FUJITSU Software
PRIMECLUSTER
Global Link Services

Configuration and Administration Guide 4.5 Redundant Line Control Function for Virtual NIC Mode

Oracle Solaris

Preface

This document describes the functions, installation, and operation procedure of Redundant Line Control Function for Virtual NIC Mode that is a function of Global Link Services (hereinafter GLS).

Who should use this document

This document is intended for system administrators responsible for the installation and administration of Redundant Line Control Function by using the virtual NIC mode. It is premised that they understand the network services of Oracle Solaris and the PRIMECLUSTER which is a basic function of the cluster control, and the description of some terms may be omitted to avoid lengthy expression.

Abstract

The document consists of the following chapters, appendices, and a glossary:

Chapter 1 Overview

This chapter describes the concept of the redundant line control function using the virtual NIC mode.

Chapter 2 Functions

This chapter describes the functions provided in the virtual NIC mode.

Chapter 3 Environment configuration

This chapter describes how to set up and configure the virtual NIC mode.

Chapter 4 Operation

This chapter describes how to operate the virtual NIC mode.

Chapter 5 Maintenance

This chapter describes how to collect troubleshooting information and take corrective action in the event of a virtual NIC mode failure.

Chapter 6 DR (Dynamic Reconfiguration) function/PHP (PCI Hot Plug) function

This chapter describes how to replace a system board or PCI card using DR or PHP function.

Appendix A Command Reference

This chapter describes how to use commands provided in the virtual NIC mode.

Appendix B Messages and corrective actions

This appendix describes messages of the virtual NIC mode.

Appendix C Changes from previous versions

This appendix discusses changes to the GLS specification. It also suggests some operational guidelines.

Glossary

This section explains terms used in this manual.

Related Documentation

Please refer to the following manuals if necessary:

- PRIMECLUSTER Global Link Services Configuration and Administration Guide: Redundant Line Control Function

- PRIMECLUSTER Concepts Guide

- PRIMECLUSTER Installation and Administration Guide

- FJQSS (Information Collection Tool) User's Guide

- Fujitsu SPARC M12 and Fujitsu M10/SPARC M10 XSCF Reference Manual

- Fujitsu SPARC M12 and Fujitsu M10/SPARC M10 Domain Configuration Guide

- Fujitsu M10-1/SPARC M10-1 Service Manual

- Fujitsu M10-4/Fujitsu M10-4S/SPARC M10-4/SPARC M10-4S Service Manual

- Fujitsu SPARC M12-1 Service Manual

- Fujitsu SPARC M12-2/2S Service Manual

- PCI Expansion Unit for Fujitsu M10/SPARC M10 Systems Service Manual

- PCI Expansion Unit for Fujitsu SPARC M12 and Fujitsu M10/SPARC M10 Service Manual

- SPARC Enterprise M3000/M4000/M5000/M8000/M9000 Servers XSCF User's Guide

- SPARC Enterprise M4000/M5000/M8000/M9000 Servers Dynamic Reconfiguration (DR) User's Guide

- SPARC Enterprise M4000/M5000 Servers Service Manual

- SPARC Enterprise M8000/M9000 Servers Service Manual

Notational conventions

Manual page section numbers

In manuals, helps, and messages of PRIMECLUSTER, a section number in a manual page is shown in parentheses after a command name or a file name. Example: cp(1)

For Oracle Solaris 11.4 or later, replace the section numbers as follows:
- "(1M)" to "(8)"
- "(4)" to "(5)"
- "(5)" to "(7)"
- "(7)" to "(4)"

Symbols

Material of particular interest is preceded by the following symbols in this manual:

P Point
. . . .

Describe the contents of an important point.
. . . .

Note
. . . .

Describes the points the users should pay close attention to.
. . . .

Example
. . . .

Describes the content by using an example.
. . . .

Information
. . . .

Provides useful information related to the topic.
. . . .

See
. . . .

Provides manuals for users' reference.
. . . .

Abbreviated name

- Oracle Solaris might be described as Solaris or Solaris Operating System.

- Oracle Solaris 11 is abbreviated as Solaris 11.

- Oracle VM Server for SPARC is abbreviated as Oracle VM.

- Oracle Solaris Zones is abbreviated as Solaris Zones.

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Date of publication and edition

April 2017, First edition
February 2019, Second edition

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Contents

Chapter 1 Overview

This chapter describes the concept of the redundant line control function using the virtual NIC mode.

1.1 What is redundant line control?

The redundant line control function of Global Link Services (hereinafter GLS) provides a high-reliability communication infrastructure that supports continuous transmission in the event of a network path or card failure by making transmission routes redundant with multiple NIC (Network Interface Cards). GLS enables the following four network control methods:

- Fast switching mode

- NIC switching mode

- GS/SURE linkage mode

- Virtual NIC mode

This section describes the virtual NIC mode. For other modes, see "PRIMECLUSTER Global Link Services Configuration and Administration Guide Redundant Line Control Function."

Virtual NIC mode

Virtual NIC mode provides a high-reliability communication by grouping multiple network interfaces on the same network as one virtual interface. If one transmission route fails, ongoing communications will be switched to the other transmission route. There are no restrictions on remote systems to communicate with. When comparing the virtual NIC mode to the NIC switching mode which makes network interfaces on the same network redundant, there are the following features:

- Specifying IP addresses to be monitored is unnecessary by the fault monitoring function

- In Solaris Zones environments, the virtual NIC is available from not only a global zone but also a non-global zone

- In Oracle VM environments, the configuration where virtual interfaces connect to virtual switches is available

Figure 1.1 Virtual NIC mode
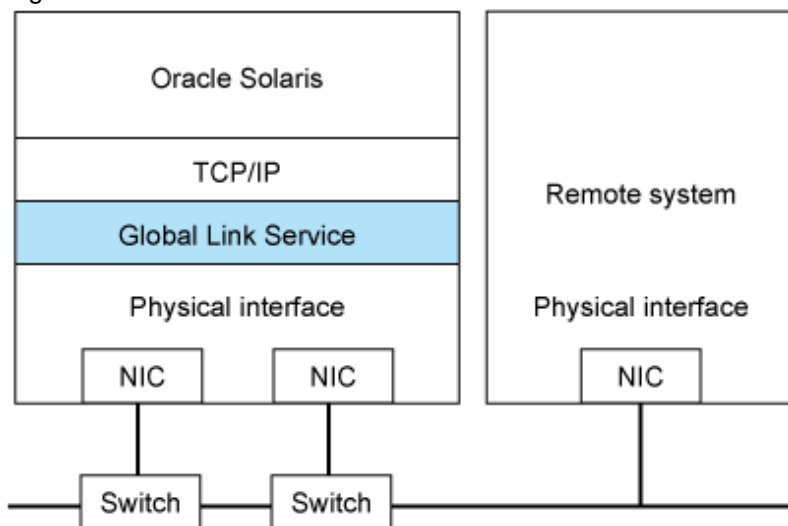
1.2 Conditions

The following describes conditions of the virtual NIC mode.

Description	Condition
Available upper protocol	IPv4 and IPv6 protocol

Description	Condition
Available application	Application for TCP/IP communication
Connectable remote device	Optional
Available NIC	Up to two physical interfaces (net0, net1, and etc.) corresponding to GLDv3 and link aggregation (with LACP) interfaces (aggr0, aggr1, and etc.) can be specified.
Sharing NIC	Multiple virtual NICs are created on the grouped one interface and NICs are shared between virtual NICs.
Setting up MAC address	For each virtual NIC, a unique MAC address is automatically set. Moreover, an optional MAC address can also be set.
Setting up IP address	IP addresses can be set with the management command of the operating system such as ipadm(1M) or ifconfig(1M) by the same procedure as the NIC.

1.3 Redundant line control effects

Virtual interfaces of virtual NIC mode enables the efficient use of network resources such as a NIC and builds a high-reliability network easily. Also, it performs the optimum switching control according to the location of failures in the event of a network failure to continue the communication.

Virtual NIC mode can be used in virtual environments (connected to Solaris Zones and guest domain in Oracle VM) in addition to the configuration of the existing physical server.

1.4 System Configuration

The following describes the system configuration of the virtual NIC mode.

System configuration of a physical server

Bundle physical interfaces "net0" and "net1" to configure the virtual NIC "fjvnet0."

Figure 1.2 System configuration of a physical server
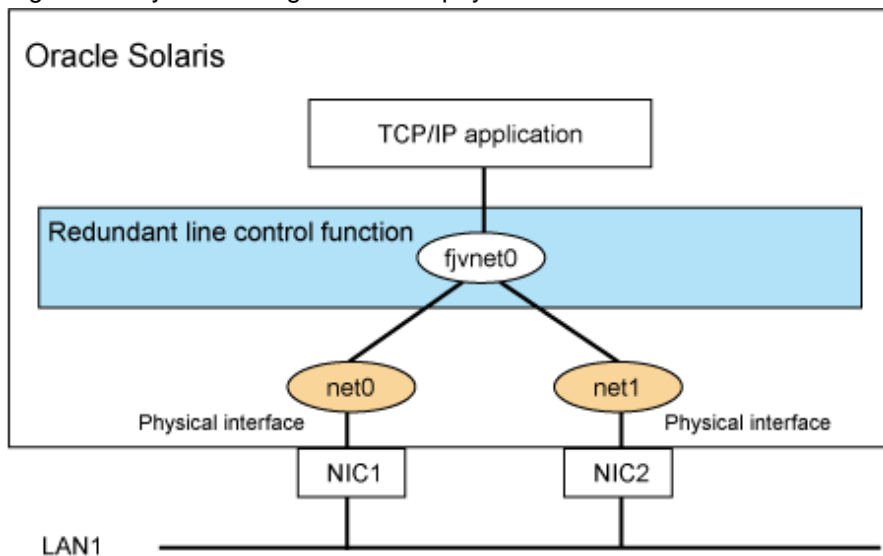
System configuration of Solaris Zones

Bundle physical interfaces "net0" and "net1" to configure the virtual NICs "fjvnet0" and "fjvnet1." Then, allocate them to non-global zones.

