Troubleshooting Network Administration Issues in Oracle® Solaris 11.3

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Using This Documentation

- **Overview** – Describes tasks for troubleshooting network configuration issues in the Oracle Solaris operating system (OS).
- **Audience** – System administrators.
- **Required knowledge** – Understanding of basic and advanced network administration concepts and practices.

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Troubleshooting Network Administration Issues

This chapter describes how to troubleshoot various problems that can occur on a network, including issues with network configuration, network connectivity, and various error conditions.

If you are transitioning from Oracle Solaris 10 to Oracle Solaris 11, see Chapter 7, "Managing Network Configuration" in *Transitioning From Oracle Solaris 10 to Oracle Solaris 11.3* for more information about network administration in this release.

This chapter contains the following topics:

- "Answers to Common Network Administration Questions" on page 11
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Answers to Common Network Administration Questions

Refer to the following troubleshooting information when using the *fixed mode* for network administration. For information about troubleshooting network administration issues when using the *reactive mode*, see "Answers to Common Profile-Based Network Configuration Questions" on page 65. For further details, see "About Network Configuration Modes" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

Question: How do I determine which networking mode my system is using after an installation?

Answer: The networking mode is determined by the profile that is activated during installation. If the `DefaultFixed` profile is activated, you are in the fixed mode. If the `Automatic` profile is activated, you are in the reactive mode. To determine which mode is currently active on your system, use the `netadm list` command as follows:

```
# netadm list
```

Question: My system defaulted to reactive mode after an installation. How can I fix this problem?

Answer: You need to switch to the fixed mode by enabling the `DefaultFixed` profile. Use the `netadm` command as follows to switch the active profile:

```
# netadm enable -p ncp DefaultFixed
```

Question: I manually configured my system during an installation and the `netadm list` command shows that I am using the fixed mode, but my system's network is still not configured correctly. What should I do?

Answer: The answer depends on which network component is not configured correctly. When in the fixed mode, you use the `dladm` and `ipadm` commands to configure the network. Given the type of configuration parameters that can be set at installation time, most likely an IP interface or address is not configured correctly.

To determine which network components need to be reconfigured, start by displaying the current network configuration as follows:

```
# ipadm
```

If the IP address is incorrect, you will need to delete that address and then create the correct IP address, for example, a static IP address or a DHCP address.

The following example shows how to delete the IPv6 `addrconf` portion of an IP configuration. In this example the IPv6 `addrconf` address is determined by running the `ipadm` command:

```
# ipadm
NAME              CLASS/TYPE STATE        UNDER      ADDR
lo0               loopback   ok           --         --
lo0/v4            static     ok           --         127.0.0.1/8
lo0/v6            static     ok           --         ::1/128
net0              ip         ok           --         --
net0/v4           dhcp       ok           --         10.1.1.10/24
net0/v6           addrconf   ok           --         fe80::8:20ff:fe90:10df/10
# ipadm delete-addr net2/v6
# ipadm
NAME              CLASS/TYPE STATE        UNDER      ADDR
lo0               loopback   ok           --         --
lo0/v4            static     ok           --         127.0.0.1/8
lo0/v6            static     ok           --         ::1/128
net0              ip         ok           --         --
net0/v4           dhcp       ok           --         10.1.1.10/24
```

Then, set just the netmask property without deleting other existing IP configuration as follows:

```
# ipadm set-addrprop -p prefixlen=len addrobj-name
```

See Chapter 3, "Configuring and Administering IP Interfaces and Addresses in Oracle Solaris" in *Configuring and Managing Network Components in Oracle Solaris 11.3* for complete instructions.

Question: How do I configure a persistent default route on my system?

Answer: Because the `/etc/defaultrouter` file is deprecated in Oracle Solaris 11, you can no longer manage default routes by editing this file. Also, after a fresh installation, you can no longer check this file to determine the system's default route.

Display and configure routes (default or otherwise) as follows:

- Display routes that are created persistently as follows:

  ```
  # route -p show
  ```
- Add a persistent default route as follows:

  ```
  # route -p add default ip-address
  ```
- Display the currently active routes on a system as follows:

  ```
  # netstat -rn
  ```

See "Creating Persistent (Static) Routes" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

Question: How do I display the MAC address of a system?

Answer: Display the MAC addresses of the physical links in a system as follows:

```
# dladm show-phys -m
```

In Oracle Solaris 10, the `ifconfig` command is used to display similar information. See the `ifconfig`(5) man page.

Display the MAC addresses of all of the links in a system (physical and non-physical) as follows:

```
# dladm show-linkprop -p mac-address
```

Question: I can no longer use the `dladm show-dev` command to display the physical links that are in my system? What command do I use now?

Answer: Use the `dladm show-phys` command as follows:

```
# dladm show-phys
LINK             MEDIA                STATE      SPEED  DUPLEX    DEVICE
net0             Ethernet             up         0      unknown   vnet0
```

Question: How do I display the mapping between link names, devices, and locations on a system?

Answer: Use the `dladm show-phys` command with the `-L` option as follows:

```
# dladm show-phys -L
LINK         DEVICE         LOCATION
net0         e1000g0        MB
net1         e1000g1        MB
net2         e1000g2        MB
net3         e1000g3        MB
net4         ibp0           MB/RISER0/PCIE0/PORT1
net5         ibp1           MB/RISER0/PCIE0/PORT2
net6         eoib2          MB/RISER0/PCIE0/PORT1/cloud-nm2gw-2/1A-ETH-2
net7         eoib4          MB/RISER0/PCIE0/PORT2/cloud-nm2gw-2/1A-ETH-2
```

Question: What command do I use to determine the MTU range my system supports?

Answer: Use the `ipadm show-ifprop` command to determine this information, as shown in the following example. The last column displays the supported MTU ranges.

```
# ipadm show-ifprop -p mtu interface
```

Question: What if the naming services settings on my system are lost or not configured correctly after an installation?

Answer: If you using the fixed mode, the naming services configuration should be what you specified during the installation. In this release, naming services are configured through the Service Management Facility (SMF). See Chapter 4, "Administering Naming and Directory Services on an Oracle Solaris Client" in *Configuring and Managing Network Components in Oracle Solaris 11.3* for instructions on how to configure naming services and how to import naming services configuration on a client system after an installation.

Note - If you are using the reactive mode, see "Creating Locations" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

Question: How can I start over and reconfigure all of the network settings for my system?

Answer: You can unconfigure and reconfigure an Oracle Solaris instance, including network settings, as follows:

```
# sysconfig unconfigure -g network,naming_services
```

Question: What is the difference between creating a virtual LAN (VLAN) with the `dladm create-vlan` command and a virtual NIC (VNIC) with the `dladm create-vnic -v VID ...` command? Also, what are the unique features of both commands that would dictate the use of one rather than the other?

Answer: Depending on your networking needs and what you trying to accomplish, you would use each of these features for different purposes.

A VLAN is a subdivision of a LAN at the datalink layer (L2) of the network stack. VLANs enable you to divide your network into subnetworks without having to add to the physical network environment. So, the subnetworks are virtual and they share the same physical network resources. VLANs facilitate network administration by using smaller groups that are easier to maintain.

VNICs are virtual network devices that use the same datalink interface as a physical network interface card (NIC). You configure VNICs over an underlying datalink. When VNICs are configured, they behave like physical NICs. Depending on the network interface that is in use, you can explicitly assign a MAC address to a VNIC other than the default address.

For more information about which network administration strategies to use, see Chapter 1, “Summary of Oracle Solaris Network Administration” in *Strategies for Network Administration in Oracle Solaris 11.3*.

Troubleshooting Network Connectivity and Configuration Issues

The following are general guidelines for troubleshooting network connectivity and configuration issues.

One of the first signs of trouble on a network is loss of communications by one or more of the hosts. If a system does not to come up the first time it is added to the network, the problem might be a faulty NIC or a problem with network daemon that is managed by SMF.

If a single system that previously was connected to the network suddenly develops a network problem, the problem could be the system's network interface configuration. If the systems on a network can communicate with each other but not with other networks, the problem could be the router. Another problem could be with the other network.

Performing Basic Network Configuration Checks

You can troubleshoot network configuration problems with a single system by using the `dladm` and `ipadm` commands. These two commands, when used without any options, provide useful information about your current network configuration.

The following are some of the ways in which you can use these commands to troubleshoot configuration issues:

- Use the `dladm` command to display general information about all of the datalinks that are on a system:

```
# dladm
LINK        CLASS     MTU     STATE     OVER
net0        phys      1500    up        --
```

- Display information about the mapping between the datalinks, their generic names, and the corresponding network device instances as follows:

```
# dladm show-phys
LINK     MEDIA        STATE     SPEED     DUPLEX     DEVICE
net0     Ethernet     up        1000      full       e1000g0
```

- Use the `ipadm` command to display general information about all of the IP interfaces that are on a system:

```
# ipadm
NAME         CLASS/TYPE STATE     UNDER  ADDR
lo0          loopback   ok        --     --
 lo0/v4       static    ok        --     127.0.0.1/8
 lo0/v6       static    ok        --     ::1/128
net0         ip         ok        --     --
 net0/v4      static    ok        --     10.132.146.233/24
```

- Use the `ipadm show-if` *interface* command to display information about a specific IP interface:

```
# ipadm show-if net0
IFNAME     CLASS    STATE    ACTIVE OVER
net0       ip       ok       yes    --
```

- Display information about all of the interfaces on a system as follows:

```
# ipadm show-if
IFNAME       CLASS        STATE     ACTIVE     OVER
lo0          loopback     ok        yes        --
net0         ip           ok        yes        --
```

- Display information about all of the IP addresses on the system as follows:

```
# ipadm show-addr
ADDROBJ          TYPE       STATE     ADDR
lo0/v4           static     ok        127.0.0.1/8
net0/v4          static     ok        192.168.84.3/24
```

- Use the `ipadm show-addr` *interface* command to display information about a specific interface's IP address:

```
# ipadm show-addr net0
ADDROBJ           TYPE     STATE        ADDR
net0/v4           dhcp     ok           10.153.123.225/24
```

- Display the properties of a specific IP address as follows::

```
# ipadm show-addrprop net1/v4
```

```
   ADDROBJ           PROPERTY   PERM CURRENT         PERSISTENT      DEFAULT   POSSIBLE
   net0/v4           broadcast  r-   10.153.123.255  --              10.255.255.255  --
   net0/v4           deprecated rw   off             --              off   on,off
   net0/v4           prefixlen  rw   24              --              8   1-30,32
   net0/v4           private    rw   off             --              off   on,off
   net0/v4           reqhost    r-   --              --              --   --
   net0/v4           transmit   rw   on              --              on   on,off
   net0/v4           zone       rw   global          --              global
```

For more information, see the ipadm(1M) man page.

Verifying That Network Services and Daemons Are Running

A critical step in troubleshooting issues with network connectivity is to determine the current status of all of the SMF network services that are running on the system.

You can verify the current status of all of the SMF network services that are running on the system as follows:

```
$ svcs svc:/network/*
```

If the command output shows that a service is disabled or in a maintenance state, you can obtain more information about that particular service as follows:

```
$ svcs -xv service-name
```

For example, you would obtain more information about the `svc:/network/loopback:default` SMF network service as follows:

```
$ svcs -xv svc:/network/loopback:default
svc:/network/loopback:default (loopback network interface)
 State: online since Thu Dec 05 19:30:54 2013
   See: man -M /usr/share/man -s 1M ifconfig
   See: /system/volatile/network-loopback:default.log
Impact: None.
```

Running Basic Network Diagnostic Checks

Less obvious causes of network problems are those that degrade network performance. If the network is having problems, you can run a series of software checks to diagnose and fix basic problems. For example, you can use the `ping` command to quantify problems, such as the loss of packets by a system. Or, you can use the `netstat` command to display routing tables and protocol statistics. For more information about the various methods that you can use to troubleshoot these types of networking problems, see "Resources for Monitoring and Detecting Problems on a TCP/IP Network" on page 24.

For information about performing network diagnostics by using the network monitor utility, see Chapter 5, "Performing Network Diagnostics With the `network-monitor` Transport Module Utility".

Third-party network diagnostic programs also provide a number of tools for troubleshooting network issues. Refer to the third-party product documentation for specifics.

▼ How to Perform Basic Network Software Checking

1. **Use the `netstat` command to display network information.**

   The `netstat` command displays a variety of useful information for troubleshooting network connectivity issues. The type of information that is displayed depends on the options that you use. See "Monitoring Network Status With the netstat Command" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3* and the `netstat`(1M) man page.

2. **Check the `hosts` database to ensure that all of the entries are correct and current.**

   For more information about the `/etc/inet/hosts` database, see the `hosts`(4) man page.

3. **Try to connect to the local system by using the `telnet` command.**

   For more information, see the `telnet`(1) man page.

4. **Ensure that the `inetd` network daemon is running.**

   ```
   # /usr/bin/pgrep inetd
   883
   ```

   The previous output indicates that the `inetd` daemon is running on the system with the process ID `883`.

5. **If IPv6 is enabled on your network, verify that the `in.ndpd` daemon is running.**

   ```
   # /usr/bin/pgrep in.ndpd
   822
   ```

   The previous output indicates that the `inetd` daemon is running on the system with the process ID `882`.

6. **Check the system's router and routing information.**

   - **Display a system's persistent route as follows:**

     ```
     # route -p show
     ```

     See "Troubleshooting Issues When Adding a Persistent Route" on page 19.

- **Display the configuration that is in the routing table as follows:**

  ```
  # netstat -nr
  ```

Troubleshooting Issues When Adding a Persistent Route

The `route` command is used to manage the network routing tables. Use the `-p` option to ensure that any changes you make to the network routing tables persist across system reboots.

Note - It is important to use care when adding persistent routes to make sure that any routes that are being added do not conflict with the existing persistent configuration.

