

Strategies for Network Administration in Oracle® Solaris 11.4

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Using This Documentation

- **Overview** – Provides information about networking strategies and describes how to use networking features to administer network configuration in the Oracle Solaris operating system (OS).
- **Audience** – System administrators.
- **Required knowledge** – Basic understanding of network administration concepts and practices.

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Summary of Oracle Solaris Network Administration

This chapter outlines network features supported in Oracle Solaris. It contains the following topics:

- “About Network Administration in Oracle Solaris”
- “About the Oracle Solaris Network Protocol Stack”
- “Network Administration by Functional Area”
- “Comparing Networking Features”

To prepare for network configuration, see [Planning for Network Deployment in Oracle Solaris 11.4](#) and “Required Information to Configure an Oracle Solaris System on the Network” in [Configuring and Managing Network Components in Oracle Solaris 11.4](#).

About Network Administration in Oracle Solaris

As a network administrator, you are responsible for establishing and maintaining reliable, secure, and efficient data communications in the data center.

Setting up a network initially consists of assigning IP addresses on the systems' network interfaces and then configuring naming services. Naming services stores information such as user names, passwords, host names and addresses, and so on to manage network access.

Beyond a basic configuration, you would also use additional Oracle Solaris features to further optimize the network for high availability, security, performance, and so on.

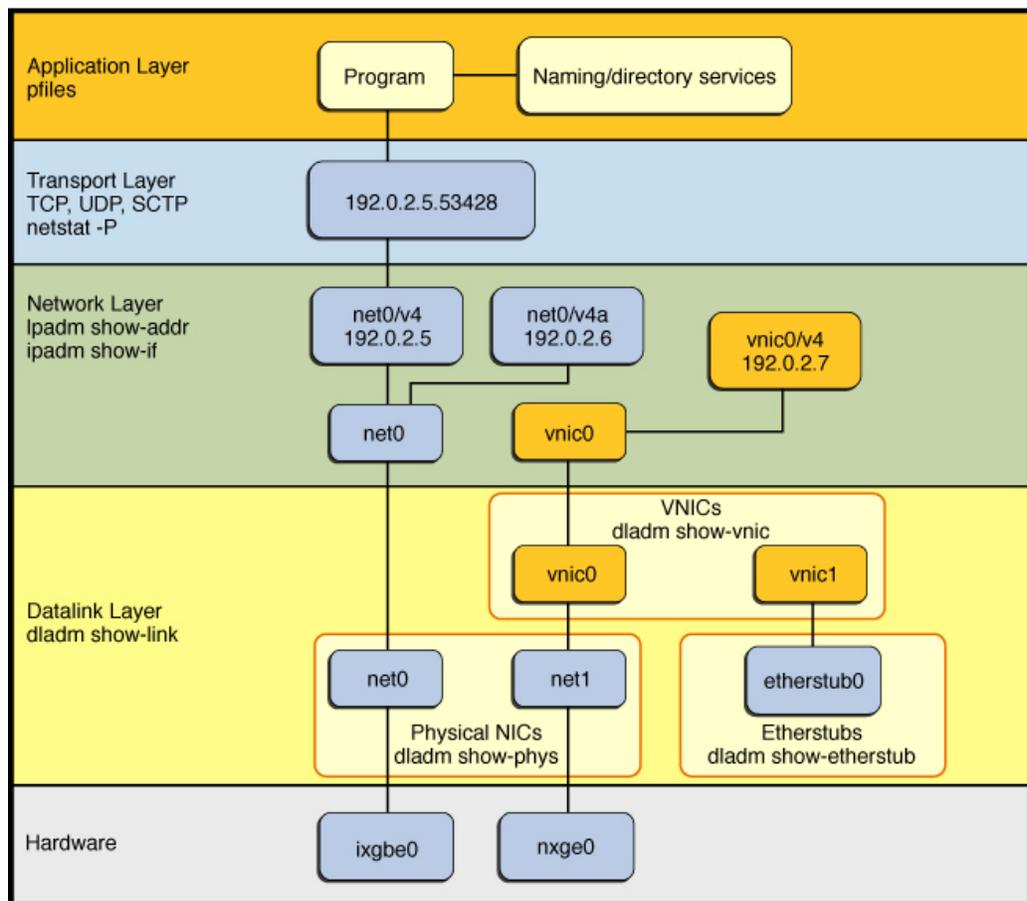
The next sections provide an overview of these network features that are designed to address the complexities of modernized network environments. They enable you to use a more modular and layered approach to addressing the various aspects of network configuration.

About the Oracle Solaris Network Protocol Stack

The following figure shows the layers of the Oracle Solaris network protocol stack. This information can help you determine which networking strategies to adopt at your site. By being familiar with the layers, you can also better detect networking connectivity problems, track and diagnose sources of performance issues, and troubleshoot configuration issues.

Note the figure shows only those layers of the stack that pertain to the various networking features described in this document.