Figure 1.3 System configuration of Solaris Zones
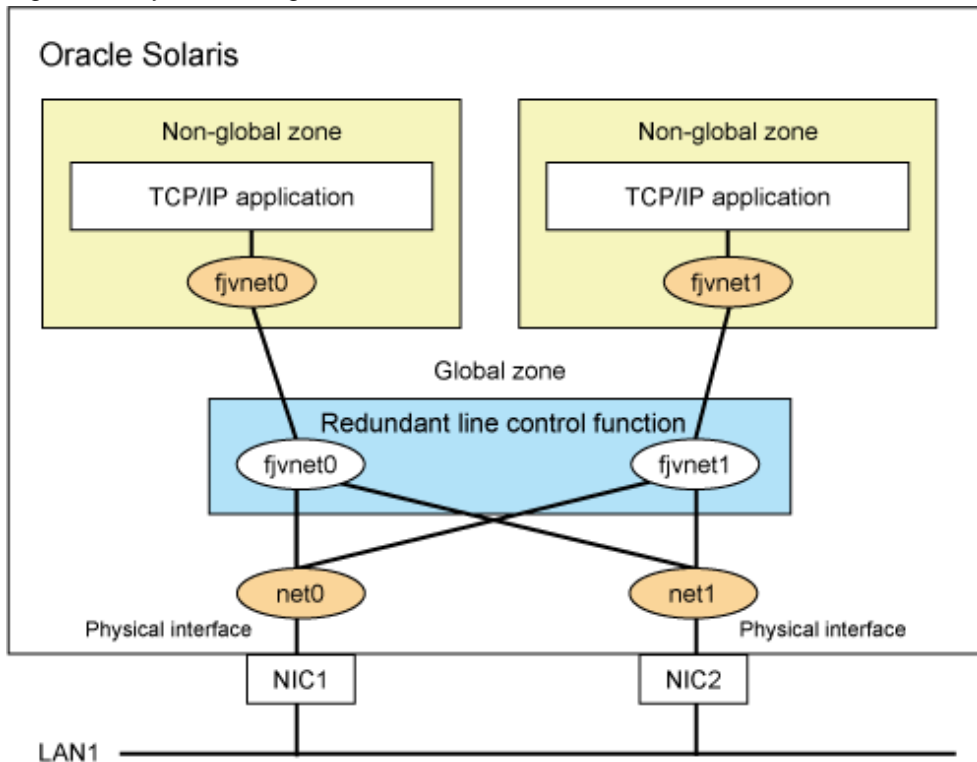
Information

When sharing physical interfaces in multiple zones, you can change a physical interface used preferentially for each zone. For example, each zone can divide the physical interfaces used for communication by specifying a physical interface "net0" and then "net1" in sequence at the fjvnet0 side, and by specifying a physical interface "net1" and then "net0" in sequence at the fjvnet1 side.

System configuration of Oracle VM

Bundle physical interfaces "net0" and "net1" to configure the virtual NIC "fjvnet0." The virtual NIC "fjvnet0" is connected to a virtual switch and communicate with a guest domain.

Figure 1.4 System configuration of Oracle VM
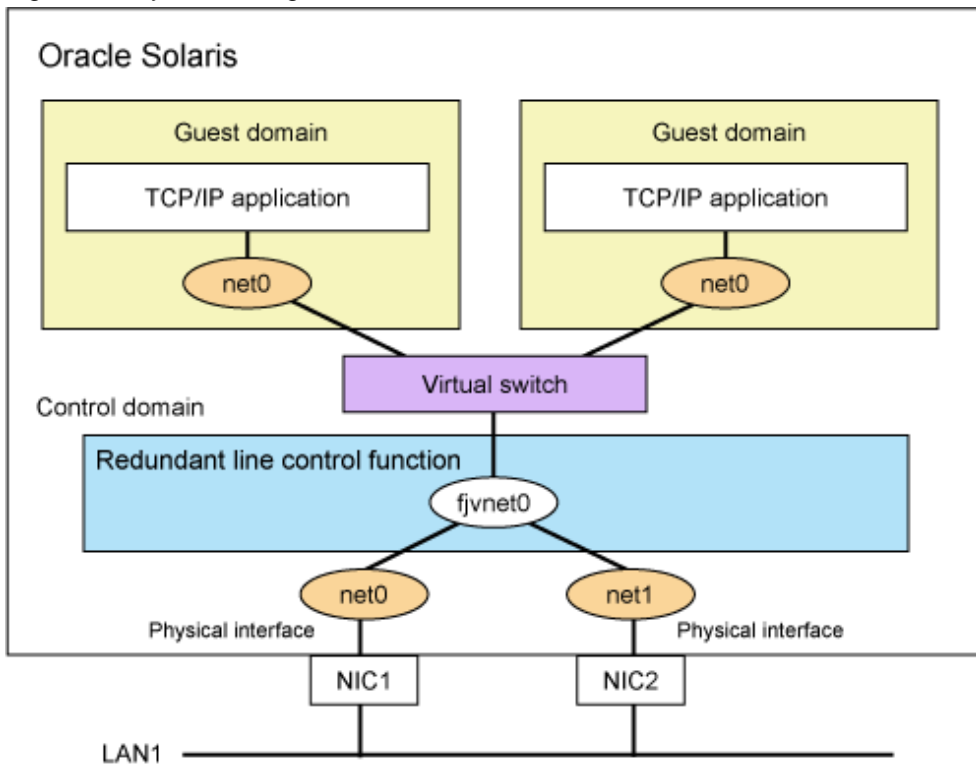
Chapter 2 Functions

This chapter describes functions provided by the virtual NIC mode.

- Fault monitoring function

- Switching function

- Other functions

2.1 Fault monitoring function

In the virtual NIC mode, failures are detected by the following monitoring functions. The fault monitoring function is started automatically by activating virtual NICs.

- Link status monitoring function

- Network monitoring function

2.1.1 Link status monitoring function

Link status monitoring function monitors the link status of interfaces regularly and detects link down and link up failures.

When the link status monitoring function detects link down of an interface at the operation side, if the interface at the standby side is available, the communication path is immediately switched.

Figure 2.1 Link status monitoring function
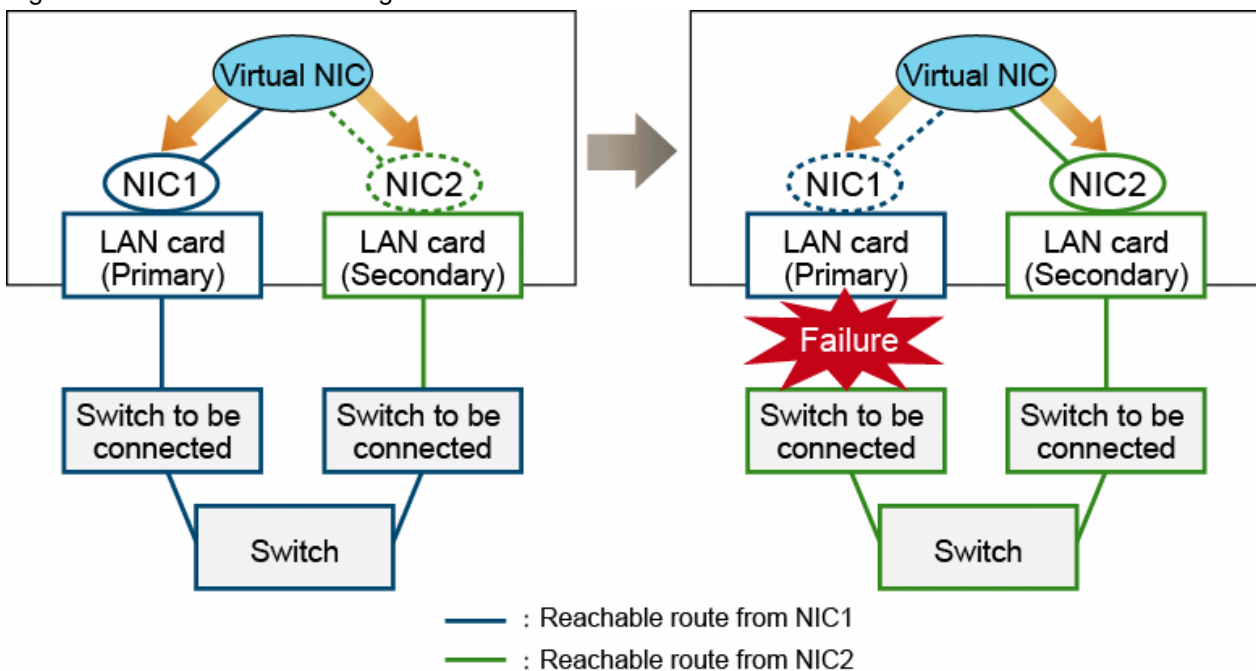
Note

When the virtual NIC is generated at OS startup, the physical NICs are connected to the virtual interface. At this time, if the physical NICs are not ready to link up, the error message number 904 is output to the system log. After that, if the message number 903 is output, no action is required. If the message 903 is not output, check the link status of the physical NICs bundled by the virtual NIC.

The error message number 904 is output both when Link Status Propagation of the virtual NIC is enabled or disabled.

```
ERROR: 90400: link down detected: the virtual interface link is down.(virtual-interface)
```

```
INFO: 90300: link up detected: the virtual interface link is up.(virtual-interface)
```

2.1.2 Network monitoring function

Network monitoring function detects switch hangs and communication path failures between switches.

Monitoring daemons periodically exchange heartbeat messages between redundant NICs so that the network monitoring function can monitor the network status. If no heartbeat messages are exchanged, the virtual NICs select optimum NICs for each communication targets among the grouped multiple NICs and this enables the reliable communication.

By default, it takes about 10 seconds to detect heartbeat failures.