Check whether a route already exists in the persistent configuration as follows:

```
# route -p show
persistent: route add default 10.153.123.1 -ifp net0
```

If the route already exists in the persistent configuration, the information in the network routing tables (which is not persistent configuration) might differ from the persistent configuration.

The following example illustrates this point further. In this example, an attempt is made to add a persistent route to `net1`. However, the command fails because a persistent route already exists for `net0`, per the previous example's output.

```
# route -p add default 10.153.123.1 -ifp net1
add net default: gateway 10.153.123.1
add persistent net default: gateway 10.153.123.1: entry exists
Warning: persistent route might not be consistent with routing table.
```

Running the `route -p show` command again reveals that the persistent route did not change and is still configured for `net0`, as shown in the following output:

```
# route -p show
persistent: route add default 10.153.123.1 -ifp net0
```

However, the command did change the routing tables in the kernel to use `net1`, as shown in the following output:

```
# netstat -nr

Routing Table: IPv4
  Destination           Gateway           Flags  Ref     Use Interface
-------------------- -------------------- ----- ----- ---------- ---------
default              10.153.123.1         UG        2          1 net1
10.153.123.0         10.153.123.78        U         3          0 net1
```

```
127.0.0.1            127.0.0.1            UH        2        466 lo0
.
.
.
```

Therefore, it is always best to delete any existing persistent route configuration prior to adding a new route. See "Creating Persistent (Static) Routes" in *Configuring and Managing Network Components in Oracle Solaris 11.3* for more information.

Troubleshooting Interface Configuration Error Conditions

This section contains the following topics:

- "Cannot Assign IP address by Using the `ipadm create-addr` command" on page 20
- "Error Message: `cannot create address object: Invalid argument provided` Displayed During IP Address Configuration" on page 20
- "Error Message: `cannot create address: Persistent operation on temporary object` Displayed During IP Interface Configuration" on page 21

Cannot Assign IP address by Using the `ipadm create-addr` command

With the traditional `ifconfig` command that is used for network configuration in Oracle Solaris 10, you can plumb and assign an IP address by using a single command. In Oracle Solaris 11, you use the `ipadm` command to configure IP interfaces and addresses.

The following example assumes that a static IP address is being assigned to an interface. This process involves two steps. First, create or plumb the IP interface by using the `ipadm create-ip` command. Then, assign an IP address to the interface by using the `ipadm create-addr` command:

```
# ipadm create-ip interface
# ipadm create-addr -T addr-type -a address addrobj
```

Error Message: `cannot create address object: Invalid argument provided` Displayed During IP Address Configuration

The address object identifies a specific IP address that is bound to an IP interface. The address object is a unique identifier for each IP address on the IP interface. You must specify a different address object to identify a second IP address that you assign to the same IP interface. If you want to use the same address object name, you must delete the first address object instance object before assigning it to a different IP address.

Use one of the following methods:

- Specify a different address object to identify a second IP address as follows:

```
# ipadm show-addr
ADDROBJ   TYPE     STATE   ADR
lo0       static   ok      127.0.0.1/10
net0/v4   static   ok      192.168.10.1

# ipadm create-addr -T static -a 192.168.10.5 net0/v4b
# ipadm show-addr
ADDROBJ   TYPE     STATE   ADR
lo0       static   ok      127.0.0.1/10
net0/v4   static   ok      192.168.10.1
net0/v4b  static   ok      192.168.10.5
```

- Delete the first instance of the address object, then assign the same address object to a different IP address, as follows:

```
# ipadm show-addr
ADDROBJ   TYPE     STATE   ADR
lo0       static   ok      127.0.0.1/10
net0/v4   static   ok      192.168.10.1
# ipadm delete-addr net0/v4
# ipadm create-addr -T static -a 192.168.10.5 net0/v4
# ipadm show-addr
ADDROBJ   TYPE     STATE   ADR
lo0       static   ok      127.0.0.1/10
net0/v4   static   ok      192.168.10.5
```

Error Message: `cannot create address: Persistent operation on temporary object` Displayed During IP Interface Configuration

By default, the `ipadm` command creates persistent network configuration. If the IP interface that you are configuring was created as a temporary interface, you cannot use the `ipadm` command to configure persistent settings on that interface. After verifying that the interface you are configuring is temporary, delete that interface and recreate it persistently. You can then resume configuring the interface as follows:

```
# ipadm show-if -o all
IFNAME   CLASS      STATE   ACTIVE   CURRENT        PERSISTENT   OVER
```

```
lo0      loopback   ok      yes      -m46-v------   46--         --
net0     ip         ok      yes      bm4---------   ----         --
```

The absence of a `4` flag for an IPv4 configuration or a `6` flag for an IPv6 configuration in the `PERSISTENT` field indicates that `net0` was created as a temporary interface.

```
# ipadm delete-ip net0
# ipadm create-ip net0
# ipadm create-addr -T static -a 192.168.1.10 net0/v4
ipadm: cannot create address: Persistent operation on temporary object
```

Troubleshooting Issues With IPv6 Deployment

Refer to the following information if you encounter any issues while planning and deploying IPv6 at your site. For specific planning tasks, see Chapter 2, “Planning for Using IPv6 Addresses” in *Planning for Network Deployment in Oracle Solaris 11.3*.

IPv6 Interface Is Not Configured Correctly

The existence of an IPv6 interface does not necessarily mean the system is using IPv6. The interface is not brought up until you actually configure an IPv6 address on that interface.

For example, the following output of the `ifconfig` command shows that the `inet6 net0` interface has not been marked as `UP` and has an address of `::/0`, meaning an IPv6 interface is not configured.

```
# ifconfig net0 inet6
net0:
flags=120002000840<RUNNING,MULTICAST,IPv6,PHYSRUNNING> mtu 1500 index 2 inet6 ::/0
```

The `in.ndpd` daemon still runs on the system but does not operate on any IP interfaces that do not have an `addrconf` address configured.

Cannot Upgrade IPv4 Router to IPv6

If you cannot upgrade your existing equipment, you might need to purchase IPv6-ready equipment. Check the manufacturer's documentation for any equipment-specific procedures that you might be required to perform to support IPv6.

You cannot upgrade certain IPv4 routers for IPv6 support. If this situation applies to your topology, as an alternative, you can physically wire an IPv6 router next to the IPv4 router. Then, you can tunnel from the IPv6 router over the IPv4 router. For instructions on configuring IP tunnels, see Chapter 5, "Administering IP Tunnels" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*.

Problems Encountered When Upgrading Services to Support IPv6

You might encounter the following issues when preparing services for IPv6 support:

- Certain applications, even after being ported to IPv6, do not turn on IPv6 support by default. You might have to configure these applications to turn on IPv6.
- A server that runs multiple services, some of which are IPv4 only and others that are both IPv4 and IPv6, can experience problems. Some clients might need to use both types of services, which can lead to confusion on the server side.

Current ISP Does Not Support IPv6

If you want to deploy IPv6, but your current Internet Service Provider (ISP) does not offer IPv6 addressing, consider the following alternatives:

- Hire another ISP to provide a second line for IPv6 communications from your site. This solution is expensive.
- Get a virtual ISP. A *virtual ISP* provides your site with IPv6 connectivity but no link. Instead, you create a tunnel from your site, over your IPv4 ISP, to the virtual ISP.
- Use a 6to4 tunnel over your ISP to other IPv6 sites. For an address, you can use the registered IPv4 address of the 6to4 router as the public topology part of the IPv6 address. For more information, see "How to Configure a 6to4 Tunnel" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*.

Security Issues When Tunneling to a 6to4 Relay Router

By nature, a tunnel between a 6to4 router and a 6to4 relay router is insecure. The following types of security problems are inherent in such a tunnel:

- Though 6to4 relay routers do encapsulate and decapsulate packets, these routers do not check the data that is contained within the packets.
- Address spoofing is a major issue on tunnels to a 6to4 relay router. For incoming traffic, the 6to4 router is unable to match the IPv4 address of the relay router with the IPv6 address of the source. Therefore, the address of the IPv6 system can easily be spoofed. The address of the 6to4 relay router can also be spoofed.

- By default, no trusted mechanism exists between 6to4 routers and 6to4 relay routers. Thus, a 6to4 router cannot identify whether the 6to4 relay router is to be trusted or even if it is a legitimate 6to4 relay router. A trusted relationship between the 6to4 site and the IPv6 destination must exist. Otherwise, both sites leave themselves open to possible attacks.

These problems and other security issues that are inherent with 6to4 relay routers are explained in RFC 3964, Security Considerations for 6to4 (`http://www.rfc-editor.org/rfc/rfc3964.txt`). See also RFC 6343, Advisory Guidelines for 6to4 Deployment (`http://www.rfc-editor.org/rfc/rfc6343.txt`) for updated information about using 6to4.

Generally, you should consider enabling support for 6to4 relay routers for the following reasons only:

- Your 6to4 site intends to communicate with a private, trusted IPv6 network. For example, you might enable 6to4 relay router support on a campus network that consists of isolated 6to4 sites and native IPv6 sites.
- Your 6to4 site has a compelling business reason to communicate with certain native IPv6 systems.
- You have implemented the checks and trust models that are suggested in Security Considerations for 6to4 (`http://www.ietf.org/rfc/rfc3964.txt`) and Advisory Guidelines for 6to4 Deployment. (`http://www.ietf.org/rfc/rfc6343.txt`).

Resources for Monitoring and Detecting Problems on a TCP/IP Network

The following table describes tasks for monitoring and detecting problems on a TCP/IP network. For complete instructions, see *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*.

TABLE 1 Tasks for Monitoring TCP/IP Networks

Task	Command and/or Description	Task Information
Monitor network traffic usage for features that are configured at the various layers of the Oracle Solaris network protocol stack.	Depending upon the feature and at which layer of the network protocol that feature is configured, you can use a variety of observability tools to gather statistics and monitor network traffic usage.	"Observing Network Configuration and Traffic Usage" on page 31
Log the IP addresses of all incoming TCP connections.	Transport layer protocols typically need no intervention to run properly. However, in some circumstances, you might need to log or modify services that run over the transport layer protocols.	"Logging IP Addresses of All Incoming TCP Connections" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Determine whether a remote system is running.	Use the `ping` command to determine the status of a remote system.	"Determining if a Remote System Is Reachable" in *Administering TCP/IP*

Task	Command and/or Description	Task Information
		Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3
Detect whether a system is dropping packets	Use the `-s` option of the `ping` command to determine whether a remote system is running but losing packets.	"Determining if Packets Between Your System and a Remote System Are Being Dropped" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Display network statistics on a per-protocol basis.	Use the `netstat` command to display statistics on a per-protocol basis for TCP, Stream Control Transmission Protocol (SCTP), and User Datagram Protocol (UDP) endpoints in table format.	"Monitoring Network Status With the netstat Command" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Perform TCP and UDP management.	Use the `netcat` (or `nc`) utility to open TCP connections, send UDP packets, listen on arbitrary TCP and UDP ports, perform port scanning.	"Performing TCP and UDP Administration With the netcat Utility" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Trace the actions of the IPv4 routing daemon, including all packet transfers.	If you suspect a malfunction of the `routed` daemon, you can start a log that traces the daemon's activity. The log includes all packet transfers when you start the `routed` daemon.	"Logging Actions of the IPv4 Routing Daemon" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Discover the route to a remote system.	Use the `traceroute` command to discover the route to a remote system. The output displays the number of hops in the path a packet follows.	"Discovering the Route to a Remote Host" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Check packets between an IPv4 server and a client.	Establish a snoop system off a hub that is connected to either a IPv4 client or a server to check intervening traffic.	"How to Check Packets Between an IPv4 Server and a Client" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Monitor the packet transfer process.	Use the `snoop` command to monitor the state of package (data) transfers.	"Monitoring Packet Transfers With the snoop Command" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Analyze network traffic.	Use the TShark command line interface (CLI) or the Wireshark graphical user interface (GUI) to analyze network traffic.	"Analyzing Network Traffic With TShark and Wireshark" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Monitor network traffic on a server.	Use the `ipstat` and `tcpstat` commands to monitor network traffic on a server.	"Observing Network Traffic With the ipstat and tcpstat Commands" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*

Task	Command and/or Description	Task Information
Monitor network traffic on an IPv6 network.	Use the `snoop ip6` command to display just IPv6 packets for a network node.	"Monitoring IPv6 Network Traffic" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Monitor the status of IPMP on your system.	Use the `ipmpstat` command to gather different types of information about the status of IPMP. You can also use the command to display information about the underlying IP interfaces for each IPMP group, as well as data and test addresses are configured for the group.	"Monitoring IPMP Information" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*
Control the output of the `ping`, `netstat`, and `traceroute` commands.	Create a file named `inet_type` that sets the `DEFAULT_IP` variable in the file that controls the display output of IPv6-related commands.	"How to Control the Display Output of IP-Related Commands" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*

Troubleshooting IPMP Configuration

This section contains the following topics:

- "Failure Detection in IPMP" on page 26
- "Disabling Outbound Load Spreading in Link-Based IPMP Configuration" on page 27
- "Error Message: *`ipadm: cannot add net0 to ipmp0: Underlying interface has addresses managed by dhcpagent(1M)`* Displayed During IPMP Group Creation" on page 27

Note - The commands and tasks for configuring IP network multipathing (IPMP) have changed. The `ipadm` command is now used instead of the `ifconfig` command to configure and manage IPMP. To learn about how these two commands map to each other, see "Comparing the ifconfig Command to the ipadm Command" in *Transitioning From Oracle Solaris 10 to Oracle Solaris 11.3*. See also the `ifconfig(5)` man page.

Failure Detection in IPMP

To ensure continuous availability of the network to send or receive traffic, IPMP performs failure detection on an IPMP group's underlying IP interfaces. Failed interfaces remain unusable until they are repaired. Any remaining active interfaces continue to function while any existing standby interfaces are deployed, as needed.