FIGURE 1 Physical and Virtual Network Administration Within the Network Protocol Stack



The following table further describes which layer of the stack each feature is administered. Some features are administered at more than one layer of the stack.

TABLE 1 Networking Features by Network Protocol Stack Layer

Network Protocol Stack Layer	Feature or Technology
Transport (L4)	<ul style="list-style-type: none"> ■ Firewalls ■ Flows ■ Pluggable congestion control ■ Socket filtering
Protocol or network (L3)	<ul style="list-style-type: none"> ■ DHCP ■ Flows ■ IP interfaces and IP addresses ■ IP tunnels ■ IP network multipathing (IPMP) ■ Integrated Load Balancer (ILB) ■ Routing ■ Virtual network interfaces (VNIs) ■ Virtual Router Redundancy Protocol (VRRP) ■ Virtual eXtensible area network (VXLANS)
Datalink (L2)	<ul style="list-style-type: none"> ■ Aggregations (Datalink Multipathing (DLMP) and trunking) ■ Edge Virtual Bridging (EVB) ■ Flows ■ Link Layer ■ Physical datalinks ■ Network virtualization features: <ul style="list-style-type: none"> ■ Data Center Bridging (DCB) ■ Etherstubs ■ Elastic Virtual Switch (EVS) ■ Virtual switches ■ Virtual local area networks (VLANs) ■ Virtual network interface cards (VNICs) ■ Virtual eXtensible area network (VXLANS)

Network Administration by Functional Area

In Oracle Solaris, networking technologies are designed to meet specific needs in areas such as the following:

- High availability
- Network security
- Network storage

- Network virtualization
- Observability, monitoring, and debugging
- Performance and efficiency
- Resource management

The following table describes these technologies, the areas where they function, and the basic commands that are used.

TABLE 2 Networking Features by Functional Area

Feature	Functional Area	Administrative Interface	For More Information
Aggregations (Datalink Multipathing (DLMP) and trunking)	High availability	dladm (create-aggr, delete-aggr, modify-aggr, add-aggr, remove-aggr)	Chapter 2, “Configuring High Availability by Using Link Aggregations” in <i>Managing Network Datalinks in Oracle Solaris 11.4</i>
Bridging protocols: <ul style="list-style-type: none"> ■ Spanning Tree Protocol (STP) ■ TRansparent Interconnection of Lots of Links (TRILL) 	High availability, network virtualization	dladm (create-bridge, delete-bridge, modify-bridge, add-bridge, remove-bridge, show-bridge)	Chapter 6, “Administering Bridging Features” in <i>Managing Network Datalinks in Oracle Solaris 11.4</i>
Data Center Bridging (DCB)	Network storage, performance	lldpadm, dladm	Chapter 8, “Managing Converged Networks by Using Data Center Bridging” in <i>Managing Network Datalinks in Oracle Solaris 11.4</i>
Etherstubs	Network virtualization	dladm (create-etherstub, delete-etherstub, show-etherstub)	“How to Configure VNICs and Etherstubs” in <i>Managing Network Virtualization and Network Resources in Oracle Solaris 11.4</i>
Edge Virtual Bridging (EVB)	Network virtualization	dladm	Chapter 4, “Using Edge Virtual Bridging” in <i>Managing Network Virtualization and Network Resources in Oracle Solaris 11.4</i>
Elastic Virtual Switch (EVS)	Network virtualization	evsadm, evsstat, dladm	Chapter 6, “Administering Elastic Virtual Switches” in <i>Managing Network Virtualization and Network Resources in Oracle Solaris 11.4</i>

Feature	Functional Area	Administrative Interface	For More Information
Firewalls	Security	Packet filtering with <code>pfconf</code> and <code>pfctl</code> ; filtering rules	Chapter 4, “Oracle Solaris Firewall” in <i>Securing the Network in Oracle Solaris 11.4</i>
Flows	Observability, resource management, security	<code>flowadm</code> , <code>flowstat</code>	“Features for Managing Network Resources in Oracle Solaris” on page 21
Integrated Load Balancer (ILB)	Performance	<code>ilbadm</code> (<code>create-servergroup</code> , <code>add-server</code> , <code>delete-servergroup</code> , <code>enable-server</code> , <code>disable-server</code> , <code>show-server</code> , <code>show-servergroup</code> , <code>remove-server</code>)	“Features of ILB” in <i>Configuring an Oracle Solaris 11.4 System as a Router or a Load Balancer</i>
IP network multipathing (IPMP)	High availability	<code>ipadm</code> (<code>create-ipmp interface</code> , <code>delete-ipmp interface</code> , <code>add-ipmp interface</code> , <code>remove-ipmp interface</code>)	Chapter 2, “About IPMP Administration” in <i>Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.4</i>
IP tunnels	IP connectivity	<code>dladm</code> (<code>create-iptun</code> , <code>modify-iptun</code> , <code>delete-iptun</code> , <code>show-iptun</code>), <code>ipadm</code> (to create the IP address over the tunnel)	Chapter 4, “About IP Tunnel Administration” in <i>Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.4</i>
Link Layer Discovery Protocol (LLDP)	Observability, network storage, network virtualization	<code>lldpadm</code>	Chapter 7, “Exchanging Network Connectivity Information With Link Layer Discovery Protocol” in <i>Managing Network Datalinks in Oracle Solaris 11.4</i>
NIC Rings	Resource management	<code>dladm</code>	“Managing NIC Rings” in <i>Managing Network Virtualization and Network Resources in Oracle Solaris 11.4</i>
Pluggable congestion control	Performance	<code>ipadm set-prop property</code>	“Implementing Traffic Congestion Control” in <i>Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.4</i>
Routing	IP connectivity	<code>route</code> , <code>netstat -r</code> , and with SMF commands	Chapter 1, “Introduction to Routers” in <i>Configuring an Oracle Solaris 11.4</i>