Figure 2.2 Network monitoring function
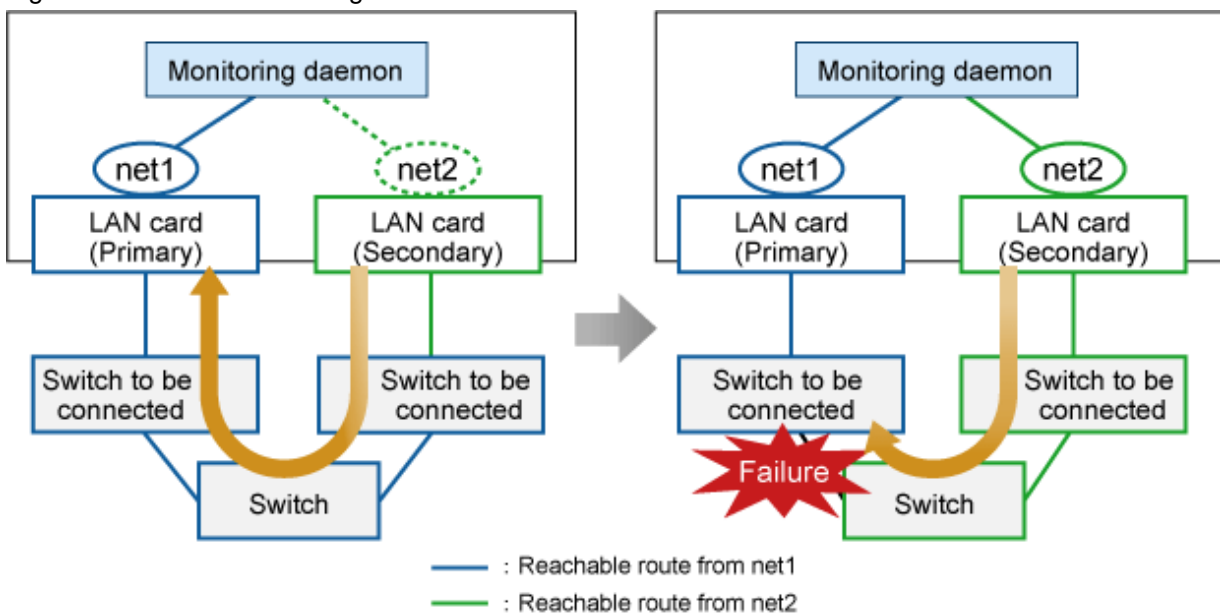
: Reachable route from net1
: Reachable route from net2

📖 Information

- The monitoring is shared in the virtual interface which bundles the same physical NIC in the same order.

- When the virtual interface state is "inactive", startup of the monitoring is suspended. After the virtual interface is activated, the monitoring is started.

- The function monitors a route of the non-tagged VLAN, not the tagged VLAN.

2.2 Switching function

Switching function switches a path used for communication depending on network topology changes due to network failures and recovery.

If an error is detected by the link status monitoring, the communication is continued by switching the system to the standby NIC.

If an error is detected by the network monitoring, the communication is continued in all NICs. However, once the communication path is recovered, the only one NIC can carry out the operation.

Here, describes examples in the following states:

- During normal operation

- In the event of NIC failures

- In the event of link failures between switches

- In the event of switch failures

- At a switch failure recovery

During normal operation

When all NICs and switches are operated normally, a virtual NIC uses redundant NIC exclusively (NIC1: Active, NIC2: Standby) to carry out the communication.

In this case, the communication for all the remote systems is carried out in NIC1 and the status of NIC2 will be "Standby."

Figure 2.3 Communication type during normal operation
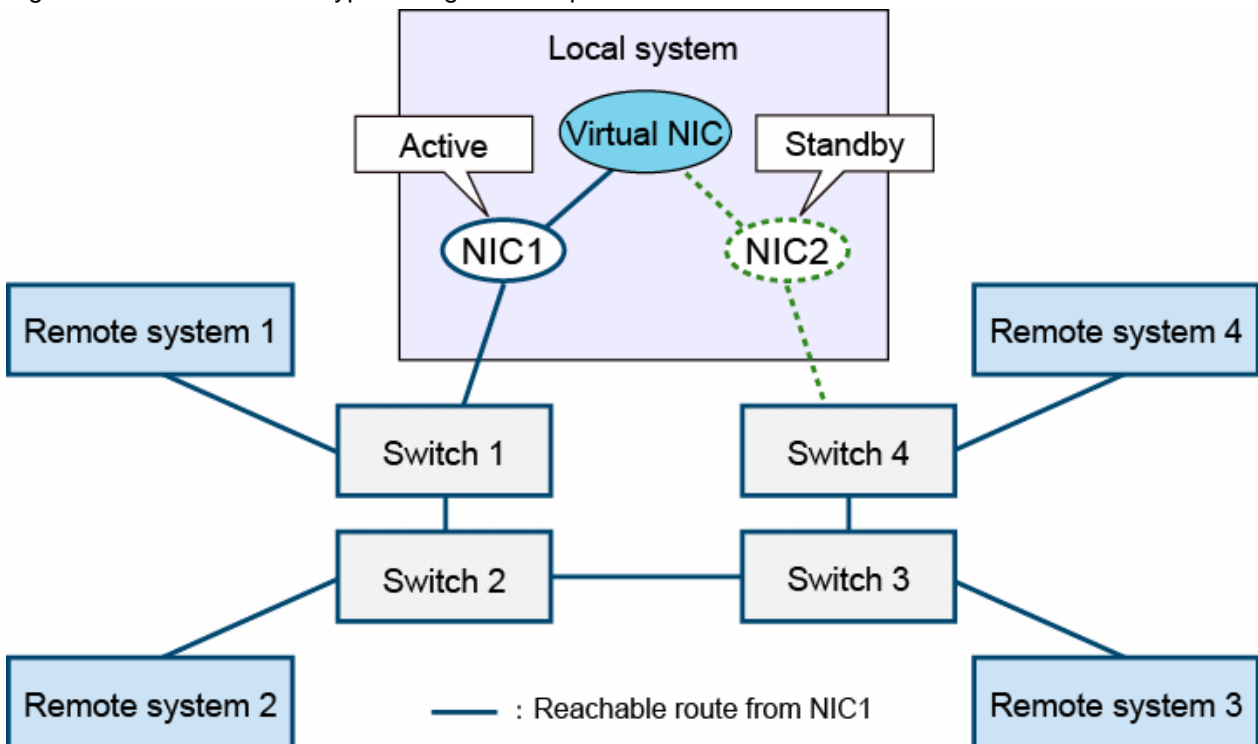
In the event of NIC failures

When an error occurred in NIC1 or Switch 1 of the connection target and NIC1 is in the link down state, the communication can be continued by switching NIC1 to NIC2. In this case, the communication for all the remote systems is carried out with NIC2.

Figure 2.4 Communication type in the event of NIC failures
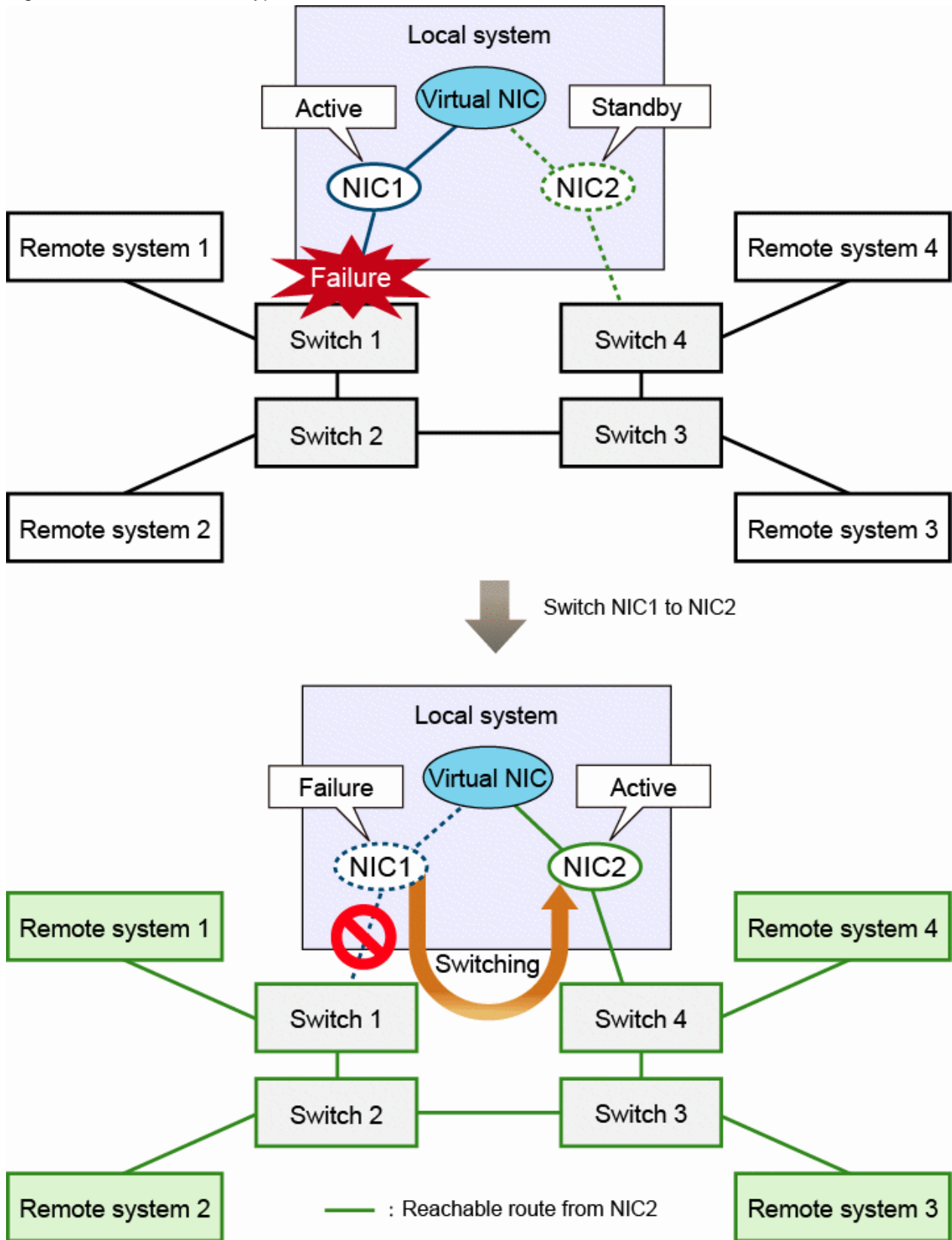
In the event of link failures between switches

If a link error occurred between Switch 2 and Switch 3, since the network is divided into two parts, the communication for the remote systems 1 and 2 can be continued. However, the ones for 3 and 4 will be disabled. In this case, make NIC2 "Active" state in addition to NIC1 so that the communication for the remote systems 3 and 4 will be continued.