The `in.mpathd` daemon handles the following types of failure detection:

- Probe-based failure detection:

  - No test addresses are configured (transitive probing)
  - Test addresses are configured
- Link-based failure detection, if supported by the NIC driver

For more details, see "Failure Detection in IPMP" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*.

Disabling Outbound Load Spreading in Link-Based IPMP Configuration

It is possible to disable outbound load spreading in link-based IPMP. If you mark an interface as standby, that interface will not be used until an active interface fails, regardless of whether link-based or probe-based failure detection is used. Link-based failure detection is always enabled by the `in.mpathd` daemon.

Use the `ipadm` command as follows:

```
# ipadm set-ifprop -m ip -p standby=on interface
```

For information about how inbound and outbound load spreading in link-based IPMP works, see "Benefits of Using IPMP" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*.

Error Message: `*ipadm: cannot add net0 to ipmp0: Underlying interface has addresses managed by dhcpagent(1M)*` Displayed During IPMP Group Creation

The following error message might be displayed when you attempt to add an IPMP group:

```
*ipadm: cannot add net0 to ipmp0: Underlying interface has addresses managed by
 dhcpagent(1M)*
```

This message is displayed because you cannot add an IP interface with an address that is managed by `dhcpagent` into an IPMP group. As a workaround, disable the DHCP and/or stateful address configuration on `net0` before adding it to the IPMP group.

Troubleshooting Issues With VRRP and the Oracle Solaris Bundled IP Filter

The Virtual Router Redundancy Protocol (VRRP) provides high availability of IP addresses, such as those that are used for routers and load balancers. Oracle Solaris supports both L2 and L3 VRRP. For more information, see Chapter 3, "Using Virtual Router Redundancy Protocol" in *Configuring an Oracle Solaris 11.3 System as a Router or a Load Balancer*.

The standard VRRP multicast address (224.0.0.18/32) is used to ensure that VRRP functions properly. See http://www.rfc-editor.org/rfc/rfc5798.txt for more information. When you use VRRP with the Oracle Solaris bundled IP Filter, you must explicitly check whether outgoing or incoming IP traffic is allowed for the multicast address.

Use the `ipfstat -io` command as follows to check for this information:

```
# ipfstat -io
empty list for ipfilter(out)
empty list for ipfilter(in)
```

If the output of the command indicates that traffic is not allowed for the standard multicast address, you must add the following rules to the IP Filter configuration for each VRRP router:

```
# echo "pass out quick on VRRP VIP Interface from VRRP VIP/32 to 224.0.0.18/32 \
pass in quick on VRRP VIP Interface from VRRP IP/32 to 224.0.0.18/32" | ipf -f
```

For more information about configuring an IP Filter rule set, see "How to Append Rules to the Active Packet Filtering Rule Set" in *Securing the Network in Oracle Solaris 11.3*.

♦ ♦ ♦ CHAPTER 2

Using Observability Tools to Monitor Network Traffic Usage

This chapter describes how to use Oracle Solaris network observability tools to display configuration information and monitor network traffic usage on each layer of the Oracle Solaris network protocol stack.

This chapter contains the following topics:

- "About Network Troubleshooting and Observability" on page 29
- "Observing Network Configuration and Traffic Usage" on page 31

This chapter contains examples for selected networking features and a particular network configuration scenario. For more information about administering networking features in the Oracle Solaris release, refer to the following additional resources:

- *Managing Network Datalinks in Oracle Solaris 11.3*
- *Managing Network Virtualization and Network Resources in Oracle Solaris 11.3*
- *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*

About Network Troubleshooting and Observability

The following table describes the major features of the Oracle Solaris network protocol stack, grouped by layer. Information about the tools that you use to observe and monitor network traffic usage and display the configuration for each of these features is also provided. For the tools that you use to manage and observe various networking features, such as the `dladm` and `dlstat` commands, the subcommands that are specific to each feature are also provided.

TABLE 2 Networking Features Grouped by Layer the Oracle Solaris Network Protocol Stack

Network Protocol Stack Layer	Feature	Functional Area	Administrative Interface
Hardware layer			
	Physical network interface card (NIC)	Hardware connectivity	`dladm show-phys`, `dlstat show-phys`

Network Protocol Stack Layer	Feature	Functional Area	Administrative Interface
	Driver configuration	Driver connectivity	Managed through the `driver.conf` file and `dladm` properties (`dladm show-linkprop`)
Datalink layer (L2)			
	Aggregations (DLMP and trunking)	High availability	`dladm show-aggr` and `dlstat show-aggr`
	Bridging protocols: ■ STP ■ TRILL	High availability, network virtualization	`dladm show-bridge` and `dlstat show-bridge`
	Data Center Bridging (DCB)	Network storage, performance	`lldpadm`, `dladm`
	Etherstubs	Network virtualization	`dladm show-etherstub`
	Edge Virtual Bridging (EVB)	Network virtualization	`dladm`
	Elastic Virtual Switch (EVS)	Network virtualization	`evsadm`, `evsstat`, `dladm`
	Flows	Observability, resource management, security	`flowadm` and `flowstat`
	IP tunnels	IP connectivity	`dladm show-iptun`, `ipadm`
	Link Layer Datalink Protocol (LLDP)	Observability, network storage, network virtualization	`lldpadm`
	Virtual local area networks (VLANs)	Network virtualization	`dladm show-vlan`, `dlstat`
	Virtual network interface cards (VNICs)	Network virtualization	`dladm show-vnic`, `dlstat`
	Virtual eXtensible area networks (VXLANs)	Network virtualization	`dladm show-vxlan`, `dlstat`
Network layer (L3)			
	Elastic Virtual Switch (EVS)	Network virtualization	`evsadm`, `evsstat`, `dladm`
	Firewalls	Security	Packet filtering with `ipf` and `ipnat`
	Flows	Observability, resource management, security	`flowadm`, `flowstat`
	Integrated Load Balancer (ILB)	Performance	`ilbadm`, `ilbadm show-server`, `ilbadm show-servergroup`
	IPMP	High availability	`ipadm`
	IP tunnels	IP connectivity	`ipadm show-iptun`
	Routing	IP connectivity	`route -p display`; `netstat`, `routeadm`
	VNIs	IP connectivity	`ipadm`
	VNICs	Network virtualization	`dladm show-vnic` and `dlstat`
	VRRP	High availability	`dladm`, `vrrpadm`

Network Protocol Stack Layer	Feature	Functional Area	Administrative Interface
	VXLANs	Network virtualization	`dladm show-vxlan` and `dlstat`
Transport layer (L4)			
	Firewalls	Security	Packet filtering with `ipf` and `ipnat`
	Flows	Observability, resource management, security	`flowadm` and `flowstat`
	Pluggable congestion control	Performance	`ipadm`
	Socket filtering	Security	`soconfig` (`-F`)

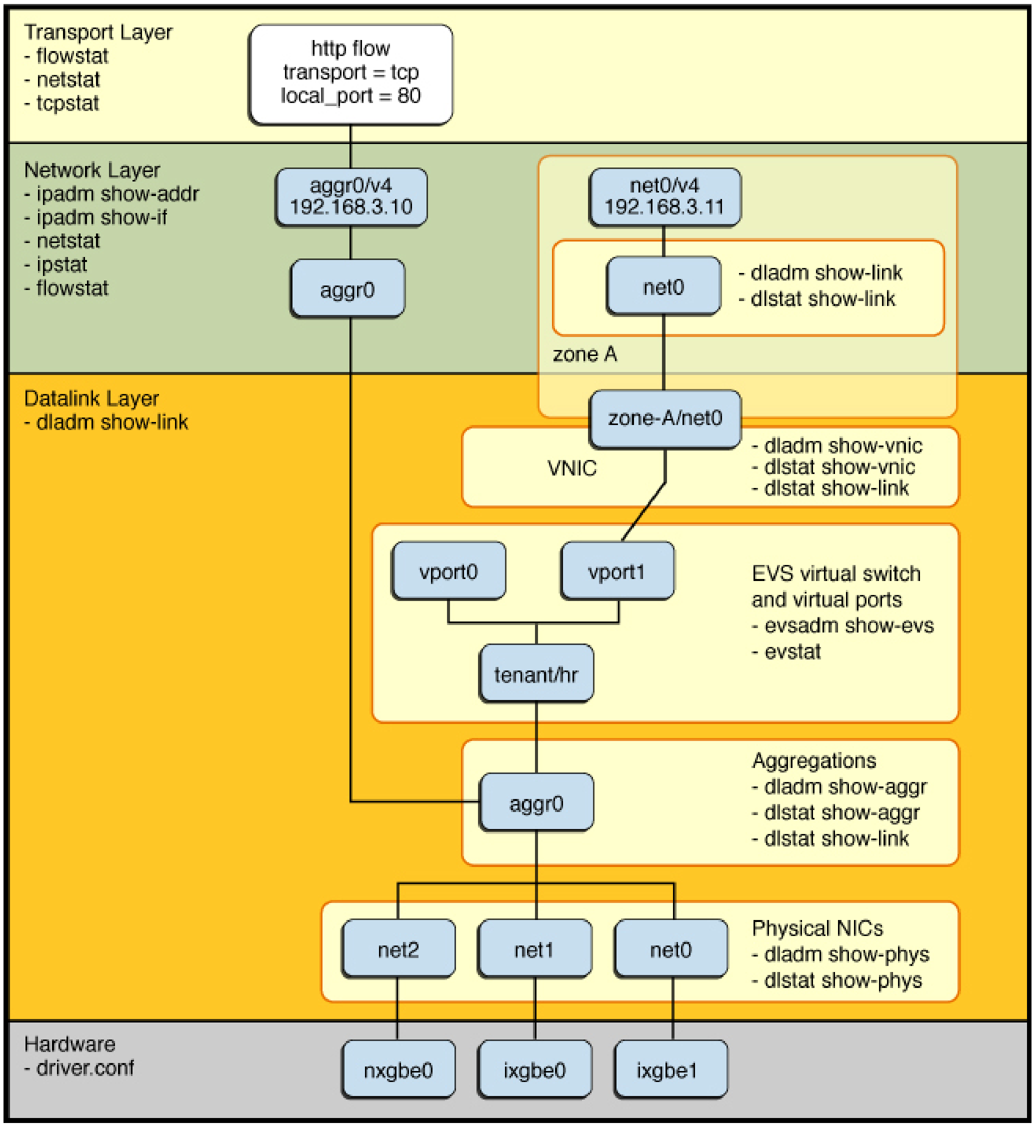
Observing Network Configuration and Traffic Usage

The following information demonstrates how to use the observability tools that are described in Table 2, "Networking Features Grouped by Layer the Oracle Solaris Network Protocol Stack," on page 29.

The following figure illustrates a common hypothetical network configuration consisting of some of the networking features that are configured at the various layers of the Oracle Solaris network protocol stack. The figure, which is provided as an example only, is followed by a set of example commands that show how you can use Oracle Solaris tools in practice to observe and gather statistics about the various components that are involved.

Note - The figure does not include every possible datalink type that you can configure. For a more detailed description of all of the features that you can configure on each layer of the network protocol stack, see Chapter 1, "Summary of Oracle Solaris Network Administration" in *Strategies for Network Administration in Oracle Solaris 11.3*.

FIGURE 1 Network Configuration Within the Oracle Solaris Network Protocol Stack



This figure depicts the following configuration, which illustrates how you can combine some Oracle Solaris features at the various layers of the network protocol stack:

- At the physical layer of the network stack, three physical NICs, `nxgbe0`, `ixgbe0`, and `ixgbe1`, are present in the system and appear as physical datalink instances, `net2`, `net1`, and `net0`, respectively.
- These physical NICs are then grouped together into a link aggregation called `aggr0`.
- The link aggregation datalink is then configured directly with an IP address (`aggr0/v4`) and is also used simultaneously as the uplink of a virtual switch, called `tenant/hr`, which is configured as an elastic virtual switch. The virtual switch has two virtual ports, `vport0` and `vport1`.
- The Oracle Solaris zone (`zone-A`) has a VNIC called `zone-A/net0`, which is connected to one of the virtual ports. Within the zone itself, the VNIC appears as a datalink (`net0`), which is configured with an IP address (`net0/v4`).
- A flow for HTTP traffic is also created on top of the aggregation (`aggr0`).

The following examples further describe how you can obtain configuration information about these components and how to observe network traffic usage for various networking features by using the tools that are provided in Oracle Solaris.

Tools for Observing Network Configuration and Traffic Usage

You configure and administer datalinks by using the `dladm` command. You use the `dlstat` command to obtain statistics on network traffic usage for datalinks. For example, you would display inbound and outbound traffic statistics per link by using one of the following commands:

```
# dlstat link
```

```
# dlstat show-link link
```

Display inbound and outbound traffic statistics per physical network device as follows:

```
# dlstat show-phys link
```

Display inbound and outbound traffic statistics per port and per link aggregation as follows:

```
# dlstat show-aggr link
```

For more information, see the `dlstat`(1M) man page.

You configure and administer *flows* by using the `flowadm` command. You use the `flowstat` command to obtain statistics on network traffic usage for flows. As shown in Figure 1, “Network Configuration Within the Oracle Solaris Network Protocol Stack,” on page 32, depending on the attributes that you specify, you can use flows to observe network traffic usage at different layers of the network stack.

```
# flowstat
```

For more information, see the `flowstat`(1M) man page.

The following examples show how to display network configuration information and observe network traffic statistics, per feature and per layer of the Oracle Solaris network protocol stack. For more information about monitoring network traffic usage, see Chapter 8, “Monitoring Network Traffic and Resource Usage” in *Managing Network Virtualization and Network Resources in Oracle Solaris 11.3*.

Observing Network Configuration and Traffic Usage at the Hardware Layer

Troubleshooting network configuration and performance issues at the hardware layer of the network protocol stack might involve observing the following:

- How many rings there are per physical NIC and how many packets are being transmitted through those rings.
- How many packet drops are occurring:
  - Per physical NIC
  - Per physical ring
- NIC-specific counters that might be useful.
- Number of rings and number of descriptors that are configured per physical NIC.