Feature	Functional Area	Administrative Interface	For More Information
			System as a Router or a Load Balancer
Socket filtering	Security	soconfig (-F)	soconfig(8) man page
Virtual local area networks (VLANs)	Network virtualization	dladm (create-vlan, modify-vlan, delete-vlan, show-vlan)	Chapter 4, “Configuring Virtual Networks by Using Virtual Local Area Networks” in <i>Managing Network Datalinks in Oracle Solaris 11.4</i>
Virtual network interfaces (VNIs)	IP connectivity	ipadm (create-vni, delete-vni)	“Configuring a Virtual Network Interface” in <i>Managing Network Virtualization and Network Resources in Oracle Solaris 11.4</i>
Virtual network interface cards (VNICs)	Network virtualization	dladm (create-vnic, modify-vnic delete-vnic, show-vnic)	“How to Configure VNICs and Etherstubs” in <i>Managing Network Virtualization and Network Resources in Oracle Solaris 11.4</i>
Virtual Router Redundancy Protocol (VRRP)	High availability	dladm and vrrpadm	Chapter 3, “Using Virtual Router Redundancy Protocol” in <i>Configuring an Oracle Solaris 11.4 System as a Router or a Load Balancer</i>
Virtual eXtensible area network (VXLANS)	Network virtualization	dladm (create-vxlan, show-vxlan, delete-vxlan)	Chapter 3, “Configuring Virtual Extensible Local Area Networks” in <i>Managing Network Virtualization and Network Resources in Oracle Solaris 11.4</i>

For a comparison of features between link aggregation and IPMP, see [Appendix B, “Link Aggregations and IPMP: Feature Comparison,” in *Managing Network Datalinks in Oracle Solaris 11.4*](#).

For a comparison of trunk and DLMP aggregations, see [Appendix A, “Comparison: Trunk Aggregations and DLMP,” in *Managing Network Datalinks in Oracle Solaris 11.4*](#).

For the list of differences between Layer 2 and Layer 3 VRRP, see [“Comparing Layer 2 and Layer 3 VRRP” in *Configuring an Oracle Solaris 11.4 System as a Router or a Load Balancer*](#).

Comparing Networking Features

VLAN, PVLAN, and VXLAN are configurations that enable you to isolate network traffic. A VLAN is a subdivision of a local area network at the datalink layer of the stack. A PVLAN enables you to divide a VLAN into sub-VLANs. A VXLAN enables you to create a Layer 2 network on top of a Layer 3 network.

The following table compares VLAN, PVLAN, and VXLAN technologies with respect to how you might want to isolate networks on your site.

TABLE 3 Feature Comparison: VLAN, PVLAN, and VXLAN

Feature	VLAN	PVLAN	VXLAN
When to use	In local area networks that use switch technology	When VLANs are required to share the same IP subnet for better isolation	In geographically dispersed data centers or in a cloud environment
Network technology type	Layer 2	Layer 2	Overlay (Layer 2 over UDP)
Number of isolated networks	Up to 4094 with 12 bit VLAN IDs	More than regular VLANs with 12 bit VLAN IDs	Up to 16 million with 24 bit VXLAN IDs
Level of isolation	Divides the network into subnetworks without having to add resources to the physical network environment	Divides a regular VLAN (primary) into sub-VLANs (secondary)	Creates a Layer 2 network over a Layer 3 network
Use with virtualization (zones)	Enables creation of multiple virtual networks within a single network unit	Enables network isolation between zones which are in the same VLAN without introducing any additional VLANs	Enables creation of multiple virtual networks between different hosts on a Layer 3 network
Broadcast domain	Single broadcast domain partitioned by VLAN segments	Partitions one broadcast domain into multiple subdomains	Single broadcast domain partitioned by VXLAN segments
Overlapping IP addresses	Not supported	Not supported	Supported if the IP addresses are unique within a VXLAN segment
Enabling IP multicast	Not required	Not required	Required
Configuration tool	dladm create-vlan dladm create-vnic	dladm create-vlan dladm create-vnic	dladm create-vxlan

Network Virtualization in Oracle Solaris

Server virtualization and the adoption of cloud architectures have become more mainstream in the IT industry. This development has shifted focus towards a deployment model that uses network virtualization to support distribution of workloads and sharing of network resources among multiple virtual machines (VMs). Thus, network virtualization is playing an even more critical role in the overall network administration strategy in Oracle Solaris.