Figure 2.5 Communication type in the event of link failures between Switch 2 and 3
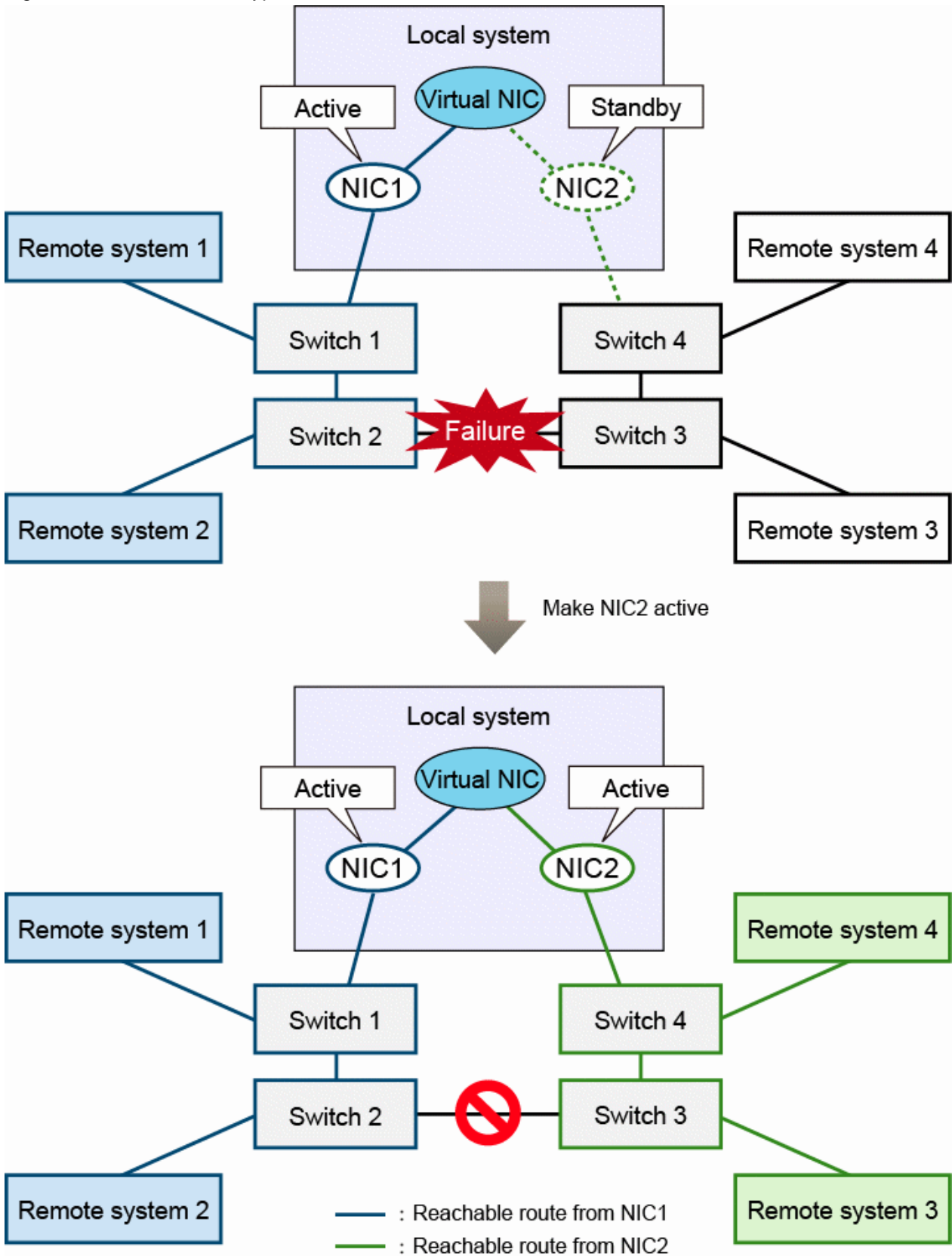
In the event of switch failures

In the event of Switch 3 failures, make NIC2 "Active" state so that the communication for the remote system 4 will be continued. For the communication for the remote system 3, since there is no physical reachable path, the communication is disabled.

Figure 2.6 Communication type in the event of Switch 3 failures
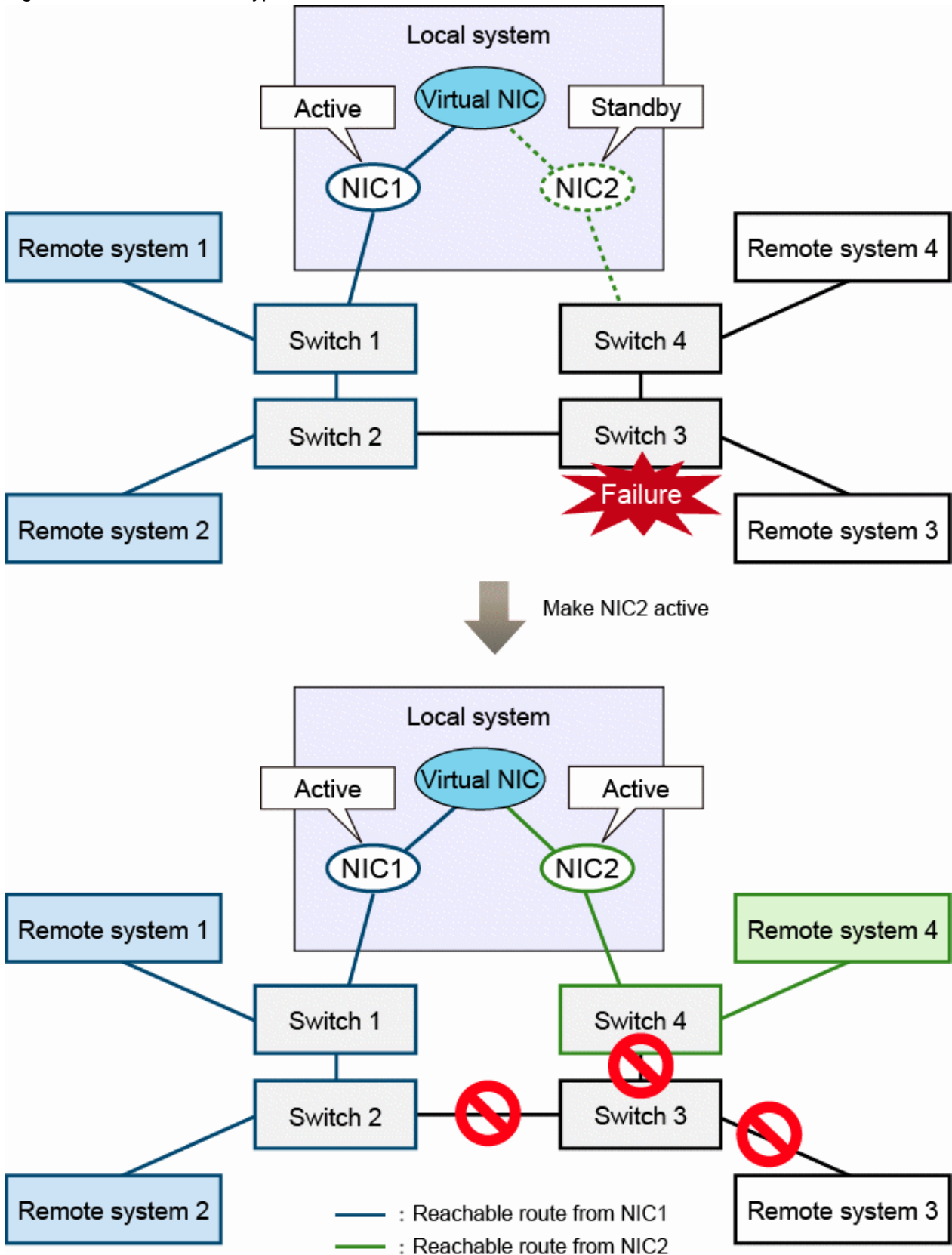
At a switch failure recovery

When the network disconnection is recovered by the maintenance such as replacing failed switches, return the status of NIC2 to "Standby" and the communication with all the remote systems will be carried out only in NIC1 again.

Figure 2.7 Communication type at a switch recovery
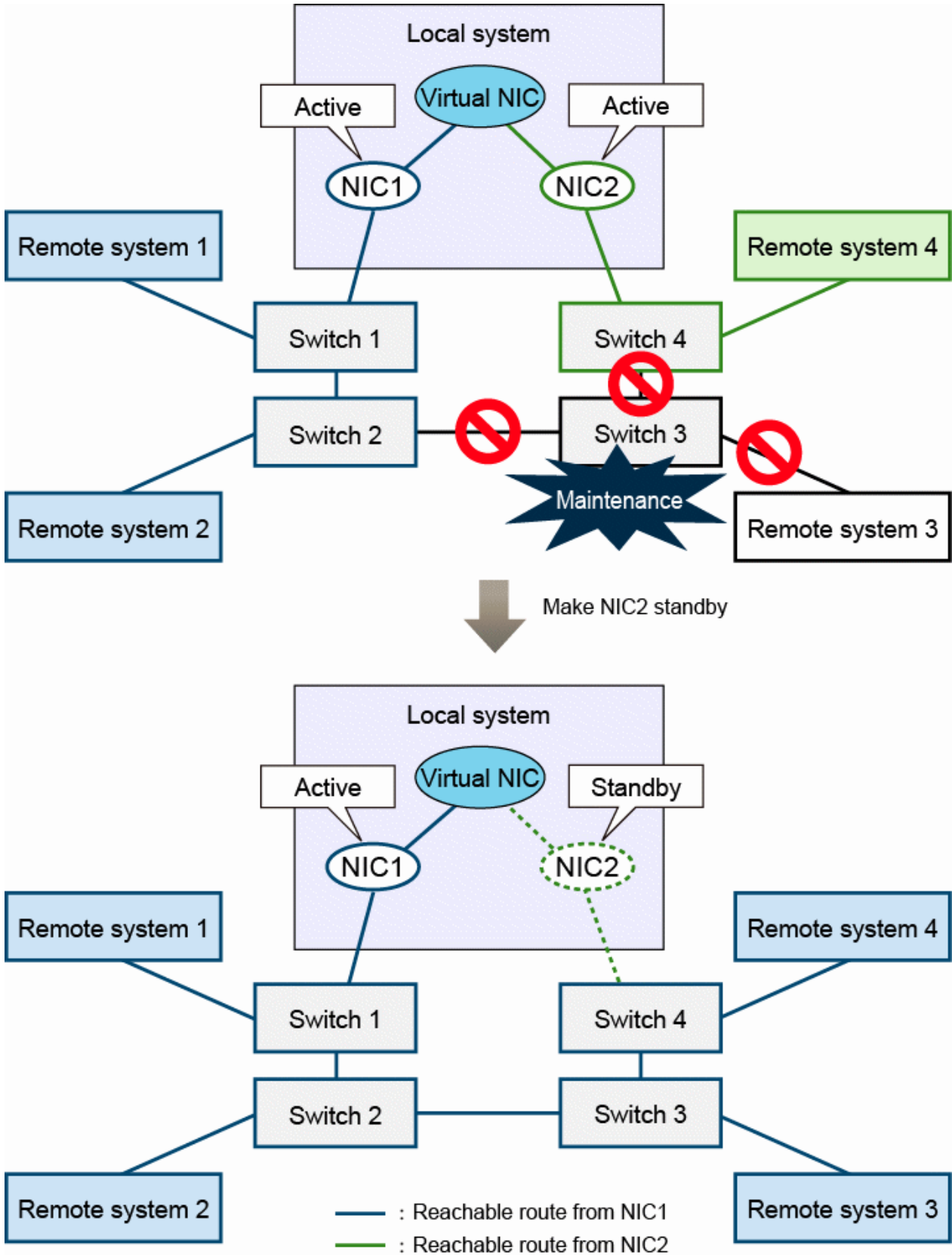
2.3 Other functions