For physical devices, you can use the `dladm show-phys` and `dlstat show-phys` commands to observe network traffic usage. These two commands display different output, depending on the type of information that you want to obtain.

For example, use the `dladm show-phys` command without any options to display the physical device and the attributes of all of the physical links on a system:

```
# dladm show-phys
LINK MEDIA    STATE   SPEED DUPLEX   DEVICE
net1 Ethernet unknown 0     unknown  bge0
net0 Ethernet up      1000  full     nge0
```

For more details and examples, see Chapter 2, “Administering Datalink Configuration in Oracle Solaris” in *Configuring and Managing Network Components in Oracle Solaris 11.3* and the `dladm`(1M) man page.

The `dlstat show-phys` command displays statistics about the packets and bytes that are transmitted and received per physical device. This subcommand operates on the hardware rings, which are at the device layer of the network stack.

The following example displays statistics for all of the physical links on a system. The output displays both incoming and outgoing traffic statistics for each link on a system. The number of packets and byte sizes per packet are also displayed:

```
# dlstat show-phys
LINK    IPKTS   RBYTES    OPKTS   OBYTES
net1        0        0        0        0
net0    1.95M  137.83M   37.95K    3.39M
```

You can use the `-r` option to display receive-side statistics on each of the hardware rings for a datalink device. The output of this command Includes the bytes and packets that are received and the hardware and software drops, etc., for the datalink device. This example shows that `net4` has eight rings, which are identified under the `INDEX` field in the following output:

```
# dlstat show-phys -r net4
LINK TYPE INDEX IPKTS RBYTES
net4 rx   0     701   42.06K
net4 rx   1     0     0
net4 rx   2     0  0
net4 rx   3     0  0
net4 rx   4     0  0
net4 rx   5     0  0
net4 rx   6     0  0
net4 rx   7     0  0
```

To obtain similar information for transmitted traffic, use the `-t` option.

The following example displays the number of inbound dropped packets per physical link:

```
dlstat show-phys -o idrops
IDROPS
0
871.14K
```

The `-o` *field*[,...] option is used to specify a case-insensitive, comma-separated list of output fields to display.

In the following example, the number of inbound and outbound dropped packets and bytes per physical link are displayed:

```
# dlstat show-phys -o idrops,idropbytes,odrops,odropbytes
IDROPS    IDROPBYTES ODROPS ODROPBYTES
0         0          0      0
871.14K   0          0      0
```

It is recommended that you specify both the `idrops` and `idropbytes` options with the `dlstat show-phys -o` command. Note that one of these values can be zero, depending on the system's hardware capabilities, as shown in the previous output where the `IDROPS` field is non-zero, while the `IDROBYTES` field is zero.

For driver configuration, you can manage property values for specific drivers through the `driver.conf` file and also through `dladm` properties. Driver configuration files enable you to provide device property values that override the default values that are provided by the devices themselves. For more information about managing information through the driver.conf file, see the driver.conf(4) man page.

Observing Network Configuration and Traffic Usage at the Datalink Layer

Several networking features are configured at the datalink layer (L2) of the network protocol stack. These features include both physical and virtual datalinks. Certain commands that you use to observe network traffic usage at this layer of the stack are generic and can be used for any type of configured datalink. Other subcommands are specific to the feature itself and therefore can be used to display additional information about that feature's configuration..

The commands that you use at this layer of the stack also depend on the type of information that you want to observe. For example, at the datalink layer of the stack, you might want to display fan-out statistics or per-link statistics. You would use different commands to obtain each type of information.

For basic information about datalinks, use the dladm show-link. This command displays link configuration information, either for all of the datalinks on the system or for a specified datalink, as shown in the following output:

```
# dladm show-link
LINK CLASS MTU STATE   OVER
net1 phys 1500 unknown --
net0 phys 1500 up      --
```

The previous output shows that this system has two datalinks, which are directly associated with their corresponding physical NICs. No special datalinks exist on the system, for example, an aggregation or a VNIC. These types of L2 entities are configured over the physical datalinks under the phys class.

You use the dlstat show-link command to observe network traffic usage at the datalink layer. The show-link subcommand operates at the datalink layer of the network protocol stack and provides statistics that refer to the lanes that are configured over the physical link.

The following output shows inbound and outbound traffic statistics per link:

```
# dlstat show-link
LINK   IPKTS  RBYTES  OPKTS  OBYTES
net1   0      0        0        0
net0   1.96M  137.97M  38.40K   3.29M
```

In the following example, receive-side traffic statistics for the net4 device are reported. The statistics for INTRS and POLLS counters are also displayed. These statistics report how many packets were received in the interrupt context versus polling mode. The IDROPS counter indicates how many packets were dropped at the datalink layer of the network stack.

```
# dlstat show-link -r net4
LINK TYPE   ID    INDEX    IPKTS  RBYTES    INTRS    POLLS   IDROPS
net4 rx    local  --        0      0        0        0       0
net4 rx    other  --        0      0        0        0       0
net4 rx    hw     0     7.46M  1.06G    5.62M    1.84M       0
net4 rx    hw     1        0      0         0        0       0
net4 rx    hw     2        0      0         0        0       0
net4 rx    hw     3        0      0         0        0       0
net4 rx    hw     4        2    196         2        0       0
net4 rx    hw     5        0      0         0        0       0
net4 rx    hw     6        0      0         0        0       0
net4 rx    hw     7        0      0         0        0       0
```

In the previous output, only statistics for the named link, physical device (for the `show-phys` subcommand), or aggregation (for the `show-aggr` subcommand) are displayed. If *link* is not specified in the command, then statistics for all of the links, devices, and aggregations are displayed in the output.

In this example, the information that is displayed under the `ID` field is interpreted as follows:

- `local` –. Denotes corresponding loopback traffic on layer 2 (L2) of the network stack.
- `other` – Includes broadcast and multicast traffic.

  Over the lifetime of a datalink, the hardware resources that are associated with a datalink might vary, depending on resource utilization, link configuration, or assignment of physical NICs to link aggregations. The `rx` entries that are listed in the output of the `show-link -r` command correspond to the hardware resource that is currently assigned to the link. The output for the `other` row includes traffic for hardware resources that are no longer assigned to the datalink.
- `hw` – Denotes a hardware lane.
- `sw` – Denotes a software lane (as shown in the following example).

The distinction between hardware and software lanes is based on a NIC's ability to support ring allocation. On hardware lanes, rings are dedicated to the packets that use those lanes. In contrast, rings on software lanes are shared among datalinks.

The following output reports statistics for outbound packets on the rings that are used by `net1`:

```
# dlstat show-link -t net1
LINK  TYPE      ID  INDEX    OPKTS   OBYTES   ODROPS
net4    tx   local     --        0        0        0
net4    tx   other     --        0        0        0
net4    tx      hw      0      372   15.67K        0
net4    tx      hw      1        1       98        0
net4    tx      hw      2        0        0        0
net4    tx      hw      3        0        0        0
net4    tx      hw      4        0        0        0
net4    tx      hw      5        0        0        0
net4    tx      hw      6        1        98       0
net4    tx      hw      7        0        0        0
```

Observing Network Configuration and Traffic Usage for Aggregations

Aggregations are also configured at the datalink layer (L2) of the network protocol stack. Depending on the type of information that you want to obtain, for example, the overall distribution of traffic between the physical NIC or aggregation statistics, use the following commands:

`dladm show-aggr`

Displays aggregation configuration (the default), LACP information or DLMP probe-based failure and recovery detection status, either for all of the aggregations or for a specified aggregation.

Specify the `-x` option to display detailed per-aggregation information for an aggregation.

`dlstat show-aggr`

Displays per-port statistics about the packets and bytes that are transmitted and received for an aggregation.

`dlstat show-link`

Displays statistics about the packets and bytes that are transmitted and received for an aggregation (the aggregation being a datalink).

One difference between the `dlstat show-aggr` and `dlstat show-link` commands is that the `dlstat show-aggr` command displays per-port statistics, while the `dlstat show-link` command provides per-link statistics. Another important difference between these two commands is that the `dlstat show-aggr` command displays the overall statistics for the entire aggregation. Whereas, the `dlstat show-link` command displays only the statistics for the primary client of the aggregation, for example IP.

Thus, if you create VNICs on top of an aggregation, the `dlstat show-aggr` command would report the total number of packets across all of the VNICs, plus the primary client (IP). This output is similar to the `show-phys` subcommand compared to the `show-link` subcommand, where `show-phys` displays the total traffic usage, while `show-link` displays only the traffic usage for the primary datalink.

The following examples demonstrate how you can observe network traffic usage for aggregations. For more information about administering aggregations, see Chapter 2, “Administering Datalink Configuration in Oracle Solaris” in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

EXAMPLE 1 Displaying Aggregation Configuration Information

The following example output reports the status of the existing aggregations that are configured on a system.

```
# dladm show-aggr -x
LINK  PORT SPEED    DUPLEX  STATE  ADDRESS          PORTSTATE
aggr1 --   1000Mb   full    up     0:14:4f:29:d1:9d --
```

```
net1       1000Mb   full    up     0:14:4f:29:d1:9d attached
net3       0Mb      unknown down   0:14:4f:29:d1:9f standby
```

EXAMPLE 2 Displaying Per-Port Statistics for Aggregations

The following example output for the `dlstat show-aggr` command reports per-port statistics for an aggregation. Both the packets and bytes that are transmitted and received for the aggregation are displayed.

```
# dlstat show-aggr
LINK            PORT    IPKTS      RBYTES    OPKTS   OBYTES
aggr1             --      99 1      2.18K     23       966
aggr1             net4    25        1.50K      8       336
aggr1             net5    74        10.68K    15       630
```

EXAMPLE 3 Displaying Per-Link Statistics for Aggregations

The following example output for the `dlstat show-link` command reports per-link statistics for an aggregation. Both the packets and bytes that are transmitted and received for the aggregation are displayed. The difference between this example and the previous example is that the `show-aggr` subcommand reports per-port statistics, while the `show-link` subcommand reports per-link statistics.

```
# dlstat show-link
LINK    IPKTS     RBYTES    OPKTS   OBYTES
net5        0          0        0        0
net2        0          0    5.60K    1.49M
net4        0          0        0        0
net6    4.43K      1.32M    6.39K    1.56M
net1    4.43K      1.32M    6.39K    1.56M
net0  387.10K     99.42M   59.43K    7.67M
net3        0          0    5.61K    1.50M
aggr1     150     18.65K       30   1.26K
```

EXAMPLE 4 Displaying Receive-Side Traffic Statistics for an Aggregation's Hardware Rings

The following example reports receive-side statistics for each of an aggregation's (`aggr1`) hardware rings.

```
# dlstat show-phys -r aggr1
LINK TYPE INDEX   IPKTS  RBYTES
aggr1   rx     0     723  43.38K
aggr1   rx     1       0       0
aggr1   rx     2       0       0
aggr1   rx     3       0       0
aggr1   rx     4       0       0
aggr1   rx     5       0       0
aggr1   rx     6       0       0
```

```
aggr1   rx     7       0       0
aggr1   rx     8  22.20K   1.33M
aggr1   rx     9     692  63.66K
aggr1   rx    10       0       0
aggr1   rx    11       0       0
aggr1   rx    12       0       0
aggr1   rx    13  12.99K   4.44M
aggr1   rx    14       0       0
aggr1   rx    15  10.39K 623.34K
```

EXAMPLE 5 Displaying Receive-Side Traffic Statistics for an Aggregation's Hardware Lanes

The following example reports receive-side traffic statistics for each of an aggregation's (`aggr1`) hardware lanes. Note that the statistics reported pertain to traffic for the primary client of the aggregation only, for example, the IP traffic on top of the aggregation. The output does not include traffic statistics for other clients that are configured on top of the aggregation, for example VNICs. To display traffic usage for all of the clients of an aggregation, you would use the `dlstat show-aggr` and `dlstat show-phys`, as shown in Example 1, "Displaying Aggregation Configuration Information," on page 38 and Example 4, "Displaying Receive-Side Traffic Statistics for an Aggregation's Hardware Rings," on page 39.

```
# dlstat show-link -r aggr1
LINK   TYPE    ID    INDEX    IPKTS   RBYTES    INTRS   POLLS  IDROPS
aggr1   rx   local     --       0       0        0        0      0
aggr1   rx   other     --       0       0        0        0      0
aggr1   rx      hw      0     721   43.26K     721        0      0
aggr1   rx      hw      1       0       0        0        0      0
aggr1   rx      hw      2       0       0        0        0      0
aggr1   rx      hw      3       0       0        0        0      0
aggr1   rx      hw      4       0       0        0        0      0
aggr1   rx      hw      5       0       0        0        0      0
aggr1   rx      hw      6       0       0        0        0      0
aggr1   rx      hw      7       0       0        0        0      0
aggr1   rx      hw      8  22.23K   1.33M   22.23K        0      1
aggr1   rx      hw      9     693  63.76K      693        0      0
aggr1   rx      hw     10       0       0        0        0      0
aggr1   rx      hw     11       0       0        0        0      0
aggr1   rx      hw     12       0       0        0        0      0
aggr1   rx      hw     13  13.00K   4.45M    13.00K       0      2
aggr1   rx      hw     14       0       0        0        0      0
aggr1   rx      hw     15  10.40K 624.06K   10.40K        0      0
```

Observing Network Configuration and Traffic Usage for an EVS Switch

You configure and manage the elastic virtual switch (EVS) feature of Oracle Solaris at the datalink layer of the network protocol stack. Depending on the type of information that you want to display, use the following commands:

`evsadm`
: Creates and manages EVS switches and their resources: IP networks (*IPnets*) and virtual ports (*VPorts*).

  Use the `show-evs` subcommand to display information for all of the EVS switches that are managed by an EVS controller or for a specified EVS switch.