This chapter covers the following topics:

- “Summary of Network Virtualization Features”
- “Uses of Virtualization in Oracle Solaris”

Summary of Network Virtualization Features

Networking technologies of Oracle Solaris work hand in hand with other operating system features or subsystems to create a virtualized environment. For example, you combine the configuration of vNICs and the deployment of Oracle Solaris zones to create virtual networks within a single system.

Oracle also offers virtualization products for servers, such as Oracle VM Server for x86 and Oracle VM Server for SPARC. With these, you can virtualize and manage your full hardware and software stack. For documentation about these products and how you might use them, see <https://docs.oracle.com/en/virtualization/>.

The Oracle Enterprise Manager family of products provides comprehensive enterprise management solutions to meet needs in complex IT environments. See <https://docs.oracle.com/en/enterprise-manager/> for more information.

Uses of Virtualization in Oracle Solaris

With Oracle Solaris network virtualization features, you can achieve goals such as the following:

- **Workload consolidation**

Consolidating multiple workloads into a single system is a common practice in large deployments.

- **Private virtual networks**

Virtualization enables you to create private virtual networks for the following purposes:

- **Security** – Create a private virtual network behind a virtual firewall to better insulate virtual machines from the physical network and also to better insulate the physical network from the virtual network.
- **Testing and simulation** – Create a private virtual *network within a box* to test different features or simulate the behavior of a feature under a given network load before actually implementing that new feature or network configuration.
- **Network consolidation** – Consolidate multiple hosts, network functions, and various network devices such as routers, firewalls, load balancers, and so on, within a box.

- **Cloud networking**

A *cloud architecture* is a network administration approach that uses a *utility computing model* to deploy workloads. This architecture is highly dynamic where multiple tenants share the same cloud and therefore must be isolated from one another. Cloud administrators can easily provision, control, and observe per-tenant virtual networks that are isolated and secure.

Network Resource Management in Oracle Solaris

In a virtualized environment where resources are shared, control over what each virtual machine is entitled must be enforced, such as setting bandwidth limits on the certain VNICs. Proper allocation of resources to clients leads to efficiency in the use of these resources.

Features for Managing Network Resources in Oracle Solaris

To manage resources, you set resource related datalink properties. Because you use the same commands to configure both traditional or physical and virtual networks, network administration is simplified.

In general, managing network resources enables you to accomplish the following:

- Provision a network
- Establish service level agreements
- Bill clients
- Diagnose security problems

Rings and flows are network features particularly designed for resource management.

- NIC rings improve system performance and manage network resources. *Receive (Rx) rings* and *Transmit (Tx) rings* are hardware resources through which the system receives and sends network packets, respectively. If a NIC supports ring allocation, its transmit and receive rings can be dedicated for use by datalinks. By managing and allocating rings according to the network traffic, you can increase the efficiency of the system for processing packets.
- Flows are a way of categorizing packets to further control how resources are used to process those packets. Network packets are categorized according to an attribute. Packets that share an attribute constitute a flow and are labeled with a specific *flow name*. You can then assign specific resources to the flow.

For instructions, see [Chapter 7, “Managing Network Resources”](#) in *Managing Network Virtualization and Network Resources in Oracle Solaris 11.4*. You can also see the `dladm(8)` and `flowadm(8)` man pages.

Network Security in Oracle Solaris

Oracle Solaris adopts a defense-in-depth strategy to ensure that your data center is protected and secure. Security is enforced in all fronts, including the network, so that unauthorized access is immediately rejected, and any breach in one area is immediately controlled to prevent further incursions in your site. For a summary of Oracle Solaris features on security, see [Security: An Oracle Solaris Differentiator](#).

Features for Managing Network Security in Oracle Solaris

The following table briefly describes several key network security features in Oracle Solaris.

TABLE 4 Oracle Solaris Network Security Features

Features and Methods Used to Secure the Network	Description	For More Information
Cryptography for Secure Shell and web applications	The OpenSSL object module provides cryptography for Secure Shell and web applications. OpenSSL is the Open Source toolkit for the Secure Sockets Layer (SSL v2/v3) and Transport Layer Security (TLS v1) protocols, and provides a cryptography library. In Oracle Solaris, Secure Shell and the Apache HTTP Server can use and benefit from OpenSSL.	“Introduction to FIPS 140-2 Level 1 Cryptography in Oracle Solaris” in Using a FIPS 140-2 Enabled System in Oracle Solaris 11.4
Link protection	The link protection mechanism provides protection from basic threats to a network, for example, IP, DHCP, and MAC spoofing, as well as L2 frame spoofing and Bridge Protocol Data Unit (BPDU) attacks.	Chapter 1, “Using Link Protection in Virtualized Environments” in Securing the Network in Oracle Solaris 11.4
Network parameter tuning	Tuning network parameters ensures that the network is secure and prevents malicious attacks, for	Chapter 2, “Tuning Your Network” in Securing the Network in Oracle Solaris 11.4