This section describes other functions provided by the virtual NIC mode.

- Communication method

- Direct communication between zones

- Cluster linkage

2.3.1 Communication method

There are two communication methods used for the virtual NIC mode: "Active-Standby" mode and "MAC Tracking" mode.

"Active-Standby" mode

One of the grouped NICs is used exclusively to carry out the communication.

"MAC Tracking" mode

When an error is detected by the network monitoring, use all NICs at the same time to carry out the communication. In MAC Tracking, source MAC addresses and NICs which received packets learn when receiving packets from the remote system. When sending packets to the remote system, select an appropriate NIC based on the learning result.

Moreover, when the application sends packets to a destination of a broadcast or multicast address, use all NICs to send packets.

Destination MAC address	Selection of sending NICs

MAC address corresponding to the destination have not learned
or
the destination address is broadcast/ multicast
	Send packets by using all NICs.
	The following two modes can be selected as MAC Tracking:
	
	- Broadcast
	  Duplicate packets and send them from all NICs simultaneously.
	
	- Round-robin
	  Distribute NICs evenly and send packets.
	
	For details, see "A.1 rvnetadm command."

MAC address corresponding to the destination has already learned	Based on the learning result, select the sending NICs and send packets.

The following shows the example of sending procedure when a connection between switches fails and the network is disconnected. Right after the network failure, the communication used for the virtual NIC is sent from both NIC1 and NIC2. Then, after receiving the response from the remote system, it learns the MAC address of the remote system and packets are transmitted via only reachable paths.

Figure 2.8 "MAC Tracking" mode
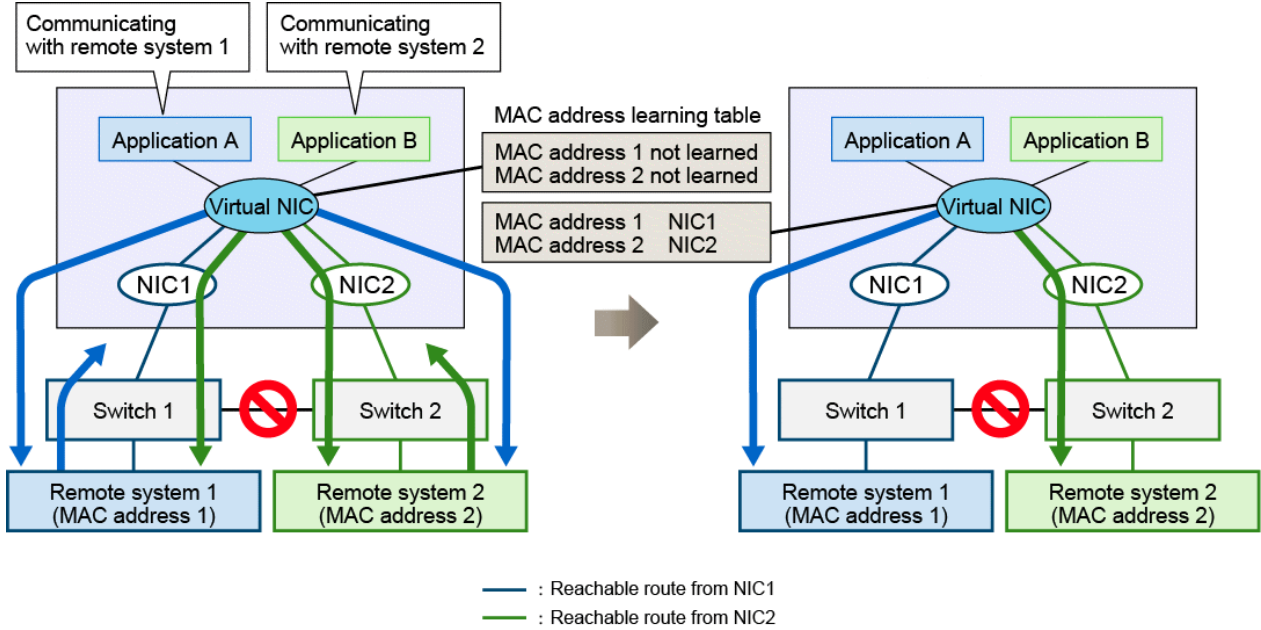
2.3.2 Direct communication between zones

When creating multiple virtual NICs which shares the grouped physical NICs and allocating them to multiple exclusive-IP zones or Kernel Zones, use one of the NIC among the grouped NICs for each zone to carry out the communication with the external remote system.

In the communication between zones, since packets are directly transferred between virtual NICs, the band of the physical NIC is not consumed. Also, if the physical NIC fails, the communication between zones is continued through the virtual NIC.

Figure 2.9 Direct communication between zones (when physical NICs are distributed)
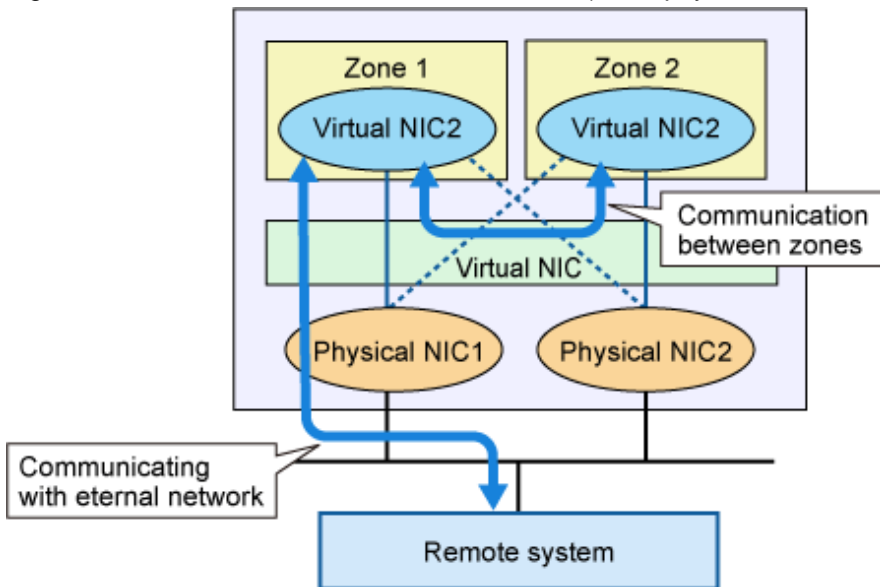
2.3.3 Cluster linkage

Use any of the following configurations if an error occurred in all of the transfer routes and want to take over the IP address.

- NIC switching mode (Virtual NIC mode)

  Builds an NIC non-redundant of NIC switching mode for Virtual NIC mode.

  For details, see "B.4.12 Example of the Cluster system (NIC non-redundant)" in "PRIMECLUSTER Global Link Services Redundant Line Control Function."

- Takeover network resources configuration

  Creates a takeover network resource of cluster application for Virtual NIC mode.

  For details, see "Creating Takeover Network Resources" in "PRIMECLUSTER Installation and Administration Guide."

Chapter 3 Environment configuration

This chapter describes how to set up and configure the virtual NIC mode.

3.1 Checking system resources

In Redundant Line Control function for Virtual NIC mode, the required capacity for the shared memory is shown below. If these parameters are insufficient in the whole system, extend these values. For modifying the parameter, refer to the Solaris manual.

Table 3.1 Required capacity for system resources

Resource parameter name	Required capacity	Reference (Meaning of parameter)
project.max-shm-memory	28672	Number of total bytes of shared memory.
project.max-shm-ids	1	Maximum number of shared memory ID.

