error_primitive = 0x2d
      dl_errno = 0x04
      dl_unix_errno = 57
error - did not receive data part of message
Link connectivity to LAN station: 0x00306E04945F
```

- e. On the switch, enter enable.
- f. Wait briefly, then on the server system, confirm the LAN has connectivity with the following command:

```
llp lanx
```

The command displays output similar to the following:

```
=====
CMD: linkloop -i 17 0x00306E04945F for hpatm247:lan17 ...
-----
Link connectivity to LAN station: 0x00306E04945F
-- OK
```

2. Configure HP APA. Do the following:
  - a. Unplug all LAN connections to be aggregated.
  - b. Create the aggregations. They must be either 2 or 4 port trunks. For two-port aggregations, the beginning port number must be odd. For four-port aggregations, the beginning port number must be a number divisible by 4 plus 1 (for example, 1, 5, 9, 13). Use the following command to create a four-port aggregation:

```
HP9304 (config)#trunk server e 1/5 to 1/8
```

- c. Save the configuration. Enter:

```
HP9304 (config)#write mem
```

- d. Reboot the switch. Enter the following:

```
HP9304 (config)#exit
```

```
HP9304#reload
```

- e. After switch reboots, plug in the cables and display the trunk configuration as follows:

```
HP9304>show trunk
```

Information similar to the following displays:

Configured trunks:

| Trunk | Type   | Ports              |
|-------|--------|--------------------|
| 3     | Server | 1/5 1/6 1/7 1/8    |
| 5     | Server | 1/9 1/10 1/11 1/12 |
| 17    | Server | 2/1 2/2            |
| 19    | Server | 2/5 2/6            |
| 20    | Server | 2/7 2/8            |
| 21    | Server | 2/9 2/10           |

Operational trunks:

| Trunk | Type   | Ports              | Duplex | Speed | Tag | Priority |
|-------|--------|--------------------|--------|-------|-----|----------|
| 3     | Server | 1/5 1/6 1/7 1/8    | Full   | 100M  | No  | level0   |
| 5     | Server | 1/9 1/10 1/11 1/12 | Full   | 100M  | No  | level0   |
| 17    | Server | 2/1 2/2            | Full   | 100M  | No  | level0   |
| 19    | Server | 2/5 2/6            | Full   | 100M  | No  | level0   |
| 20    | Server | 2/7 2/8            |        |       |     |          |
| 21    | Server | 2/9 2/10           | Full   | 100M  | No  | level0   |

To remove the trunk in the previous example, enter the following:

```
no trunk server e 1/5 to 1/8
```

---

# Glossary

## A

|                              |                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>administrative key</b>    | An integer value that determines which network physical ports can be aggregated into a common LACP link aggregate. The key must match the key of the desired aggregate that the user wants the port to join |
| <b>aggregate</b>             | A group. For APA, a group of up to eight ports (32 ports for LACP aggregates) makes one link aggregate. There can be 50 link aggregates per computer.                                                       |
| <b>aggregation</b>           | <i>See aggregate.</i>                                                                                                                                                                                       |
| <b>APA</b>                   | Auto Port Aggregation                                                                                                                                                                                       |
| <b>ARP</b>                   | Address Resolution Protocol. A TCP/IP protocol used to obtain a node's physical address.                                                                                                                    |
| <b>Auto Port Aggregation</b> | APA. An HP software product that allows grouping up to eight ports into an aggregate to boost performance and provide port failover. The eight port limit applies only for FEC_AUTO and MANUAL mode.        |

## F

|                          |                                                                                                                                                          |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>failover group</b>    | A logical grouping of one or more physical ports formed by LAN Monitor. The failover group is used as an alternative if the link fails.                  |
| <b>Fast EtherChannel</b> | <i>See FEC.</i>                                                                                                                                          |
| <b>FEC</b>               | <i>See Fast EtherChannel.</i> The proprietary name of Cisco's port aggregation product. When referring to FEC mode, it indicates use of PAgP on a link.. |
| <b>FEC_AUTO</b>          | The automatic configuration mode of FEC.                                                                                                                 |
| <b>flow</b>              | A sequence of MAC frames between a pair of hosts where all of the MAC frames form part of the same conversation between that pair of hosts.              |

## G

|                         |                                                                                                               |
|-------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>group capability</b> | An integer value used to determine which network physical ports can be aggregated into an FEC link aggregate. |
|-------------------------|---------------------------------------------------------------------------------------------------------------|

## H

|                    |                                         |
|--------------------|-----------------------------------------|
| <b>Hot Standby</b> | A method of providing high availability |
|--------------------|-----------------------------------------|

## L

|                         |                                                                                                                                                                                                                                                                                      |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LACP_AUTO</b>        | Link Aggregation Control Protocol                                                                                                                                                                                                                                                    |
| <b>LAN</b>              | Local Area Network                                                                                                                                                                                                                                                                   |
| <b>LB_IP</b>            | Internet Protocol-based algorithm for <i>server-to-router</i> configurations.                                                                                                                                                                                                        |
| <b>LB_MAC</b>           | MAC-based algorithm for <i>server-to-switch</i> configurations (this is the default algorithm). <i>See also</i> for information..                                                                                                                                                    |
| <b>LB_PORT</b>          | TCP/UDP port-based algorithm for <i>server-to-server</i> (back-to-back) configurations                                                                                                                                                                                               |
| <b>link aggregate</b>   | A logical grouping of one or more physical ports into a single fat-pipe. This term is used to describe LACP_AUTO, Manual, or PAgP (Cisco Fast EtherChannel) created logical ports.                                                                                                   |
| <b>link aggregation</b> | <i>See link aggregate.</i>                                                                                                                                                                                                                                                           |
| <b>linkaggPPA</b>       | The PPA or logical card instance number of a specific link aggregate.                                                                                                                                                                                                                |
| <b>load balancing</b>   | A method of distributing traffic across the network physical ports in a link aggregate. Unicast and multicast traffic is distributed across the network physical ports in a link aggregate. Broadcast traffic is always sent out the first network physical port in a link aggregate |

## M

|               |                                                                                                                          |
|---------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>MAC</b>    | Media Access Control                                                                                                     |
| <b>MANUAL</b> | The default mode of port configuration. Can be performed by using SMH (preferred) or by editing two configuration files. |
| <b>MIB</b>    | Management Information Base                                                                                              |

## N

|                              |                                                                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>network adapter</b>       | A network device which has one or more network physical ports.                                                                     |
| <b>network physical port</b> | The communications channel formed when you attach a network cable between a specific network port (adapter card) and a LAN device. |

## P

|                                         |                                                                                                                                                                           |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PAgP</b>                             | <i>See</i> Port Aggregation Protocol.                                                                                                                                     |
| <b>PCI</b>                              | Peripheral Component Interconnect                                                                                                                                         |
| <b>physical point of attachment</b>     | <i>See</i> PPA.                                                                                                                                                           |
| <b>port</b>                             | The communications channel formed when you attach a network cable between a network physical port and a LAN device.                                                       |
| <b>port aggregate</b>                   | <i>See</i> link aggregate.                                                                                                                                                |
| <b>port aggregation</b>                 | <i>See</i> link aggregate.                                                                                                                                                |
| <b>Port Aggregation Protocol (PAgP)</b> | The proprietary port aggregation protocol, developed by Cisco Systems Inc., which automatically determines a bidirectional connection between two network physical ports. |
| <b>port priority</b>                    | An integer value used to determine which network physical port will be used as the port in a link aggregate in hot standby mode.                                          |
| <b>PPA</b>                              | A unique integer identifier for each network physical port installed on a server.                                                                                         |

## S

|                         |                               |
|-------------------------|-------------------------------|
| <b>SAM</b>              | System Administration Manager |
| <b>server-to-router</b> | <i>See</i> LB_IP.             |
| <b>server-to-server</b> | <i>See</i> LB_PORT.           |
| <b>server-to-switch</b> | <i>See</i> LB_MAC.            |

## T

|              |                               |
|--------------|-------------------------------|
| <b>TCP</b>   | Transmission Control Protocol |
| <b>trunk</b> | <i>See</i> link aggregate.    |
| <b>TSO</b>   | TCP Segmentation Offload      |



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