Features and Methods Used to Secure the Network	Description	For More Information
	example, various types of denial-of-service (DoS) attacks.	
OpenBSD Packet Filter (PF)	PF is a network firewall that captures and evaluates inbound packets for entry to and exit from the system. PF provides stateful packet inspection. PF can match packets by IP address and port number, as well as the receiving network interface.	Chapter 5, “Configuring the Firewall in Oracle Solaris” in <i>Securing the Network in Oracle Solaris 11.4</i>
IP Security Architecture (IPsec)	IPsec provides cryptographic protection for IP datagrams in IPv4 and IPv6 network packets. IPsec includes several components that provide protection for IP packages by authenticating or encrypting the packets.	Chapter 7, “Configuring IPsec” in <i>Securing the Network in Oracle Solaris 11.4</i>
Internet Key Exchange (IKE)	The IKE feature automates key management for IPsec. IKE easily scales to provide a secure channel for a large volume of traffic.	Chapter 9, “Configuring IKEv2” in <i>Securing the Network in Oracle Solaris 11.4</i>
Port-based authentication	You use the IEEE 802.1X feature to restrict the use of IEEE 802 LAN service access points (ports) and to secure communications between authenticated devices. Support is limited to wired datalinks only.	“Administering Port-Based Authentication on Datalinks” in <i>Securing the Network in Oracle Solaris 11.4</i>

For additional information, see also security related documentation in the [Securing the Oracle Solaris Operating System](#) shelf of the Oracle Solaris 11.4 documentation.

◆◆◆ CHAPTER 5

Network Configuration Scenarios

This chapter provides a few scenarios that show how you can avail of different features of Oracle Solaris to configure your network. The scenarios are not exhaustive nor exclusive of each other. You can combine any number of Oracle Solaris networking technologies illustrated in the scenarios to build a network that meets your goals.

This chapter contains the following topics:

- [“Basic Network Configuration Scenario”](#)
- [“Configuring for High Availability”](#)
- [“Creating a Virtual Network Stack for Cloud Environments”](#)
- [“Combining Network Virtualization With Oracle VM Server for SPARC”](#)

Basic Network Configuration Scenario

A basic network setup consists of a configuration of datalinks, IP interfaces, and network services. Configuring IP addresses enables network communication, while configuring network services controls access to the networks by users.

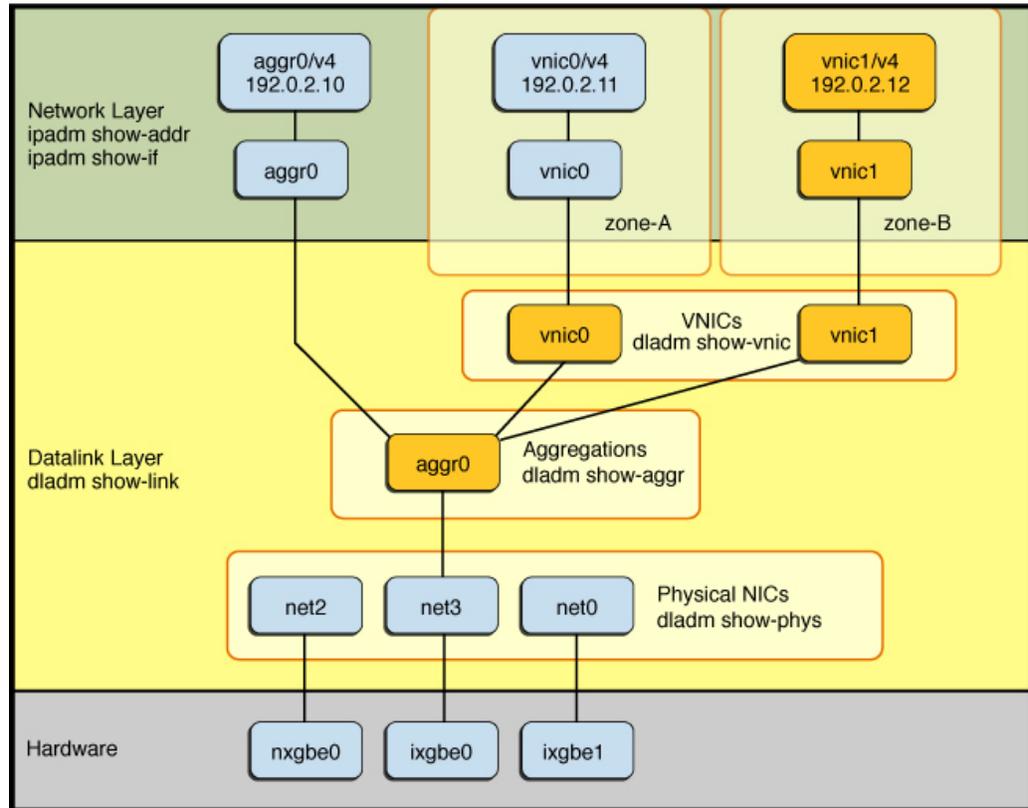
For reference, see the following resources in [Configuring and Managing Network Components in Oracle Solaris 11.4](#):