3.2 Additional virtual NIC setup

This section describes how to add a virtual NIC in the following environments:

- Physical server environment

- Solaris Zones environment

- Oracle VM environment

3.2.1 Setting up a virtual NIC in a physical server environment

The following is an example of configuration for adding a virtual NIC in the physical server environment:

Figure 3.1 Example of configuration in the physical server environment
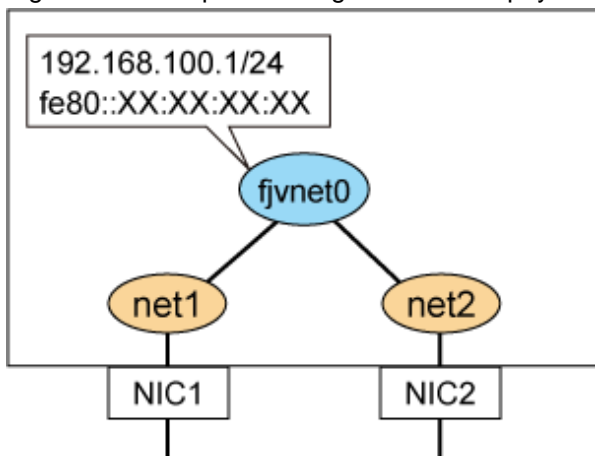
The procedure below shows how to configure IPv4 and IPv6 addresses automatically by bundling "net1" and "net2" to create the virtual NIC "fjvnet0":

1. Creating a virtual NIC
   Create a virtual NIC with the rvnetadm create command.

```
# /opt/FJSVrvnet/bin/rvnetadm create -n fjvnet0 -i net1,net2
```

2. Enabling a network monitoring function

   Enable a network monitoring function with the rvnetadm start-observ command.

```
# /opt/FJSVrvnet/bin/rvnetadm start-observ
```

 Note
....
When a network monitoring function is enabled, disable it with the rvnetadm stop-observ command, and then enable it with the rvnetadm start-observ command again.
....

3. Setting up an IP address

   Define the virtual NIC as an IP interface with the ipadm create-ip command. Configure the IP address with the ipadm create-addr command.

```
# ipadm create-ip fjvnet0
# ipadm create-addr -T static -a 192.168.100.1/24 fjvnet0/v4static
# ipadm create-addr -T addrconf fjvnet0/v6addrconf
```

3.2.2 Setting up a virtual NIC in a Solaris Zones environment

3.2.2.1 Exclusive-IP zones

The following is an example of configuration for adding a virtual NIC in the Solaris Zones environment (exclusive-IP zones).

Figure 3.2 Example of configuration in the Solaris Zones environment (exclusive-IP zones)
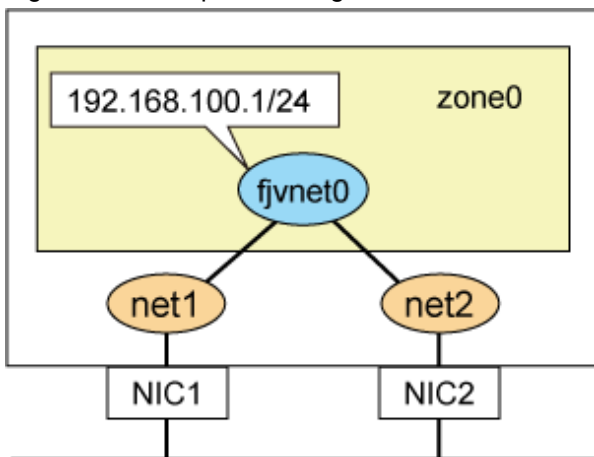
Create a virtual NIC "fjvnet0" on the global zone by bundling "net1" and "net2." Set an IP address to the virtual NIC "fjvnet0" after assigning it to the exclusive-IP zone "zone0." This procedure is shown below:

1. Creating a virtual NIC
   Create a virtual NIC on the global zone with the rvnetadm create command.

   ```
   # /opt/FJSVrvnet/bin/rvnetadm create -n fjvnet0 -i net1,net2
   ```

   ### See
   ....
   For details on the rvnetadm command, see "A.1 rvnetadm command."
   ....

2. Enabling a network monitoring function
   Enable a network monitoring function with the rvnetadm start-observ command.

   ```
   # /opt/FJSVrvnet/bin/rvnetadm start-observ
   ```

   ### Note
   ....
   When a network monitoring function is enabled, disable it with the rvnetadm stop-observ command, and then enable it with the rvnetadm start-observ command again.
   ....

   ### See
   ....
   For details on the rvnetadm command, see "A.1 rvnetadm command."
   ....

3. Network setting for an exclusive-IP zone
   Assign a virtual NIC to the exclusive-IP zone with the zonecfg command, and then start it with the zoneadm command.

   ```
   # zonecfg -z zone0
   zonecfg:zone0> add net    <- Add a network interface setting.
   zonecfg:zone0:net> set physical=fjvnet0  <- Specify a virtual NIC interface.
   zonecfg:zone0:net> end
   zonecfg:zone0> verify     <- Check integrity.
   zonecfg:zone0> commit     <- Register a zone.
   zonecfg:zone0> exit       <- Zone setting is completed.
   # zoneadm -z zone0 boot  <- Start up zone0.
   ```

   ### Note
   ....
   Use virtual NICs in a network interface (net) registered in the resource. Virtual NICs cannot be used in an automatic network interface (anet).
   ....

   ### See
   ....
   For details on the zonecfg(1M) and zoneadm(1M) commands, see the Solaris manual.
   ....

4. Setting up an IP address in the exclusive-IP zone

   Define the virtual NIC as an IP interface with the ipadm create-ip command after logging in to the exclusive-IP zone with the zlogin command. Then, assign an IP address to the IP interface with the ipadm create-addr command.

```
# zlogin zone0
# ipadm create-ip fjvnet0
# ipadm create-addr -T static -a 192.168.100.1/24 fjvnet0/v4
```

🗐 See
. . . .

For details on the ipadm(1M) command, see the Solaris manual.
. . . .

3.2.2.2 Kernel Zones

The following is an example of configuration for adding a virtual NIC in the Kernel Zones environment.

Figure 3.3 Example of configuration in the Kernel Zones environment
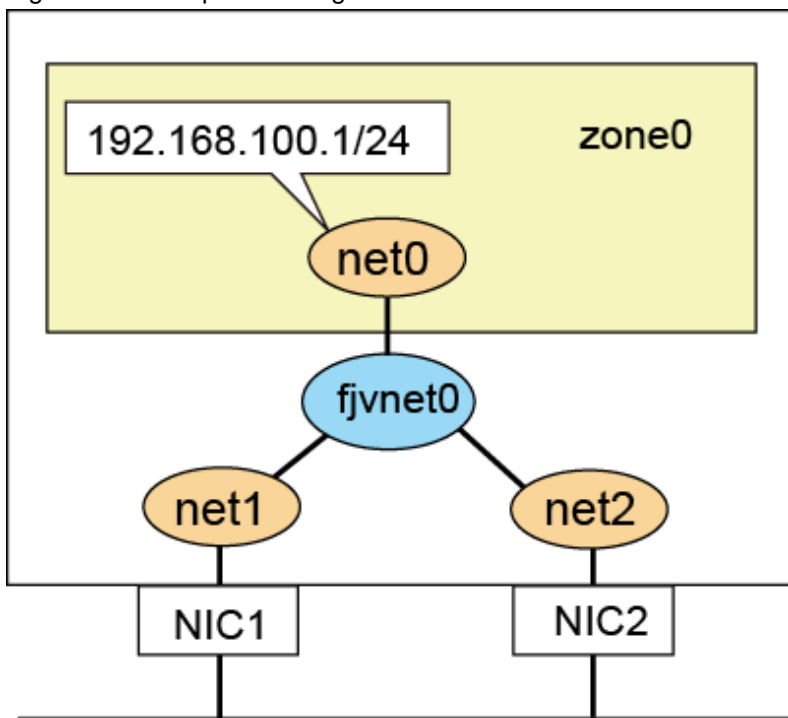
Create a virtual NIC "fjvnet0" by bundling "net1" and "net2" on the global zone, and then assign it to the Kernel Zone "zone0." After that, set an IP address to the NIC "net0" on "zone0" that was connected to the virtual NIC "fjvnet0."

1. Creating a virtual NIC

   Create a virtual NIC on the global zone with the rvnetadm create command.

```
# /opt/FJSVrvnet/bin/rvnetadm create -n fjvnet0 -i net1,net2
```

🗐 See
. . . .

For details on the rvnetadm command, see "A.1 rvnetadm command."
. . . .

2. Enabling a network monitoring function

   Enable a network monitoring function with the rvnetadm start-observ command.

```
# /opt/FJSVrvnet/bin/rvnetadm start-observ
```

3. Network setting for a Kernel Zone

   Assign a virtual NIC to the Kernel Zone with the zonecfg command, and then start it with the zoneadm command.

```
# zonecfg -z zone0
zonecfg:zone0> add net   <- Add a network interface setting.
zonecfg:zone0:net> set physical=fjvnet0  <- Specify a virtual NIC interface.
zonecfg:zone0:net> end
zonecfg:zone0> verify    <- Check integrity.
zonecfg:zone0> commit    <- Register a zone.
zonecfg:zone0> exit      <- Zone setting is completed.
# zoneadm -z zone0 boot  <- Start up zone0.
```

4. Setting up an IP address in the Kernel Zone

   Define the virtual NIC as an IP interface with the ipadm create-ip command after logging in to the Kernel Zone with the zlogin
   command. Then, assign an IP address to the IP address with the ipadm create-addr command.

```
# zlogin zone0
# ipadm create-ip net0
# ipadm create-addr -T static -a 192.168.100.1/24 net0/v4
```

3.2.3 Setting up a virtual NIC in an Oracle VM environment

The following is an example of configuration for adding a virtual NIC in the Oracle VM environment.