`evsstat`
: Displays network traffic statistics for all of the VPorts for a large deployment or for all of the VPorts of a specified elastic virtual switch. The command also reports the statistics for any VNICs associated with the VPorts.

`dladm show-vnic -c`
: Displays information about the VNICs that are connected to an EVS switch. The VPort and the EVS switch to which the VNIC is connected is determined by the EVS switch.

The following examples demonstrate how you can display configuration information for an elastic virtual switch and observe network traffic usage and other statistics for an EVS configuration. For more information about administering the EVS feature, see Chapter 6, “Administering Elastic Virtual Switches” in *Managing Network Virtualization and Network Resources in Oracle Solaris 11.3*.

EXAMPLE 6 Displaying Information About an EVS Configuration

In the following example, the `evsadm` command is used to display basic information about an EVS configuration.

```
# evsadm
NAME          TENANT        STATUS  VNIC    IP          HOST
evs0          sys-global    busy    --      ipnet0      sysabc-02
sys-vport0    --            used    vnic0   10.0.0.2/24 sysabc-02
```

EXAMPLE 7 Displaying Inbound and Outbound Traffic Usage for VPorts That Are Connected to an EVS Switch

In the following example the `evsstat` command is used to display incoming and outgoing network traffic statistics for the only VPort that is connected to an EVS switch.

```
# evsstat
VPORT       EVS   TENANT      IPKTS    RBYTES   OPKTS   OBYTES
sys-vport0  evs0  sys-tenant  101.88K  32.86M  40.16K  4.37M
sys-vport1  evs0  sys-tenant    4.50M   6.78G   1.38M  90.90M
```

EXAMPLE 8 Displaying Information About VNICs That Are Connected to an EVS Switch

There are two types of VNICs: those that you create on top of an underlying link and those that are connected to an EVS switch. To obtain information about a VNIC that is connected to an

EVS switch, use the `dladm show-vnic` command with the `-c` option, as shown in the following example.

```
# dladm show-vnic -c
LINK       TENANT        EVS     VPORT       OVER   MACADDRESS        IDS
vnic0      sys-global    evs0    sys-vport0  net    12:8:20:f2:46:22  VID:200
```

Observing Network Configuration and Traffic Usage for VNICs

VNICs are configured at the datalink layer (L2) of the network protocol stack. Use the following commands to display configuration information and observe network traffic usage for these L2 entities:

`dladm show-vnic` Displays VNIC configuration information for all of the VNICs on a system, all of the VNICs on a link, or for a specified `vnic-link`.

`dlstat` Displays statistics about the packets and bytes that are transmitted and received per VNIC.

The following examples demonstrate how you can observe network traffic usage for VNICs. For more information about administering VNICs, see “Managing VNICs” in *Managing Network Virtualization and Network Resources in Oracle Solaris 11.3*.

EXAMPLE 9 Displaying VNIC Configuration Information

The following example displays VNIC configuration information for the one existing VNIC on a system (`vnic0`).

```
# dladm show-vnic
LINK        OVER        SPEED  MACADDRESS       MACADDRTYPE IDS
vnic0       net1        1000   2:8:20:f2:46:22  fixed       VID:200
```

EXAMPLE 10 Displaying Network Traffic Statistics for VNICs

In the following example, the `dlstat` command is used to display statistics about the packets and bytes that are transmitted and received by a specific VNIC (`vnic0`).

```
# dlstat vnic0
LINK    IPKTS   RBYTES    OPKTS    OBYTES
vnic0   1.53M   158.18M   154.22K  32.84M
```

Observing Network Configuration and Traffic Usage at the IP Layer

You observe network traffic usage at the IP layer (L3) of the network protocol stack by using several different commands. Depending on the type of information that you want to display, use the following commands:

`flowstat` Displays statistics for flows that you create for various IP addresses or subnets that are configured at the IP layer of the network protocol stack.

`ipadm` Displays general configuration information for IP interfaces and addresses.

`ipadm show-addr` Displays IP address information, either for the given address object (`addrobj`) or for all of the address objects that are configured on a specified interface, including those that are only in the persistent configuration.

`ipadm show-if` Displays network interface configuration information, either for all of the network interfaces that are configured on the system, including those that are only in the persistent configuration, or for a specified interface.

`ipstat` Displays statistics on IP traffic based on the selected output mode and sort order.

`netstat` Displays the contents of certain network-related data structures in various formats.

The following examples demonstrate how to observe network traffic usage and gather statistics for networking features that are configured at the IP layer of the network protocol stack. For more information about administering IP configuration, see "Monitoring IP Interfaces and Addresses" in *Configuring and Managing Network Components in Oracle Solaris 11.3*. See also the `ipstat`(1M) and `netstat`(1M) man pages.

EXAMPLE 11 Displaying General Information About IP Configuration

You use the `ipadm` command to display general information about IP configuration. The following example shows how to display information about all of the IP interfaces and addresses that are configured on a system.

```
# ipadm
NAME              CLASS/TYPE STATE        UNDER      ADDR
lo0               loopback   ok           --         --
   lo0/v4         static     ok           --         127.0.0.1/8
   lo0/v6         static     ok           --         ::1/128
net0              ip         ok           --         --
```

```
   net0/v4          static     ok           --         10.134.67.140/24
```

EXAMPLE 12 Displaying Information About Configured IP Interfaces

You use the `ipadm` command with the `show-if` subcommand to display information about the configured IP interfaces on a system, as shown in the following example:

```
# ipadm show-if
IFNAME   CLASS      STATE   ACTIVE   OVER
lo0      loopback   ok       yes     ---
net0     ip         ok       yes     ---
```

EXAMPLE 13 Displaying Information About Configured IP Address Objects

The following example shows how to use the `ipadm` command with the `show-addr` subcommand to display information about configured IP address objects on a system.

```
# ipadm show-addr
ADDROBJ      TYPE       STATE   ADDR
lo0/v4       static     ok      127.0.0.1/8
```

EXAMPLE 14 Displaying Statistics About IP Traffic by Using the `ipstat` Command

The following example shows how to use the `ipstat` command to display statistics about IP traffic. The command provides options for reporting statistics about the IP traffic that matches a specified source or destination address, interface, and higher layer protocols.

```
# ipstat
SOURCE               DEST                 PROTO   INT    RATE
abc11example-02      dhcp-sys.example     TCP     net0   145.6
dns1.example.com     abc11example-02      UDP     net0   66.0
abc11example-02      dns1.example.com     UDP     net0   10.4
dhcp-sys.example     abc11example-02      TCP     net0   4.0
foo1.example.com     all-sys.mcast.net    ICMP    net0   3.2
```

For more information, see “Observing Network Traffic With the ipstat and tcpstat Commands” in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*.

EXAMPLE 15 Displaying Connected Sockets by Using the `netstat` Command

The `netstat` command displays network status and protocol statistics. You can display the status of TCP, SCTP, and UDP endpoints in table format. You can also display routing table and interface information by using this command. The various types of network data that is reported depends on the command-line option that you specify.

In the following example, the `netstat` command is used without any options to display a list of active sockets for each protocol.

```
# netstat
 TCP: IPv4
   Local Address        Remote Address         Swind  Send-Q  Rwind   Recv-Q  State
  -----------------     -----------------    -------  ------  ------- ------  --------
   localsys.local.port1  remotesys1            65535   0      128592   0
 ESTABLISHED
   localsys.local.port2  localsys.local.port5   130880  0      139264   0
 ESTABLISHED
   localsys.local.port3  localsys.local.port6   139060  0      130880   0
 ESTABLISHED
   localsys.local.port4  remotesys2.remote.port2 65572  63     128480   0
 ESTABLISHED
```

Use the `netstat -P` *protocol* command as follows to limit the display of statistics or state of just those sockets that are applicable to a specific protocol, as shown in the following example.

```
# netstat -P tcp
TCP: IPv4
Local Address Remote Address               Swind  Send-Q  Rwind  Recv-Q    State
------------ -------------------          ------ ------ ------- ------  --------
sys3.48962   foo.com.ldaps                49232   0   128872    0    ESTABLISHED
sys3.ssh     dhcp1-10-132-146-210.foo.com  64292  63   128480    0    ESTABLISHED
```

You can specify *protocol* as any of the following: `ip`, `ipv6`, `icmp`, `icmpv6`, `igmp`, `udp`, `tcp`, `rawip`.

The following abbreviated example shows how to use the `netstat -s` command to display per-protocol statistics:

```
# netstat -s
RAWIP   rawipInDatagrams    =     2    rawipInErrors   =  0
        rawipInCksumErrs    =     0
        rawipOutDatagrams   =     2
        rawipOutErrors      =     0

UDP     udpInDatagrams      =   1023   udpInErrors    =   0
        udpOutDatagrams     =   1023
        udpOutErrors        =      0

TCP     tcpRtoAlgorithm     =      4    tcpRtoMin     =   200
        tcpRtoMax           =  60000
        tcpMaxConn          =     -1
        tcpActiveOpens      =    382
        tcpPassiveOpens     =     83
        tcpAttemptFails     =     81
        tcpEstabResets      =      1
        tcpCurrEstab        =      2
        tcpOutSegs          =   6598
        tcpOutDataSegs      =   5653
        tcpOutDataBytes     = 836393
        tcpRetransSegs      =     16
```

```
. . .
```

EXAMPLE 16 Displaying Statistics About Flows That Are Configured at the IP Layer of the Network Stack

As shown in the following example, you can create flows for various IP addresses or subnets of interest that are configured at the IP layer of the network protocol stack. You can then use the `flowstat` command to display statistics about these flows.

```
# flowadm add-flow -l net0 -a transport=tcp tcpflow1
# flowadm add-flow -l net4 -a transport=tcp tcpflow2

# flowstat
FLOW      IPKTS   RBYTES   IDROPS    OPKTS   OBYTES   ODROPS
tcpflow2      0        0        0        0        0        0
tcpflow1     53   5.62K        0       45    5.52K        0
```

Specify the `-l` option to display flow information for a specific datalink device:

```
# flowstat -l net0
FLOW      IPKTS   RBYTES  IDROPS   OPKTS  OBYTES ODROPS
tcpflow1    108   11.19K       0     86   10.45K      0
```

EXAMPLE 17 Creating and Observing Flows for Specific IP Addresses

You can create flows for specific IP addresses by using the `local_ip` and `remote_ip` attributes with the `flowadm add-flow` command. You can then use the `flowstat` command display statistics for these flows, as shown in the following example.

```
# flowadm add-flow -l net0 -a local_ip=10.10.12.45 flow1
# flowadm add-flow -l net4 -a remote_ip=10.134.64.0/24 flow2
# flowstat
FLOW      IPKTS     RBYTES   IDROPS    OPKTS  OBYTES   ODROPS
flow2   528.54K    787.39M        0  179.39K  11.85M        0
flow1   742.81K      1.10G        0        0       0        0
```

Observing Network Configuration and Traffic Usage at the Transport Layer

You observe network traffic for features that are configured and administered at the transport layer (L4) of the network protocol stack by using the following commands:

`flowstat` Reports runtime statistics about user-defined flows. Use the `flowadm show-flow` command to determine the flow name to specify with the `flowstat` command.

You can use flows as an observability tool rather than just for bandwidth control, for example, to measure the amount of traffic that a specific service consumes.

`netstat` Displays the contents of certain network-related data structures in various formats. With no arguments, the `netstat` command displays the connected sockets for `PF_INET`, `PF_INET6`, and `PF_UNIX`, unless modified by using the `-f` option.

`tcpstat` Reports statistics on TCP and UDP traffic on a server based on the selected output mode and sort order that is specified in the command syntax.

The following examples demonstrate how you can observe network traffic usage and gather statistics for features that are configured at the transport layer of the network protocol stack.

For more information about administering TCP/IP networks with the `netstat` and `tcpstat` commands, see.Chapter 1, "Administering TCP/IP Networks" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3*.

For more information about the `flowstat` command, see "Displaying Network Traffic Statistics of Flows" in *Managing Network Virtualization and Network Resources in Oracle Solaris 11.3* and the `flowstat`(1M) man page.

EXAMPLE 18 Displaying Runtime Statistics for Flows by Using the `flowstat` Command

The following example output shows a static display of traffic information for all of the configured flows that are on a system. The `flowadm` command is used to determine the name of the flow.

```
# flowadm
FLOW        LINK     PROTO LADDR   LPORT RADDR  RPORT DIR
tcpflow1    net1     tcp   --      --    --     --    bi
tcpflow0    net0     tcp   --      --    --     --    bi
udpflow0    net0     udp   --      --    --     --    bi
```

```
# flowstat
FLOW       IPKTS   RBYTES  IDROPS    OPKTS   OBYTES   ODROPS
tcpflow1      0        0       0        0        0        0
tcpflow0  1.39K  117.86K       0     2.16K  260.77K        0
udpflow0      5    1.43K       0         0        0        0
```

You can also use the `flowstat` command with the `-l` option to display statistics for all of the flows for a specified link or statistics for a specified flow, as shown in output of the following two examples.

```
# flowstat -l net0
FLOW      IPKTS   RBYTES   IDROPS    OPKTS    OBYTES   ODROPS
```

```
tcpflow0  1.51K  126.85K        0    2.43K   292.85K        0
udpflow0      9    2.80K        0        0         0        0

# flowstat -l net0 tcpflow0
FLOW      IPKTS    RBYTES   IDROPS     OPKTS   OBYTES  ODROPS
tcpflow0  1.66K   137.11K        0     2.69K  324.42K       0
```

EXAMPLE 19 Displaying Information About Transport Layer Data Structures by Using the `netstat` Command

You can use the `netstat` command to display information about data structures at the transport layer (L4) of the network protocol stack, for example TCP or UDP. In the following example, the `netstat -P` *transport-protocol* command is used to display information about TCP.

```
# netstat -p tcp
TCP: IPv4
  Local Address     Remote Address   Swind   Send-Q  Rwind  Recv-Q  State
  ----------------  ---------------  ------- ------ ------- ------ -----------
  localsys.ssh     remotesys1.port4   65380     63     128480   0    ESTABLISHED
  localsys.port1   remotesys2.ldaps   65535      0     128592   0    ESTABLISHED
  localsys.port2   localsys.port5    130880     0      139264   0    ESTABLISHED
  localsys.port3   localsys.port6    139060     0      130880   0    ESTABLISHED
```

EXAMPLE 20 Displaying Statistics for TCP and UDP Traffic by Using the `tcpstat` Command

You use the `tcpstat` command to observe network traffic at the transport layer of the network protocol stack, specifically for TCP and UDP. In addition to the source and destination IP addresses, you can observe the source and destination TCP or UDP ports, the PID of the process that is sending or receiving the traffic, and the name of the global zone in which that process is running.