- [Chapter 3, Configuring and Administering IP Interfaces and Addresses in Oracle Solaris](#)
- [Chapter 4, Administering Naming and Directory Services on an Oracle Solaris System](#)

Configuring for High Availability

The following figure shows how you might combine the use of link aggregations with VNICs to improve network availability in a virtualized environment. The scenario includes the deployment of Oracle Solaris zones.

FIGURE 2 Combining the Use of Aggregations With VNICs



In the figure, multiple physical datalinks, `net0`, `net2`, and `net3`, are combined into a single link aggregation, `aggr0`, which is then assigned an IP address.

The aggregation is further used as the underlying link for configured VNICs that are used by two non-global zones.

This particular configuration makes the VNICs highly available because any failures of the underlying physical NICs that occur are automatically handled by the link aggregation layer and are transparent to the zones.

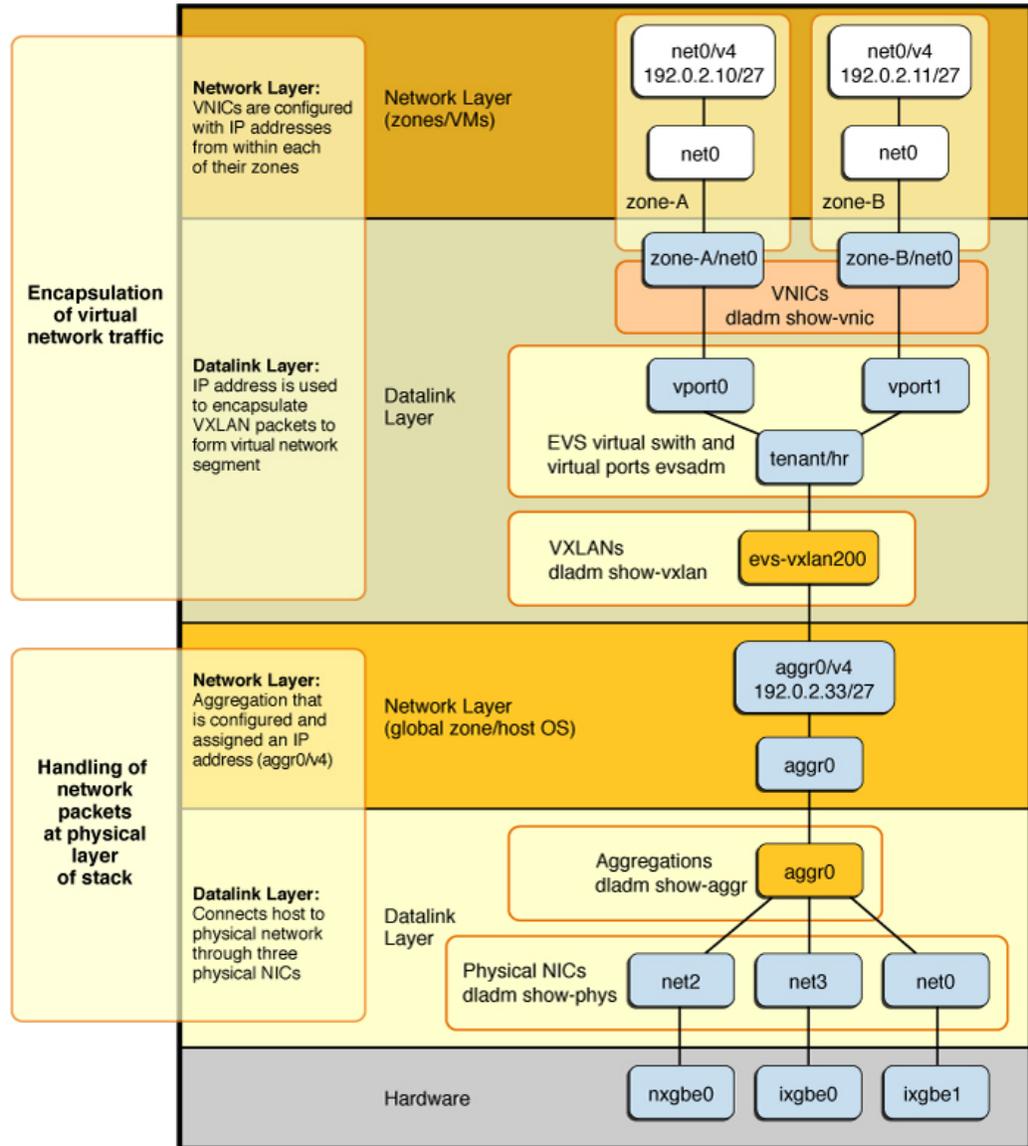
For reference, see the following resources:

- [Chapter 2, “Configuring High Availability by Using Link Aggregations” in *Managing Network Datalinks in Oracle Solaris 11.4*](#)
- [“Building Virtual Networks” in *Managing Network Virtualization and Network Resources in Oracle Solaris 11.4*](#)
- [Creating and Using Oracle Solaris Zones](#)

Creating a Virtual Network Stack for Cloud Environments

The following figure shows how you might create a highly available and integrated virtual network stack for cloud environments by using aggregations, VNICs, VXLANs, and an EVS switch.

FIGURE 3 Combining Aggregations With VXLANs, VNICs, and an EVS Switch



The scenario as illustrated uses VXLANs, which provide virtual network segments that are encapsulated within IP packets. Consequently, the datalink and network layers therefore twice in the stack: one to show the handling of packets at the physical layer and the second to show the encapsulated virtual network traffic within these layers of the stack.

The figure shows the following configuration details:

1. On the hardware layer, multiple physical NICs (`net0`, `net2`, and `net3`) are aggregated to create `aggr0`.
2. The aggregation is configured with an IP address, `aggr0/v4` (`192.0.2.33/27`).
3. An EVS virtual switch `tenant/hr` is created on top of the IP interface `aggr0`. In this figure, EVS is configured to use a VXLAN.

The new `vxlان0` datalink is connected to a virtual L2 network that overlays the IP network.

4. Assuming that EVS assigned the virtual switch a VXLAN ID of 200, EVS automatically creates a VXLAN datalink called `evs-vxlان200`, which is associated with the `tenant/hr` virtual switch.
5. The EVS switch has two virtual ports (`vport0` and `vport1`), which are connected to two VNICs that are used by two zones. The VNICs appear in the zone as datalinks named `net0` and are visible from the global zone as `zone-A/net0` and `zone-B/net0`.

For reference, refer to the following resources:

- [Chapter 2, “Configuring High Availability by Using Link Aggregations” in *Managing Network Datalinks in Oracle Solaris 11.4*](#)
- [Chapter 6, “Administering Elastic Virtual Switches” in *Managing Network Virtualization and Network Resources in Oracle Solaris 11.4*](#)
- [Managing Network Virtualization and Network Resources in Oracle Solaris 11.4](#)

Combining Network Virtualization With Oracle VM Server for SPARC

The following scenario combines network virtualization features with Oracle VM Server for SPARC to create a multilevel virtual network that parallels a cloud environment. This deployment method provides highly efficient, enterprise-class virtualization capabilities for Oracle's SPARC T-Series servers and supported M-Series servers.

This scenario assumes that you are running an Oracle VM Server for SPARC version that supports Oracle Solaris 11.4.

At a high level, the objective of this scenario is to set up a SPARC based system into multiple Oracle Solaris VM Server guest domains, where each domain corresponds to a node within a cloud environment. You can deploy per-tenant workloads as zones within these Oracle VM Server for SPARC guest domains.

Configuring network virtualization features in this way enables you to build an entire cloud within a single SPARC based system. You can also use this type of configuration to integrate a SPARC based system into a larger cloud environment, where the system appears as a set of nodes within that environment.

Combining network virtualization features with Oracle VM Server for SPARC parallels a traditional cloud in the following ways:

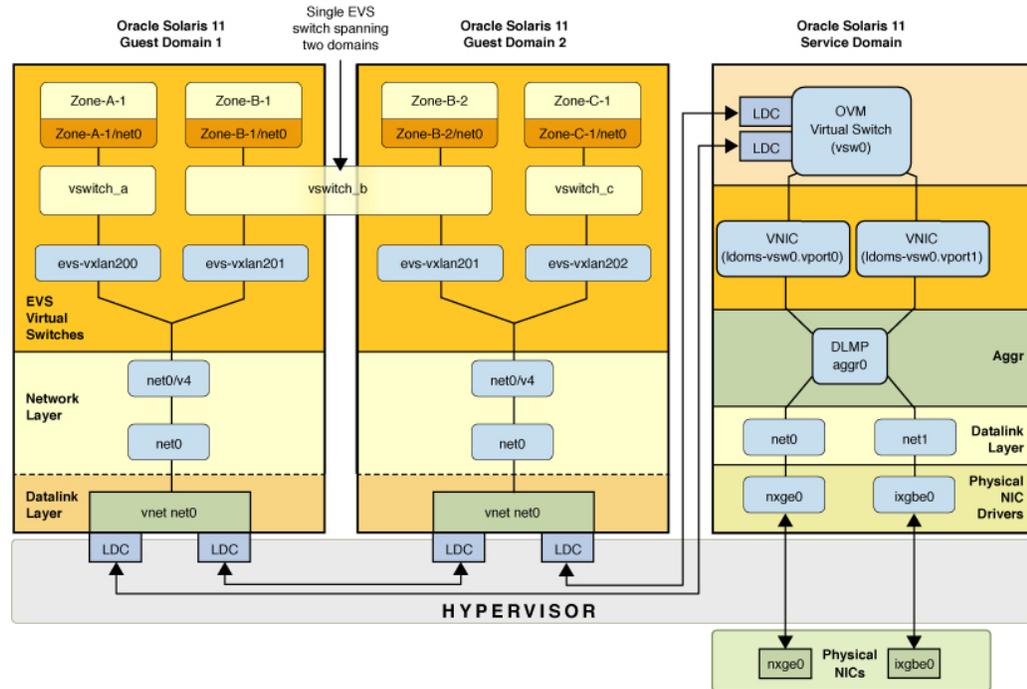
- Compute nodes are implemented as Oracle VM Server for SPARC guest domains
- Compute nodes communicate with each other through the virtual network infrastructure that is provided by Oracle VM Server for SPARC, and Oracle Solaris running on the service domain
- The vnet driver instances (a private virtual network assigned to one of the tenants of a shared infrastructure) that are within each guest domain correspond to a physical NIC within a physical compute node