Figure 3.4 Example of configuration in the Oracle VM environment
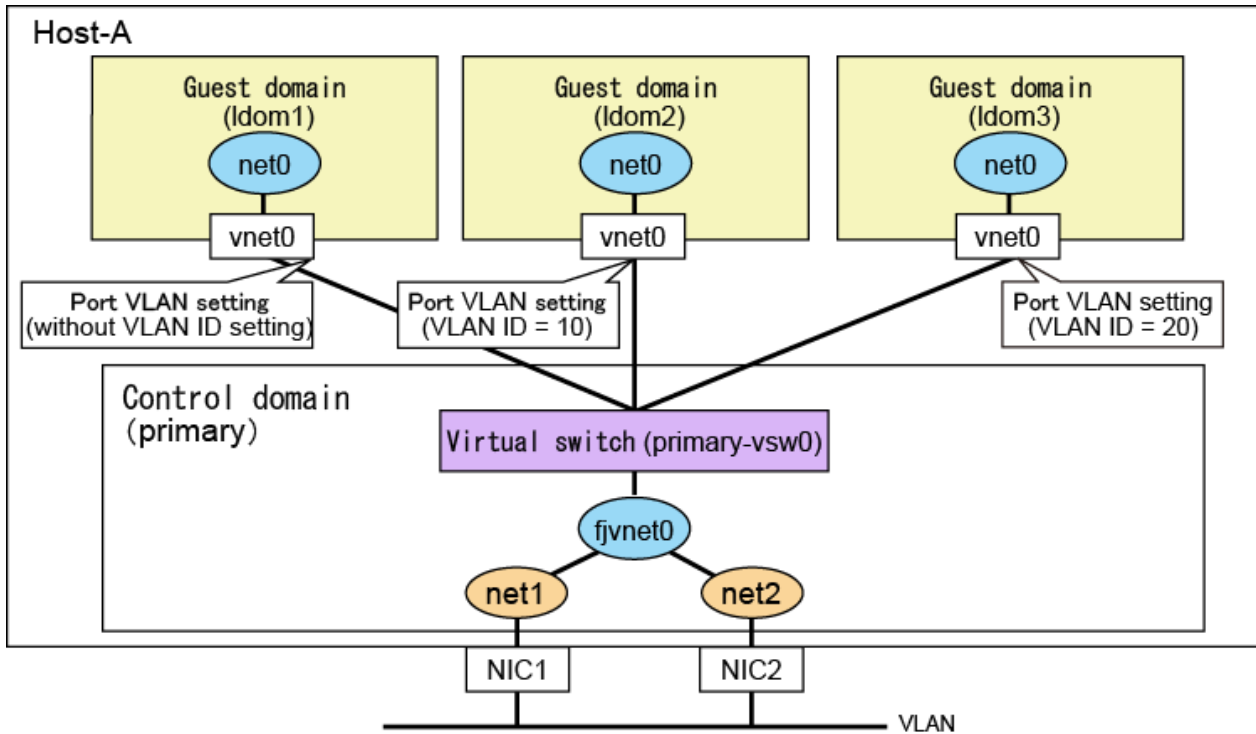
Create a virtual NIC "fjvnet0" by bundling "net1" and "net2" on the control domain (primary), and then connect it to a virtual switch "primary-vsw0" in Oracle VM. This procedure is shown below.

Communication is available without setting VID on the guest domain (ldom1), by setting VID=10 on the gust domain (ldom2), and by setting VID=20 on the guest domain (ldom3).

1. Creating a virtual NIC
   Create a virtual NIC on the control domain with the rvnetadm create command.

```
# /opt/FJSVrvnet/bin/rvnetadm create -n fjvnet0 -i net1,net2 -v yes
```

🈁 Note
. . . .
You must set "yes" to the value of "ALLOW-UPPER-VNIC" with the -v option to connect to a virtual switch.
. . . .

📇 See
. . . .
For details on the rvnetadm command, see "A.1 rvnetadm command."
. . . .

2. Enabling a network monitoring function
   Enable a network monitoring function with the rvnetadm start-observ command.

```
# /opt/FJSVrvnet/bin/rvnetadm start-observ
```

🈁 Note
. . . .
When a network monitoring function is enabled, disable it with the rvnetadm stop-observ command, and then enable it with the rvnetadm start-observ command again.
. . . .

See

For details on the rvnetadm command, see "A.1 rvnetadm command."

3. Creating a virtual switch
   Specify the virtual NIC as a network adapter to be used with the ldm add-vsw command, and then create the virtual switch running on the control domain.

```
# ldm add-vsw net-dev=fjvnet0 primary-vsw0 primary
```


See

For details on the ldm(1M) command, see the Solaris manual.

4. Connecting a guest domain
   Connect a guest domain to the virtual switch with the ldm add-vnet command.

   When connecting the guest domain "ldom1" in which the port VLAN is not used

```
# ldm add-vnet vnet0 primary-vsw0 ldom1
```

   When connecting the guest domain "ldom2" in which the port VLAN_ID(10) is used, and connecting the guest domain "ldom3" in which the port VLAN ID(20) is used

```
# ldm add-vnet pvid=10 vnet0 primary-vsw0 ldom2
# ldm add-vnet pvid=20 vnet0 primary-vsw0 ldom3
```


See

For details on the ldm(1M) command, see the Solaris manual.

3.3 Deleting a virtual NIC

This section describes how to delete a virtual NIC in the following environments:

- Physical server environment
- Solaris Zones environment
- Oracle VM environment

3.3.1 Deleting a virtual NIC in a physical server environment

The following describes how to delete a virtual NIC in the physical server environment using the configuration in "3.2.1 Setting up a virtual NIC in a physical server environment" as an example.

1. Deleting an IP interface
   If an IP interface remains, delete the IP interface on the virtual NIC with the ipadm delete-ip command beforehand. This because the virtual NIC cannot be deleted with the rvnetadm command.

```
# ipadm delete-ip fjvnet0
```

2. Disabling a network monitoring function
   Disable a network monitoring function with the rvnetadm stop-observ command.

```
# /opt/FJSVrvnet/bin/rvnetadm stop-observ
```

3. Deleting a virtual NIC
   Delete a virtual NIC with the rvnetadm delete command.

```
# /opt/FJSVrvnet/bin/rvnetadm delete -n fjvnet0
```

3.3.2 Deleting a virtual NIC in a Solaris Zones environment

3.3.2.1 Exclusive-IP zones

The following describes how to delete a virtual NIC in the Solaris Zones environment using the configuration in "3.2.2.1 Exclusive-IP zones" as an example:

1. Deleting an IP address in an exclusive-IP zone
   If an IP interface remains, delete the IP interface on the virtual NIC with the ipadm delete-ip command after logging in to the exclusive-IP zone with the zlogin command. This is because the virtual NIC cannot be deleted with the rvnetadm command.

   Example: When logging in to the exclusive-IP zone "zone0" and delete the IP interface generated in the virtual NIC "fjvnet0"

```
# zlogin zone0                          <- Login to zone0.
# ipadm delete-ip fjvnet0               <- Delete the IP interface on fjvnet0.
```

2. Stopping the exclusive-IP zone
   Stop the exclusive-IP zone.

3. Deleting the network setting in the exclusive-IP zone
   Remove the assignment of the virtual NIC to the exclusive-IP zone with the zonecfg command.

   Example: When removing the assignment of the virtual NIC "fjvnet0" for the exclusive-IP zone "zone0."

```
# zonecfg -z zone0                          <- Begin configuring zone0.
zonecfg:zone0> remove net physical=fjvnet0  <- Specify a virtual NIC interface.
zonecfg:zone0> verify                       <- Check setup consistency.
zonecfg:zone0> commit                       <- Register the setting.
zonecfg:zone0> exit                         <- Complete the zone setting.
```

📖 **See**

. . . .

For details on the zonecfg(1M) command, see the Solaris manual.

. . . .

4. Disabling a network monitoring function
   Disable a network monitoring function with the rvnetadm stop-observ command.

```
# /opt/FJSVrvnet/bin/rvnetadm stop-observ
```

📖 **See**

. . . .

For details on the rvnetadm command, see "A.1 rvnetadm command."

. . . .

5. Deleting a virtual NIC
   Delete a virtual NIC on the global zone with the rvnetadm delete command.

   Example: When deleting the virtual NIC "fjvnet0"

```
# /opt/FJSVrvnet/bin/rvnetadm delete -n fjvnet0
```

📖 **See**

. . . .

For details on the rvnetadm command, see "A.1 rvnetadm command."

. . . .

3.3.2.2 Kernel Zones

The following describes how to delete a virtual NIC in the Kernel Zones environment using the configuration in "3.2.2.2 Kernel Zones" as an example:

1. Deleting an IP interface in a Kernel Zone
   If an IP interface remains, delete the IP interface on the virtual NIC with the ipadm delete-ip command after logging in to the Kernel Zone with the zlogin command. This is because the virtual NIC cannot be deleted with the rvnetadm command.

   Example: When logging in to the Kernel Zone "zone0" to delete the IP interface that was generated in the NIC "net0" connected to the virtual NIC "fjvnet0."

```
# zlogin zone0                   <- Log in to zone0.
# ipadm delete-ip net0           <- Delete the IP interface on net0.
```

📖 **See**

. . . .

For details on the ipadm(1M) command, see the Solaris manual.

. . . .

2. Stopping the Kernel Zone
   Stop the Kernel Zone.

📖 **See**

. . . .

For details on how to stop it, see the Solaris manual.

. . . .

3. Deleting the network setting of the Kernel Zone
   Remove the assignment of the virtual NIC to the Kernel Zone with the zonecfg command.

   Example: When canceling to assign the virtual NIC "fjvnet0" for the Kernel Zone "zone0."

```
# zonecfg -z zone0                          <- Start the zone setting of zone0.
zonecfg:zone0> remove net physical=fjvnet0  <- Specify the virtual NIC interface.
zonecfg:zone0> verify                       <- Check integrity.
zonecfg:zone0> commit                       <- Register a zone.
zonecfg:zone0> exit                         <- Zone setting is completed.
```

See
....
For details on the zonecfg(1M) command, see the Solaris manual.
....

4. Disabling a network monitoring function
   Disable a network monitoring function with the rvnetadm stop-observ command.

```
# /opt/FJSVrvnet/bin/rvnetadm stop-observ
```

See
....
For details on the rvnetadm command, see "A.1 rvnetadm command."
....

5. Deleting a virtual NIC
   Delete the virtual NIC on the global zone with the rvnetadm delete command.

   Example: when deleting the virtual NIC "fjvnet0"

```
# /opt/FJSVrvnet/bin/rvnetadm delete -n fjvnet0
```

See
....
For details on the rvnetadm command, see "A.1 rvnetadm command."
....

3.3.3 Deleting a virtual NIC in an Oracle VM environment

The following describes how to delete a virtual NIC in the Oracle VM environment using the configuration in "3.2.3 Setting up a virtual NIC in an Oracle VM environment" as an example.

1. Disconnecting a guest domain
   Disconnect the guest domains "ldom1," "ldom2," or "ldom3" from the virtual switch with the ldm remove-vnet command.

```
# ldm remove-vnet vnet0 ldom1
# ldm remove-vnet vnet0 ldom2
# ldm remove-vnet vnet0 ldom3
```

See
....
For details on the ldm(1M) command, see the Solaris manual.
....