The following example shows the type of information that is reported when you use the `tcpstat` command with the `-c` option. The `-c` option specifies to print newer reports after previous reports, without overwriting previous reports.

```
# tcpstat -c 3
ZONE         PID PROTO  SADDR             SPORT DADDR            DPORT   BYTES
global    100680 UDP    antares           62763 agamemnon          1023   76.0
global    100680 UDP    antares             775 agamemnon          1023   38.0
global    100680 UDP    antares             776 agamemnon          1023   37.0
global    100680 UDP    agamemnon          1023 antares           62763   26.0
global    104289 UDP    zucchini          48655 antares            6767   16.0
global    104289 UDP    clytemnestra      51823 antares            6767   16.0
global    104289 UDP    antares            6767 zucchini          48655   16.0
global    104289 UDP    antares            6767 clytemnestra      51823   16.0
global    100680 UDP    agamemnon          1023 antares             776   13.0
global    100680 UDP    agamemnon          1023 antares             775   13.0
global    104288 TCP    zucchini          33547 antares            6868    8.0
global    104288 TCP    clytemnestra      49601 antares            6868    8.0
global    104288 TCP    antares           6868 zucchini         33547    8.0
global    104288 TCP    antares           6868 clytemnestra     49601    8.0
Total: bytes in: 101.0  bytes out: 200.0
```

In the following output, the `tcpstat` command reports the five most active TCP traffic flows for a server:

```
# tcpstat -l 5
ZONE            PID  PROTO  SADDR            SPORT DADDR            DPORT   BYTES
global        28919 TCP    achilles.exampl  65398 aristotle.exampl   443   33.0
zone1          6940 TCP    ajax.example.com  6868 achilles.exampl  61318    8.0
zone1          6940 TCP    achilles.exampl  61318 ajax.example.com  6868    8.0
global         8350 TCP    ajax.example.com  6868 achilles.exampl  61318    8.0
global         8350 TCP    achilles.exampl  61318 ajax.example.com  6868    8.0
Total: bytes in: 16.0  bytes out: 49.0
```

For more information, see "Observing Network Traffic With the ipstat and tcpstat Commands" in *Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.3* and the `tcpstat`(1M) man page.

♦ ♦ ♦ CHAPTER 3

Troubleshooting Naming Services Configuration Issues

This chapter describes basic naming services configuration in Oracle Solaris and how to manage and troubleshoot various related issues that could prevent your network from working properly.

This chapter contains the following topics:

- "About Naming Services Configuration" on page 51
- "Troubleshooting DNS Issues" on page 51
- "Troubleshooting NFS Issues" on page 53
- "Troubleshooting Issues With the Name Service Switch File" on page 55
- "Troubleshooting NIS Issues" on page 55

About Naming Services Configuration

In this release, naming services configuration is managed by the Service Management Facility (SMF). What this change means is that the SMF repository is now the primary repository for all naming services configuration and you no longer modify a specific file to configure naming services. To make the configuration persistent, you must enable or refresh the appropriate SMF services.

If no network configuration exists after an installation, naming services default to `files only` behavior rather than `nis files`. To avoid potential configuration issues, make sure that the `svc:/system/name-service/cache` SMF service is enabled at all times. For more information, see Chapter 1, "About Naming and Directory Services" in *Working With Oracle Solaris 11.3 Directory and Naming Services: DNS and NIS*.

Troubleshooting DNS Issues

The following procedures are described:

- "How to Troubleshoot DNS Client Issues" on page 52

- "How to Troubleshoot DNS Server Issues" on page 52

▼ How to Troubleshoot DNS Client Issues

In Oracle Solaris 11, you no longer edit the `/etc/resolv.conf` file to make persistent changes to a DNS client. All DNS client configuration is managed by the `dns/client` SMF service. For information about how to enable a DNS client, see "How to Enable a DNS Client" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

1. **Check the status of the DNS service.**

   ```
   # svcs -xv dns/client:default
   ```

2. **Check the DNS client service log.**

   ```
   # more /var/svc/log/network-dns-client:default.log
   ```

3. **Check the name server settings.**

   ```
   # svcprop -p config/nameserver dns/client
   ```

4. **Check the search settings.**

   ```
   # svcprop -p config/search dns/client
   ```

5. **Check all DNS settings.**

   ```
   # svcprop -p config dns/client
   ```

▼ How to Troubleshoot DNS Server Issues

1. **Check the status of the DNS service.**

   ```
   # svcs -xv dns/server:default
   ```

2. **Check the DNS service log.**

   ```
   # more /var/svc/log/network-dns-server:default.log
   ```

3. **Check for `syslog` messages.**

   ```
   # grep named /var/adm/messages
   ```

4. **Start the `named` daemon.**

```
# named -g
```

5. **After resolving the issue, clear the DNS service.**

```
# svcadm clear dns/server:default
```

6. **Verify that the DNS service is back online.**

```
# svcs dns/server:default
```

Troubleshooting NFS Issues

The following procedures are described:

- "How to Troubleshoot NFS Client Connectivity Issues" on page 53
- "How to Check the NFS Server Remotely" on page 54
- "How to Troubleshoot Issues With the NFS Service on the Server" on page 54

▼ How to Troubleshoot NFS Client Connectivity Issues

Troubleshooting issues with a client connecting to an NFS server can involve several steps, depending on the root cause. The following procedure follows the logical sequence that you might follow to resolve NFS client connectivity issues. If you cannot resolve the problem by performing a given step, proceed to the next step until you have identified and corrected the issue.

1. **Check that the NFS server is reachable from the client system.**

```
# ping nfs-server
```

2. **If the server is not reachable from the client, check that the local naming service is running.**

3. **If the local naming service is running, check that the client has the correct host information.**

```
# getent hosts nfs-server
```

4. **If the host information on the client is correct, try to reach the NSF server by running the `ping` command from another client.**

5. **If the NFS server is reachable from the second client, check whether the first client can connect to any other systems on the local network by using the `ping` command:**

   ```
   # ping other-client-system
   ```

6. **If other clients are unreachable, follow the steps that are described in “Running Basic Network Diagnostic Checks” on page 17.**

How to Check the NFS Server Remotely

The following procedure describes the logical sequence that you would follow to check an NFS server remotely.

1. **Check that the NFS services have been started on the NFS server.**

   ```
   # rpcinfo -s bee|egrep 'nfs|mountd`
   ```

2. **Check that the NFS server's `nfsd` processes are responding by running the following command on the client:**

   ```
   # rpcinfo -u nfs-server nfs
   ```

3. **Check that the `mountd` daemon is running on the NFS server.**

   ```
   # rpcinfo -u nfs-server mountd
   ```

4. **Check whether the local `autofs` service is being used.**

   ```
   # cd /net/wasp
   ```

5. **Verify that the file system is being shared as expected on the NFS server.**

   ```
   # showmount -e nfs-server
   ```

How to Troubleshoot Issues With the NFS Service on the Server

The following procedure describes the logical sequence that you would follow to verify whether the NFS service is running on the server.

1. **Check that the NFS server can reach the clients.**

   ```
   # ping client
   ```

2. **If the client is not reachable, check that the local naming service is running.**

3. **If the naming service is running, check the networking software configuration on the server, for example, the `/etc/netmasks` file and the properties that are set for the `svc:/system/name-service/switch` SMF service.**

4. **Check whether the `rpcbind` daemon is running.**

   ```
   # rpcinfo -u localhost rpcbind
   ```

5. **Check whether the `nfsd` daemon is running.**

   ```
   # rpcinfo -u localhost nfs
   # ps -ef | grep mountd
   ```

Troubleshooting Issues With the Name Service Switch File

Check the current configuration for the name service switch file (`/etc/nsswitch.conf`) as follows:

```
# svccfg -s name-service/switch listprop config
```

Troubleshooting NIS Issues

The following information describes how to debug issues with the Network Information Service (NIS) (pronounced "niss" in this guide). Before attempting to debug a NIS server or client problem, review Chapter 5, "About the Network Information Service" in *Working With Oracle Solaris 11.3 Directory and Naming Services: DNS and NIS*.

This section contains the following topics:

- "Troubleshooting NIS Binding Issues" on page 55
- "Troubleshooting sues That Affect a Single NIS Client" on page 56
- "Troubleshooting Issues That Affect Multiple NIS Clients" on page 59

Troubleshooting NIS Binding Issues

The following are common symptoms of NIS binding problems:

- Messages saying that the `ypbind` daemon cannot find or communicate with a server.
- Messages that say server not responding.

- Messages that say NIS is unavailable.
- Commands on a client limp along in background mode or function much slower than normal.
- Commands on a client hang. Sometimes commands hang, even though the system as a whole seems fine and you can run new commands.
- Commands on a client crash with obscure messages or no messages at all.

Troubleshooting sues That Affect a Single NIS Client

If only one or two clients are experiencing symptoms that indicate NIS binding difficulty, the problems probably are on those clients. However, if many NIS clients are failing to bind properly, the problem probably exists on one or more of the NIS servers. See "Troubleshooting Issues That Affect Multiple NIS Clients" on page 59.

The following are common NIS issues that affect a single client:

- `ypbind` **daemon not running on the client**

  One client has problems, but the other clients on the same subnet are operating normally. On the problem client, run the `ls -l` command on a directory that contains files that are owned by many users (such as `/usr`), including files that are not in the client `/etc/passwd` file. If the resulting display lists file owners who are not in the local `/etc/passwd` file as numbers rather than names, the NIS service is not working on the client.

  These symptoms usually indicate that the client's `ypbind` process is not running. Verify whether the NIS client services are running as follows:

  ```
  client# svcs \*nis\*
  STATE          STIME    FMRI
  disabled       Sep_01   svc:/network/nis/domain:default
  disabled       Sep_01   svc:/network/nis/client:default
  ```

  If the services are in a `disabled` state, log in and become the `root` role, then start the NIS client service as follows:

  ```
  client# svcadm enable network/nis/domain
  client# svcadm enable network/nis/client
  ```

- **Missing or incorrect domain name**

  One client has problems and other clients are operating normally, but the `ypbind` daemon is running on that client. In this case, the client might have an incorrectly set domain.

  Run the `domainname` command on the client to determine which domain name is set:

  ```
  client# domainname
  ```

```
example.com
```

Compare the output with the actual domain name in the `/var/yp` directory on the NIS master server. As shown in the following example, the actual NIS domain is shown as a subdirectory in the `/var/yp` directory:

```
client# ls -l /var/yp
-rwxr-xr-x 1 root Makefile
drwxr-xr-x 2 root binding
drwx------ 2 root example.com
```

If the domain name that is displayed in the output of the `domainname` command on the NIS client is not the same as the server domain name that is listed as a subdirectory in the `/var/yp` directory, the domain name in the `config/domain` property of the `nis/domain` service is incorrect. Reset the NIS domain name. For instructions, see "How to Set a Machine's NIS Domain Name" in *Working With Oracle Solaris 11.3 Directory and Naming Services: DNS and NIS*.

Note - The NIS domain name is case-sensitive.

- **NIS Client not bound to server**

  If your domain name is set correctly and the `ypbind` daemon is running, yet commands still hang, make sure that the client is bound to a server by running the `ypwhich` command. If you have just started the `ypbind` daemon, then run the `ypwhich` command. You might need to run the `ypwhich` command several times. Typically, the first time you run the command, it reports that the domain is not bound. The second time you run the command, it should proceed normally.
- **No NIS server available**

  If your domain name is set correctly and the `ypbind` daemon is running, but you receive messages indicating the NIS client cannot communicate with the server, check the following:

  - Does the client have a `/var/yp/binding/`*domainname*`/ypservers` file that contains a list of servers to bind to? To view the selected NIS servers, use the `svcprop -p config/ypservers nis/domain` command. If not, run the `ypinit -c` command to specify which servers this client should bind to, in order of preference.
  - If the client does have a `/var/yp/binding/`*domainname*`/ypservers` file, are there enough servers listed, in case one or two servers become unavailable? To view the selected NIS servers, use the `svcprop -p config/ypservers nis/domain` command. If not, add additional servers to the list by running the `ypinit -c` command.
  - Do the selected NIS servers have entries in the `/etc/inet/hosts` file? To view the selected NIS servers, use the `svcprop -p config/ypservers nis/domain` command. If these systems are not in the local `/etc/inet/hosts` file, add the servers to the `hosts` NIS maps and rebuild your maps by running the `ypinit -c` or `ypinit -s` command.

    For information, see "Working With NIS Maps" in *Working With Oracle Solaris 11.3 Directory and Naming Services: DNS and NIS*.

    - Is the name service switch set up to check the system's local `hosts` file, in addition to NIS? For more information, see Chapter 2, "About the Name Service Switch" in *Working With Oracle Solaris 11.3 Directory and Naming Services: DNS and NIS*.
    - Is the name service switch set up to check `files` first for `services` and then `rpc`?

- `ypwhich` **displays are inconsistent**

  If you run the `ypwhich` command several times on the same client, the resulting display varies because the NIS server changes. This behavior is normal. The binding of the NIS client to the NIS server changes over time when the network or the NIS servers are busy. Whenever possible, the network becomes stable at the point when all clients receive an acceptable response time from the NIS servers. As long as the client receives the NIS service, it does not matter where the service comes from. For example, one NIS server can receive NIS services from another NIS server on the network.