This type of configuration has the following benefits:

- Provides more flexibility by enabling you to run smaller domains that you can upgrade individually without affecting other workloads that are running on the system
- Takes advantage of SPARC Reliability, Availability, and Serviceability (RAS) features
- Uses a faster virtual network for communication between nodes instead of relying on a physical infrastructure

The following figure illustrates the two distinct levels of network virtualization that you create with this configuration.

FIGURE 4 Network Virtualization Configured on Oracle VM Server for SPARC



On the first level, you configure network virtualization features that are supported by Oracle VM Server for SPARC. This part of the network virtualization combines Oracle VM Server for SPARC configuration with the Oracle Solaris OS that is running on the service domain. The vnet configuration takes place at this first level of virtualization. Because the configuration only relies upon IP connectivity from the guest domains, no additional support from Oracle VM Server for SPARC is required for the configuration on the second network virtualization level to work.

On the second level, EVS is used to create elastic virtual switches across the guest domains. EVS is configured to use the vnet interfaces as uplinks. VXLAN datalinks are automatically created by EVS from each guest domain and then used to encapsulate the traffic of the individual elastic virtual switches.

The figure represents the following configuration details:

- Two physical NICs, nxge0 and ixgbe0, which are directly assigned to the service domain where they are represented by datalinks net0 and net1

- To provide high availability in case of failure of the physical NICs, `net0` and `net1` in the service domain are grouped into the DLMP aggregation, `aggr0`
- The aggregation, `aggr0`, is then connected to an Oracle VM Server for SPARC virtual switch in the service domain named `vsw0`

Two VNICs, `ldoms-vsw.vport0` and `ldoms-vsw.vport1`, are automatically created by `vsw0`, with each VNIC corresponding to the Oracle VM Server for SPARC `vnet` instances within the guest domains
- The `vsw0` and the `vnet` instances communicate with each other through the hypervisor by using Logical Domain Channels (LDCs)
- Each guest uses its instance of the `vnet0` driver, which appears in the guest domain as a datalink, `net0`, for the purpose of communicating with other guest domains and the physical network
- In each guest domain, the `vnet` datalinks for `net0` are configured with the IP interface `net0/v4`
- Each guest domain is an EVS compute node, with three EVS switches, `vswitch_a`, `vswitch_b`, and `vswitch_c`, that are configured from the EVS controller (not shown in the figure)
- EVS is configured to use a VXLAN as its underlying protocol. For each guest domain that uses an elastic virtual switch, EVS automatically configures a VXLAN datalink. These VXLAN datalinks are named `evs-vxlanid`, where `id` is the VXLAN ID that is assigned to the virtual switch
- In the guest domains, Oracle Solaris Zones are configured to run the tenants' workload. Each zone is connected through a VNIC and a virtual port (not shown in the figure) to one of the EVS switches
- The zones, `Zone-B-1` and `Zone-B-2`, belong to the same user and are running on two different guest domains. The EVS switch, `vswitch_b`, is instantiated on both guest domains. From the two zones' perspective, it appears as if each zone is connected to a single Ethernet segment that is represented by `vswitch_b` and isolated from the other virtual switches
- EVS automatically creates the VXLAN datalinks that are needed by the various elastic virtual switches. For example, for `vswitch_b`, EVS automatically creates a VXLAN datalink named `evs-vxlan201` on each of the guest domains

For reference, see the following resources:

- [Managing Network Virtualization and Network Resources in Oracle Solaris 11.4](#)
- [Creating and Using Oracle Solaris Zones](#)
- [Oracle VM Server for SPARC \(https://docs.oracle.com/en/virtualization/oracle-vm-server-sparc/\)](https://docs.oracle.com/en/virtualization/oracle-vm-server-sparc/)

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