- **What to do when NIS server binding is not possible**

  In extreme cases where local server binding is not possible, use the `ypset` option with the `ypbind` command to temporarily allow binding to another NIS server on another network or subnet, if available. Note that to use the `-ypset` option, you must start the `ypbind` daemon by using either the `-ypset` or `-ypsetme` option. For more information, see the `ypbind`(1M) man page.

  ```
  # /usr/lib/netsvc/yp/ypbind -ypset
  ```

  For another method, see "Binding to a Specific NIS Server" in *Working With Oracle Solaris 11.3 Directory and Naming Services: DNS and NIS*.

Caution - For security reasons, using the `-ypset` or `-ypsetme` option is not recommended. Only use these options for debugging purposes under controlled circumstances. Using the `-ypset` or `-ypsetme` option can result in serious security breaches. While the daemons are running, anyone can alter NIS server bindings, which can permit unauthorized access to sensitive data. If you must start the `ypbind` daemon by using either of these options, kill the `ypbind` process after you have corrected the problem, then restart it without specifying these options.

Restart the `ypbind` daemon as follows:

```
# svcadm enable -r svc:/network/nis/client:default
```

See the `ypset`(1M) man page.

- `ypbind` **daemon crashes**

  If the `ypbind` daemon crashes almost immediately each time you start it, look for a problem in the `svc:/network/nis/client:default` service log. Check for the presence of the `rpcbind` daemon as follows:

```
% ps -e |grep rpcbind
```

If the rpcbind daemon is not present, does not stay up, or behaves strangely, check the svc:/network/rpc/bind:default log file. For more information, see the rpcbind(1M) and rpcinfo(1M) man pages.

You might be able to communicate with the rpcbind daemon on the problematic client from a system that is functioning normally.

Run the following command from a functioning system:

```
% rpcinfo client
```

If the rpcbind daemon on the problematic system is fine, the following output is displayed:

```
program version netid address service owner
...
100007    3    udp6      ::.191.161          ypbind     1
100007    3    tcp6      ::.135.200          ypbind     1
100007    3    udp       0.0.0.0.240.221     ypbind     1
100007    2    udp       0.0.0.0.240.221     ypbind     1
100007    1    udp       0.0.0.0.240.221     ypbind     1
100007    3    tcp       0.0.0.0.250.107     ypbind     1
100007    2    tcp       0.0.0.0.250.107     ypbind     1
100007    1    tcp       0.0.0.0.250.107     ypbind     1
100007    3    ticlts    2\000\000\000       ypbind     1
100007    2    ticlts    2\000\000\000       ypbind     1
100007    3    ticotsord 9\000\000\000       ypbind     1
100007    2    ticotsord 9\000\000\000       ypbind     1
100007    3    ticots    @\000\000\000       ypbind     1
...
```

If no addresses are displayed (your system will have different addresses), the ypbind daemon was unable to register its services. Reboot the system and run the rpcinfo command again. If the ypbind processes are there and they change each time you attempt to restart the NIS service, reboot the system, even if the rpcbind daemon is running.

Troubleshooting Issues That Affect Multiple NIS Clients

If only one or two clients are experiencing symptoms that indicate NIS binding difficulty, the problems probably are on those clients. See “Troubleshooting sues That Affect a Single NIS Client” on page 56. However, if several NIS clients are failing to bind properly, the problem most likely exists on one or more of the NIS servers.

The following are common NIS issues that can affect multiple clients:

- **The `rpc.yppasswdd` command considers a non-restricted shell that begins with `r` to be restricted**

  To resolve this problem, do the following:

  1. Create a `/etc/default/yppasswdd` file that contains a special string: `"check_restricted_shell_name=1"`.
  2. If the `"check_restricted_shell_name=1"` string is commented out, the `r` check does not occur.

- **Network or servers unreachable**

  NIS can hang if the network or NIS servers are so overloaded that the `ypserv` daemon cannot receive a response back from the client's `ypbind` process within the timeout period. NIS can also hang if the network is down.

  Under both of these circumstances, every client that is on the network experiences the same or similar problems. In most cases, the condition is temporary. The messages usually go away when the NIS server reboots and restarts the `ypserv` daemon, when the load on the NIS servers or the network itself decreases, or when the network resumes normal operations.

- **NIS Server malfunction**

  Make sure the NIS servers are up and running. If you are not physically near the servers, use the `ping` command to determine if the server is reachable.

- **NIS daemons not running**

  If the NIS servers are up and running, try to find a client that is behaving normally and run the `ypwhich` command on it. If the `ypwhich` command does not respond, kill it. Then, become the `root` role on the NIS server and check whether the NIS process is running as follows:

  ```
  # ptree |grep ypbind
  100759 /usr/lib/netsvc/yp/ypbind -broadcast
  527360 grep yp
  ```

  If neither the `ypserv` daemon (NIS server) nor the `ypbind` daemon (NIS client) daemons are running, restart them as follows:

  Restart the NIS client service as follows:

  ```
  # svcadm restart network/nis/client
  ```

  If both the `ypserv` and `ypbind` processes are running on the NIS server, then run the `ypwhich` command. If the command does not respond, the `ypserv` daemon is probably hung and should be restarted.

  On the server, restart the NIS service as follows:

  ```
  # svcadm restart network/nis/server
  ```

- **Servers have different versions of a NIS map**

  Because NIS propagates maps among servers, occasionally you might find different versions of the same map on various NIS servers that are on the network. This version discrepancy is normal and acceptable if the differences do not last too long.

  The most common cause of map discrepancy is when normal map propagation is prevented. For example, a NIS server or router that is located between NIS servers is down. When all NIS servers and the routers between them are running, the `ypxfr` command should succeed.

  If the servers and routers are functioning properly, proceed as follows:

  - Check the `ypxfr` log output. See Example 21, “Logging `ypxfr` Command Output,” on page 62.
  - Check the `svc:/network/nis/xfr:default` log file for errors.
  - Check the control files (`crontab` file and `yupxfr` shell script).
  - Check the `ypservers` map on the master server.

- `ypserv` **process crashes**

  When the `ypserv` process crashes almost immediately and does not stay up even after repeated activations, the debugging process is virtually the same as the debugging process for `ypbind` crashes.

  First, run the following command to see if any errors are being reported:

  ```
  # svcs -vx nis/server
  ```

  Check for the existence of the `rpcbind` daemon as follows:

  ```
  # ptree |grep rpcbind
  ```

  Reboot the NIS server if you do not find the daemon. Otherwise, if the daemon is running, run the following command and look for similar output:

  ```
  # rpcinfo -p ypserver


  program vers     proto port   service
  100000  4        tcp   111    portmapper
  100000  3        tcp   111    rtmapper
  100068 2        udp   32813  cmsd
  ...
  100007  1       tcp   34900 ypbind
  100004 2        udp   731    ypserv
  100004  1        udp   731    ypserv
  100004  1        tcp   732    ypserv
  100004  2        tcp   32772  ypserv
  ```

  In the previous example, the following four entries represent the `ypserv` process:

```
100004  2        udp   731    ypserv
100004  1        udp   731    ypserv
100004         tcp   732    ypserv
100004  2t       tcp   32772  ypserv
```

If there are no entries, and `ypserv` is unable to register its services with `rpcbind`, reboot the system. If there are entries, deregister the service from `rpcbind` before restarting `ypserv`. For example, you would deregister the service from `rpcbind` as follows:

```
# rpcinfo -d number 1
# rpcinfo -d number 2
```

where *number* is the ID number that is reported by `rpcinfo` (`100004` in the preceding example).

EXAMPLE 21 Logging `ypxfr` Command Output

- If a particular slave server has problems updating the maps, log in to that slave server and run the `ypxfr` command interactively.

  If the command fails, a message about why it failed is displayed to enable you to fix the problem. If the command succeeds, but you suspect it has occasionally failed, create a log file on the slave server to enable the logging of messages as follows:

  ```
  ypslave# cd /var/yp
  ypslave# touch ypxfr.log
  ```

  The output of the log file resembles the output of the `ypxfr` command when you run it interactively, with the exception that each line in the log file is time stamped. If you notice unusual ordering in the timestamps that is because it shows each time that the `ypxfr` command was actually run. If copies of `ypxfr` ran simultaneously but took differing amounts of time to finish, each copy might write a summary status line to the log file in a different order than when the command was run. Any pattern of intermittent failure shows up in the log.

  Note - When you have resolved the problem, turn off logging by removing the log file. If you forget to remove it, the file continues to grow without limit.

- Check the `crontab` file and `ypxfr` shell script.

  Inspect the `root crontab` file and check the `ypxfr` shell script that it invokes. Typographical errors in these files can cause propagation problems. Failures to refer to a shell script within the `/var/spool/cron/crontabs/root` file or failures to refer to a map within any shell script can also cause errors.
- Check the `ypservers` map.

Also, make sure that the NIS slave server is listed in the `ypservers` map on the master server for the domain. If it is not listed, the slave server still operates perfectly as a server, but `yppush` does not propagate map changes to the slave server.

- Update the maps on a broken slave server.

  If the NIS slave server problem is not obvious, you can perform a workaround while debugging the problem by using the `scp` or `ssh` command. These commands copy a recent version of the inconsistent map from any healthy NIS server.

  The following example shows how to transfer the problem map:

  ```
  ypslave# scp ypmaster:/var/yp/mydomain/map.\* /var/yp/mydomain
  ```

  In the previous example, the `*` character has been escaped in the command line so that it will be expanded on `ypmaster` instead of locally on `ypslave`.

♦ ♦ ♦ CHAPTER 4

Troubleshooting Profile-Based Network Administration Issues

This chapter provides information for troubleshooting problems that you might encounter when configuring and administering reactive profiles. The reactive mode is most commonly used for notebook PCs and in situations where network conditions change frequently.

For more information about profile-based network configuration, see Chapter 5, "About Administering Profile-Based Network Configuration in Oracle Solaris" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

This chapter contains the following topics:

- "Answers to Common Profile-Based Network Configuration Questions" on page 65
- "Troubleshooting Profile Configuration Issues by Using the `netadm` Command" on page 68
- "Monitoring the Current State of All Network Connections" on page 70
- "Viewing and Setting Profile Properties by Using the `netcfg walkprop` Command" on page 70

Answers to Common Profile-Based Network Configuration Questions

Refer to the following troubleshooting information when using the *reactive mode* for network administration. For information about troubleshooting network administration issues when using the *fixed mode*, see "Answers to Common Network Administration Questions" on page 11. For further details, see "About Network Configuration Modes" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

Question: How do I determine which networking mode my system is using after an installation?

Answer: The networking mode is determined by the profile that is activated during installation. If the `Automatic` profile is activated, you are in the reactive mode. If the `DefaultFixed` profile is activated, you are in the fixed mode. To determine which mode is currently active on your system, use the `netadm list` command as follows:

```
# netadm list
```

Question: My system defaulted to the fixed mode after an installation and the `DefaultFixed` profile is currently active. How do I switch to reactive mode?

Answer: To enable the reactive mode, you need to switch to either the `Automatic` profile or another reactive profile by using the `netadm enable` command. For example, you would enable the `Automatic` profile as follows:

```
# netadm enable -p ncp Automatic
```

Question: What profile must be referenced to not plumb IPv6 and how is this aspect of network configuration managed when using the Automated Installer (AI) or at installation time?

Answer: You can create any profile that does not have an IPv6 address configured. When the profile is enabled, IPv6 is not plumbed. You cannot create new reactive profiles at installation time from an AI manifest. If you want to create a reactive profile after an installation, use the `netcfg` command. See "Configuring Profiles" in *Configuring and Managing Network Components in Oracle Solaris 11.3*. Note that an AI manifest does enable you to choose which profile to activate after the installation after the system reboots.

Question: The naming services settings on my system are not set correctly after installing Oracle Solaris. What should I do?

Answer: For the reactive mode, naming services information and other system-wide settings are specified in a `Location` profile, which is another primary profile type. See "Profile Type Descriptions" in *Configuring and Managing Network Components in Oracle Solaris 11.3* for more details.

The following example shows how to display all of the profiles that are on a system and their states. Use this command to determine the currently active `Location` profile. The second part of the example shows how to initiative an interactive `netcfg` session, then select the currently active `Location` and list its configuration information:

```
# netadm list
TYPE        PROFILE        STATE
ncp         DefaultFixed   disabled
ncp         Automatic      online
ncu:phys    net0           offline
ncu:ip      net0           offline
loc         Automatic      online
loc         NoNet          offline
loc         DefaultFixed   offline

# netcfg
netcfg> select loc myloc
```

```
netcfg:loc:myloc> list
loc:myloc
      activation-mode                 manual
      enabled                         false
      nameservices                    dns
      nameservices-config-file        "/etc/nsswitch.dns"
      dns-nameservice-configsrc       dhcp
netcfg:loc:myloc>
```

In the previous example, DNS is used and the `/etc/nsswitch.dns` file is referenced.

The following example shows how you would modify the existing naming services configuration for a `Location` named `myloc`:

```
# netadm list
TYPE        PROFILE        STATE
ncp         DefaultFixed   disabled
ncp         Automatic      online
ncu:phys    net0           offline
ncu:ip      net0           offline
loc         Automatic      offline
loc         NoNet          offline
loc         DefaultFixed   offline
loc         myloc          online

# netcfg
netcfg> select loc myloc
netcfg:loc:myloc> list
loc:myloc
activation-mode                 manual
enabled                         false
nameservices                    nis
nameservices-config-file        "/etc/nsswitch.nis"
dns-nameservice-configsrc       dhcp
nfsv4-domain
netcfg:loc:myloc> set nameservices=dns
netcfg:loc:myloc> set nameservices-config-file="/etc/nsswitch.dns"
netcfg:loc:myloc> list
        activation-mode                 system
        enabled                         false
        nameservices                    dns
        nameservices-config-file        "/etc/nsswitch.dns"
netcfg:loc:myloc> commit
Committed changes
netcfg:loc:myloc> exit
```

For more information about configuring `Locations`, see “Creating Locations” in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

Question: I cannot start the network administration GUI (formerly NWAM) from the desktop. Can I start the GUI from the command line?

Answer: Use the following command to start the GUI from the command line:

```
% /usr/lib/nwam-manager
```

If the GUI still does not start, make sure that the network administration GUI icon is displayed in the GNOME notification area of your desktop panel. If the icon is not displayed, press the right mouse button to select the Add to Panel... option on the desktop panel, then add the Notification Area to the panel.

Question: I started the network administration GUI from the command line (`/usr/lib/nwam-manager`) as a regular user and received the message, "Another instance is running. This instance will exit now”. The GUI seemed to start, but the icon is not displayed on the desktop. How can I access the GUI?

Answer: If the icon is not displayed in the desktop panel, press the right mouse button to select the Add to Panel... option on the desktop panel, then add the Notification Area to the panel.

Troubleshooting Profile Configuration Issues by Using the `netadm` Command

Use the `netadm list` command with the appropriate options and arguments to display information about the profiles on a system and troubleshoot profile-based network configuration. For complete details see the `netadm`(1M) man page.

When used with no additional options, the `netadm list` command displays all of the profiles that are on a system and their current state:

```
%  netadm list
TYPE        PROFILE       STATE
ncp         DefaultFixed  disabled
ncp         Automatic     online
ncu:phys    net0          online
ncu:ip      net0          online
loc         Automatic     online
loc         NoNet         offline
loc         DefaultFixed  offline
```

To display information about a particular profile, specify the profile's name, as shown in the following example where the `Automatic` profile is specified:

```
% netadm list Automatic
TYPE        PROFILE       STATE
```

```
ncp          Automatic      online
ncu:ip       net1           offline
ncu:phys     net1           offline
ncu:ip       net0           online
ncu:phys     net0           online
loc          Automatic      online
```

To display information about all of the profiles on the system that are of a certain type, use the `netadm list` command with the `-p` option. For example, you would display all of the `Location` profiles on a system as follows:

```
% netadm list -p loc
TYPE         PROFILE        STATE
loc          NoNet          offline
loc          Automatic      online
loc          DefaultFixed   offline
```

In the following example, the `netadm list` command is used with the `-c` option to display configuration details for the currently active profile.

```
% netadm list -c ip
TYPE         PROFILE         STATE
ncu:ip       net0            online
```

The `netadm list -x` command is useful for determining why a network interface might not be configured correctly. Use this command to display the various profiles on a system, their current state, and the reason for being in that state.

For example, if a cable is unplugged, use the `netadm list -x` command to determine if the link state is offline and why, for example, "link is down." Similarly, for duplicate address detection, the output of the `netadm list -x` command shows that the physical link is online (up), but the IP interface is in a maintenance state. In this example, the reason that is given is "Duplicate address detected.".

The following example shows the type of information that you can obtain by using the `netadm list -x` command:

```
% netadm list -x
TYPE        PROFILE        STATE          AUXILIARY STATE
ncp         DefaultFixed   online         active
ncp         Automatic      disabled       disabled by administrator
loc         NoNet          offline        conditions for activation are unmet
loc         DefaultFixed   online         active
loc         Automatic      offline        conditions for activation are unmet
```

After determining the reason a link or an interface is offline, you can then proceed to correct the problem. In the case of a duplicate IP address, you must modify the static IP address that is assigned to the specified interface by using the `netcfg` command. For instructions, see "Setting Property Values for Profiles" in *Configuring and Managing Network Components in Oracle*

Solaris 11.3. After you commit the changes, run the `netadm list -x` command again to check that the interface is configured correctly and its state is showing as `online`.

Another example of why an interface might not be configured correctly is if no known wireless local area networks (WLANs) are available. In this case, the WiFi link's state would be displayed as "offline" and the reason would be indicated as "need WiFi network selection". Alternatively, if a WiFi selection was initially made, but a key is required, the reason would be indicated as "need WiFi key".

Monitoring the Current State of All Network Connections

Use the `netadm show-events` command to listen for and display events that are being monitored by the network management daemon, `nwamd`. This subcommand provides useful information about events that are related to the configuration process for network profiles.

```
% netadm show-events
EVENT                   DESCRIPTION
OBJECT_ACTION           ncp Automatic -> action enable
OBJECT_STATE            ncp Automatic -> state online, active
OBJECT_STATE            ncu link:net0 -> state offline*, (re)initialized but not config
OBJECT_STATE            ncu link:net0 -> state online, interface/link is up
OBJECT_STATE            ncu interface:net0 -> state offline*, (re)initialized but not c
OBJECT_STATE            ncu interface:net0 -> state offline*, waiting for IP address to
PRIORITY_GROUP          priority-group: 0
LINK_STATE              net0 -> state up
OBJECT_STATE            loc NoNet -> state offline*, method/service executing
OBJECT_STATE            loc Automatic -> state offline, conditions for activation are u
OBJECT_STATE            loc NoNet -> state online, active
IF_STATE                net0 -> state flags 1004843 addr 10.153.125.198/24
OBJECT_STATE            ncu interface:net0 -> state offline*, interface/link is up
OBJECT_STATE            ncu interface:net0 -> state online, interface/link is up
IF_STATE                net0 -> state flags 2080841 addr 2002:a99:7df0:1:221:28ff:fe3c:
IF_STATE                net0 -> state flags 2004841 addr 2001:db8:1:2::4ee7/128
OBJECT_STATE            loc Automatic -> state offline*, method/service executing
OBJECT_STATE            loc NoNet -> state offline, conditions for activation are unmet
OBJECT_STATE            loc Automatic -> state online, active
```

Viewing and Setting Profile Properties by Using the `netcfg walkprop` Command

Use the `netcfg walkprop` command to view or change individual or multiple properties of a profile interactively. By using this command, you can display the various properties of a profile (one at a time) and make changes to each property, as needed. When you use the `walkprop` subcommand, you do not need to use the `set` subcommand to set property values.

Note that to view or change a profile's configuration by using the `walkprop` subcommand, you must be in the correct interactive *scope*. See "Configuring Profiles" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

For instructions and examples, see "Setting Property Values for a Profile by Using the walkprop Subcommand" in *Configuring and Managing Network Components in Oracle Solaris 11.3*.

♦ ♦ ♦ CHAPTER 5

Performing Network Diagnostics With the network-monitor Transport Module Utility

This chapter describes how to use the network diagnostics monitoring utility to detect misconfigured network resources and error conditions on your Oracle Solaris system.

This chapter contains the following topics:

Overview of the network-monitor Transport Module Utility

The network-monitor (also referred to as the *monitor* in this chapter) is a fault manager daemon (fmd) transport module utility that you use to perform network diagnostics on your Oracle Solaris 11 system. The utility monitors network resources and reports conditions that might lead to limited or degraded network functionality. When the monitor detects an abnormal network condition, a report (called an *ireport*) is generated. You can retrieve ireports by using the fmdump command. See "Retrieving Reports That Are Generated by the network-monitor Module" on page 75. The monitor does not perform any further diagnosis of the error condition, nor does it perform any additional recovery actions. See the network-diagnostics(4) man page for more details.

The monitor is controlled by property values that are stored in the svc:/network/diagnostics Service Management Facility (SMF) service. See "Controlling the Use of Probes Through the svc:/network/diagnostics SMF Service" on page 77 for more details.

How Datalink MTU Mismatch Errors Are Detected

This error condition occurs when there is a mismatch in the maximum transmission unit (MTU) between two peer datalinks. This type of mismatch can result in dropped frames because one datalink might transmit frames that are larger than the peer datalink can receive. The monitor attempts to detect any datalinks on the local system with MTUs that are set too high. Datalinks are verified upon system start-up and then again when an MTU change occurs.

MTU verification is performed by using either the Link-Layer Discovery Protocol (LLDP) or the Internet Control Message Protocol (ICMP) probe method. A peer system that has the LLDP service enabled can include MTU details in the information exchange. The utility performs MTU verification by extracting peer MTU information. When LLDP information is unavailable, the monitor attempts to verify the MTU by transmitting a series of ICMP probes of different sizes until the datalink MTU is reached. A mismatch is flagged if the utility consistently fails to reach a target by using maximum-sized probes.

How Datalink VLAN ID Mismatch Errors Are Detected

Virtual local area networks (VLANs) are used to group end-system hosts into the same broadcast domain. The hosts on a VLAN might not reside on the same LAN, but even if they do, each host can communicate with another host by using Layer 2 (L2) protocols. Conversely, hosts that reside on the same LAN but different VLANs cannot communicate by using L2 protocols. Each host that resides on a VLAN uses a network interface to communicate with other hosts on the VLAN. VLANs are identified by VLAN identifiers (VIDs) that are exported by LLDP daemons over the relevant network interfaces to their peers. These peers are typically network devices, for example, switches that use a VID to forward data packets to respective hosts.

Hosts might not receive the intended packets if the VIDs are not configured correctly on the relevant network interfaces. The VLAN ID mismatch monitor captures this type of misconfiguration because it verifies the VID information whenever the VLAN information is modified, at system boot time and periodically. If the VID for an interface changes, the appropriate ireport messages are generated. Because the VLAN information is verified by using LLDP packets, the peer host needs to have the LLDP service enabled. See Chapter 6, "Exchanging Network Connectivity Information With Link Layer Discovery Protocol" in *Managing Network Datalinks in Oracle Solaris 11.3*.

Managing the `network-monitor` Module

The `fmadm` command reports the current status of the monitor, which is displayed as `active` when it is performing fault monitoring, as shown in the following example:

```
# fmadm config

  MODULE                   VERSION STATUS  DESCRIPTION
  cpumem-retire            1.1     active  CPU/Memory Retire Agent
  disk-diagnosis           0.1     active  Disk Diagnosis engine
  ...
  network-monitor          1.0     active  Network monitor
```

The `/usr/lib/fm/fmd/plugins/network-monitor.conf` configuration file has an `enable` property that controls the state of the `network-monitor`. To enable the monitor, set the `enable` property to `true` as follows:

```
# enable
#
# Enable/disable the network-monitor.
#
setprop enable true
```

The monitor will be active upon reboot.

Retrieving Reports That Are Generated by the `network-monitor` Module

If a problem with your network occurs, or if you suspect degraded network performance, you can retrieve the ireports that are generated by the `network-monitor` by using the `fmdump` command. These reports include the name of the datalink for which a potential problem was detected.

For example, you can retrieve an ireport by running the following command:

```
# fmdump -IVp -c 'ireport.os.sunos.net.datalink.*'
```

`-I` Specifies to retrieve information reports.

`-V` Specifies to dump the contents of the report.

`-p` Specifies to print the report.

`-c` *class* Specifies the type of event.

The `-c` *class* option can be used to output only those events that match a specific class. Events that are generated by the monitor use the `'ireport.os.sunos.net.datalink'` class prefix.

For more information, see the `fmdump`(1M) man page.

The following example shows the output of an ireport that is posted by the `network-monitor`.

```
nvlist version: 0
     class = ireport.os.sunos.net.datalink.mtu_mismatch
     version = 0x0
     uuid = f3832064-e83b-6ce8-9545-8588db76493d
     pri = high
     detector = fmd:///module/network-monitor
     attr = (embedded nvlist)
     nvlist version: 0
  linkname = net0
  linkid = 0x3
  mtu = 0x1b58
     (end attr)
 __ttl = 0x1
 __tod = 0x513a4f2e 0x279ba218
```

The output of this particular ireport includes the following information:

`class` Specifies the type of error condition. The ireports that are posted by the `network-monitor` module are prefixed by `ireport.os.sunos.net.datalink`. This information is specified with the `-c` option, as shown in the previous example.

`linkname` Specifies the name of the datalink for which the condition was detected.

Viewing Statistics for the `network-monitor` Module With the `fmstat` Command

The `fmstat` command reports fault management module statistics. You can also use the command to view statistics for diagnosis engines and agents that are currently participating in fault management, which includes the `network-monitor` transport module utility.

To view statistics that are kept by a specific fault management module, use the following command syntax:

```
# fmstat -m module
```

where `-m` *module* specifies the fault management module.

For example, you would view statistics for the `network-monitor` as follows:

```
# fmstat -m network-monitor
                NAME VALUE            DESCRIPTION
mtu-mismatch.allocerr 0               memory allocation errors
mtu-mismatch.enabled true             operating status for mtu-mismatch
mtu-mismatch.nprobes 7                number of transmitted ICMP probes
mtu-mismatch.procerr 0                errors processing datalinks
```

```
          sysev_drop 0                number of dropped sysevents
vlan-mismatch.enabled true            operating status for vlan-mismatch
```

For more information about using the `fmstat` command, see the `fmstat`(1M) man page.

To obtain a list of the modules that participate in fault management, use the `fmadm` command. See the `fmadm`(1M) man page.

Controlling the Use of Probes Through the `svc:/network/diagnostics` SMF Service

The types of diagnostics that the monitor performs are controlled by values that are stored in the `policy/allow_probes` property of the `svc:/network/diagnostics` SMF service. This property determines whether probe packets can be transmitted by diagnostic agents for the purpose of monitoring and reporting network problems. To set or change values for this property, use the `svccfg` command. Valid values are `true` and `false`. By default, the property is set to `true`. See the `svccfg`(1M) and `network-diagnostics`(4) man pages for more information.

EXAMPLE 22 Disabling the Transmission of Diagnostic Probes

The following example shows how you would disable the transmission of diagnostic probes by setting the `policy/allow_probes` property of the `svc:/network/diagnostics` SMF service to `false`. You must refresh the SMF service after changing the default value for the changes to take effect.

```
# svccfg -s network/diagnostics setprop policy/allow_probes = boolean: false
# svccfg -s network/diagnostics refresh
```

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