2. Deleting a virtual switch
   Delete a virtual switch with the ldm remove-vsw command.

```
# ldm remove-vsw primary-vsw0
```

See
....
For details on the ldm(1M) command, see the Solaris manual.
....

3. Disabling a network monitoring function
    Disable a network monitoring function with the rvnetadm stop-observ command.

    ```
    # /opt/FJSVrvnet/bin/rvnetadm stop-observ
    ```

See
....
For details on the rvnetadm command, see "A.1 rvnetadm command."
....

4. Deleting a virtual NIC
    Delete a virtual NIC with the rvnetadm delete command.

    ```
    # /opt/FJSVrvnet/bin/rvnetadm delete -n fjvnet0
    ```

Note
....
Deleting the connected virtual switch beforehand is necessary when you delete a virtual NIC.
....

See
....
For details on the rvnetadm command, see "A.1 rvnetadm command."
....

3.4 Notes on setting a configuration

Note the following points when creating an environment.

- A physical NIC used in the virtual NIC mode cannot be shared with a Solaris standard virtual NIC (vnetX) or a link aggregation (aggrX).

- Do not change the name of a virtual NIC in the virtual NIC mode or the name of a NIC used in the virtual NIC with the rename-link subcommand of dladm(1M).

- The following interfaces cannot be configured under the virtual NIC:

    - Tagged VLAN interfaces (net2001, net4001002, etc.)

    - The interfaces created by the SR-IOV

    - The interface of the virtual network device used in the Oracle VM environment

- Do not use the following commands for a virtual NIC because if you use these commands, the operation will not work correctly.

    - dladm set-linkprop

    - dladm reset-linkprop

    - dladm delete-vnic

    - ipadm create-ipmp

    - ipadm add-ipmp

    - ifconfig group

    - ifconfig standby | -standby

- ifconfig failover | -failover

- When specifying the alternative MAC address (alt-mac-addrs) with the ldm add-vnet command and the ldm set-vnet command, if the interface used for communication by GLS is switched, communication from outside may be interrupted temporarily and it may take time to resume the communication again. This is because GLS cannot notify the MAC address to the adjacent switch.

- It is possible to configure a new system, by cloning the system which is already configured and changing the IP address using the ipadm(1M) command.

  The requirements for cloning depend on the cloning software/cloning function of your use.

- Before changing MAC address of the virtual NIC, make sure to inactivate the virtual NIC.

  According to your environment, take the appropriate procedure to change the settings. See the procedures below to inactivate the virtual NIC and then change the settings. After that, restore the virtual NIC.

  Replace the interface name, the virtual switch name, and the zone name depending on your environment.

  [Physical server environment and Oracle VM environment]

    Take this procedure on the control domain.

      1. Delete IP interfaces on the virtual NIC.

        Check if IP interfaces exist on the virtual NIC. If they exist, delete them by using the ipadm(1M) command.

```
# /usr/sbin/ipadm show-if fjvnet0
# /usr/sbin/ipadm show-addr fjvnet0
# /usr/sbin/ipadm delete-ip fjvnet0
```

      2. Disconnect the virtual switch and the virtual NIC.

        If the virtual switch exists on the virtual NIC, disconnect the virtual NIC and the virtual switch.

```
# /usr/sbin/ldm set-vsw net-dev= primary-vsw0
```

      3. Check the inactive status of the virtual NIC.

        Check if the virtual NIC is "inactive".

```
# /opt/FJSVrvnet/bin/rvnetstat

 VNET            STATE     MODE          ACTIVE-LINK
+--------------+---------+------------+-----------------------------+
 fjvnet0         inactive  ACT-STANDBY
```

      4. Change the settings of the virtual NIC.

        Change the settings of the virtual NIC, for example, MAC address.

```
# /opt/FJSVrvnet/bin/rvnetadm set-prop -n fjvnet0 -a MACaddress
```

      5. Reconnect the virtual switch and the virtual NIC.

        If the virtual NIC and the virtual switch are disconnected in step 2, reconnect them.

```
# /usr/sbin/ldm set-vsw net-dev=fjvnet0 primary-vsw0
```

      6. Re-create the IP interfaces on the virtual NIC.

        If the IP interfaces are deleted in step 1, re-create the IP interfaces.

```
# /usr/sbin/ipadm create-ip fjvnet0
# /usr/sbin/ipadm delete-addr -T static -a ipaddress/netmask fjvnet0
```

  [Solaris Zone environment]

    Take this procedure on the global zone.

1. Stop the Solaris Zone that uses the virtual NIC.

   Stop the active Solaris Zone if it uses the virtual NIC.

   ```
   # /usr/sbin/zoneadm -z zone0 shutdown
   ```

2. Check the inactive status of the virtual NIC.

   Check if the virtual NIC is "inactive".

   ```
   # /opt/FJSVrvnet/bin/rvnetstat

    VNET            STATE     MODE         ACTIVE-LINK
   +---------------+---------+------------+-----------------------------+
    fjvnet0         inactive  ACT-STANDBY
   ```

3. Change the settings of the virtual NIC.

   Change the settings of the virtual NIC, for example, MAC address.

   ```
   # /opt/FJSVrvnet/bin/rvnetadm set-prop -n fjvnet0 -a MACaddress
   ```

4. Activate the Solaris Zone that uses the virtual NIC.

   Activate the Solaris Zone again if it is stopped in step 1.

   ```
   # /usr/sbin/zoneadm -z zone0 boot
   ```

Chapter 4 Operation

This chapter describes how to operate the virtual NIC mode.

4.1 Starting and Stopping virtual NICs

This section describes how to start and stop the virtual NICs.

4.1.1 Starting virtual NICs

All the virtual NICs start automatically when the operating system starts up.

4.1.2 Stopping virtual NICs

All the virtual NICs stop automatically when the operating system is shut down.

4.2 Displaying Operation Status

When an error is detected by the fault monitoring, execute the rvnetstat command and check the difference between the current state and the normal operation state. For the virtual NICs and interfaces under the virtual NIC, a status of link and network monitoring can be checked with the rvnetstat command.

See
. . . .
For details on this command, see "A.2 rvnetstat command."
. . . .

4.2.1 When an error is detected by the link status monitoring function

When link down of a NIC is detected by the link status monitoring function, switch the NIC to continue the communication.

The following shows the operation status when a link down is detected:

Figure 4.1 Link down state is detected
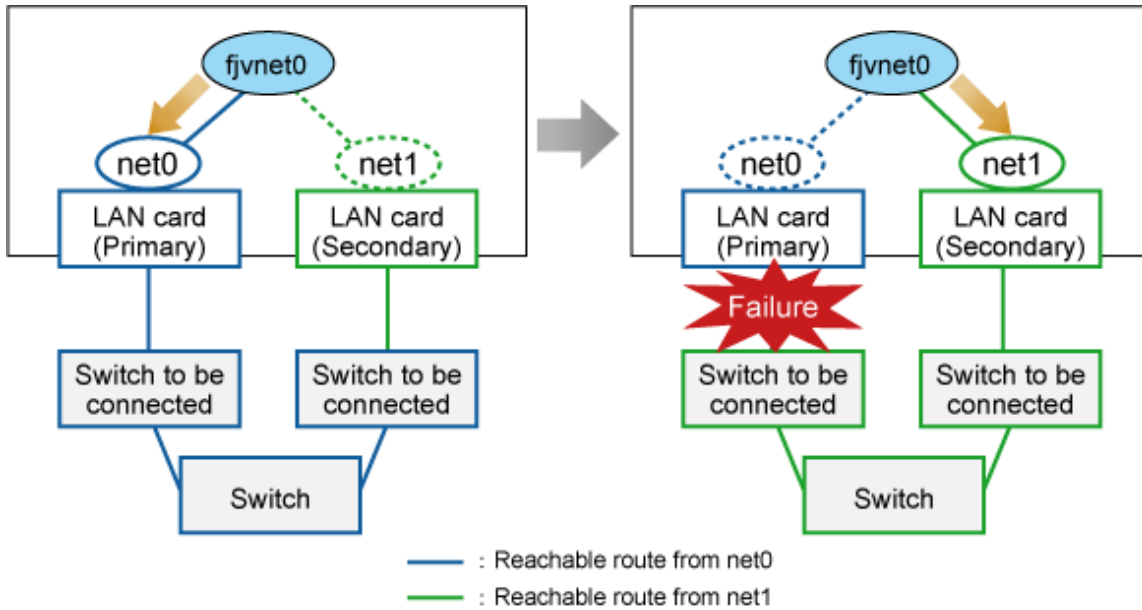
The following shows the link status of the virtual NIC for this case:

Before detecting link down

```
# /opt/FJSVrvnet/bin/rvnetstat
 VNET              STATE      MODE         ACTIVE-LINK
+-----------------+---------+------------+----------------------------------------+
 fjvnet0           active    ACT-STANDBY  net0
```

After detecting link down

```
# /opt/FJSVrvnet/bin/rvnetstat
 VNET              STATE      MODE         ACTIVE-LINK
+-----------------+---------+------------+----------------------------------------+
 fjvnet0           active    ACT-STANDBY  net1
```

Also, the following shows the link status of interfaces under the virtual NIC and the monitoring status:

Before detecting link down

```
# /opt/FJSVrvnet/bin/rvnetstat -s -v

Monitoring Function : enable


[fjvnet0]
 Monitoring Status  : active
 Reachability       : {net0, net1}

 LINK               STATUS     IF-LINK
+-----------------+---------+-------+
 net0               active     up
 net1               standby    up
```

After detecting link down

```
# /opt/FJSVrvnet/bin/rvnetstat -s -v

Monitoring Function : enable
```

```
[fjvnet0]
 Monitoring Status  : fail
 Reachability       : {net1}

 LINK               STATUS     IF-LINK
 +-----------------+----------+-------+
 net0               fail       down
 net1               active     up
```

4.2.2 When an error is detected by the network monitoring function

When heartbeat errors are detected between NICs by the network monitoring function, change the communication type to "MAC tracking" to continue the communication by multiple NICs.

The following shows the operation status when an error is detected by network topology changes:

Figure 4.2 Error detection status by network topology changes
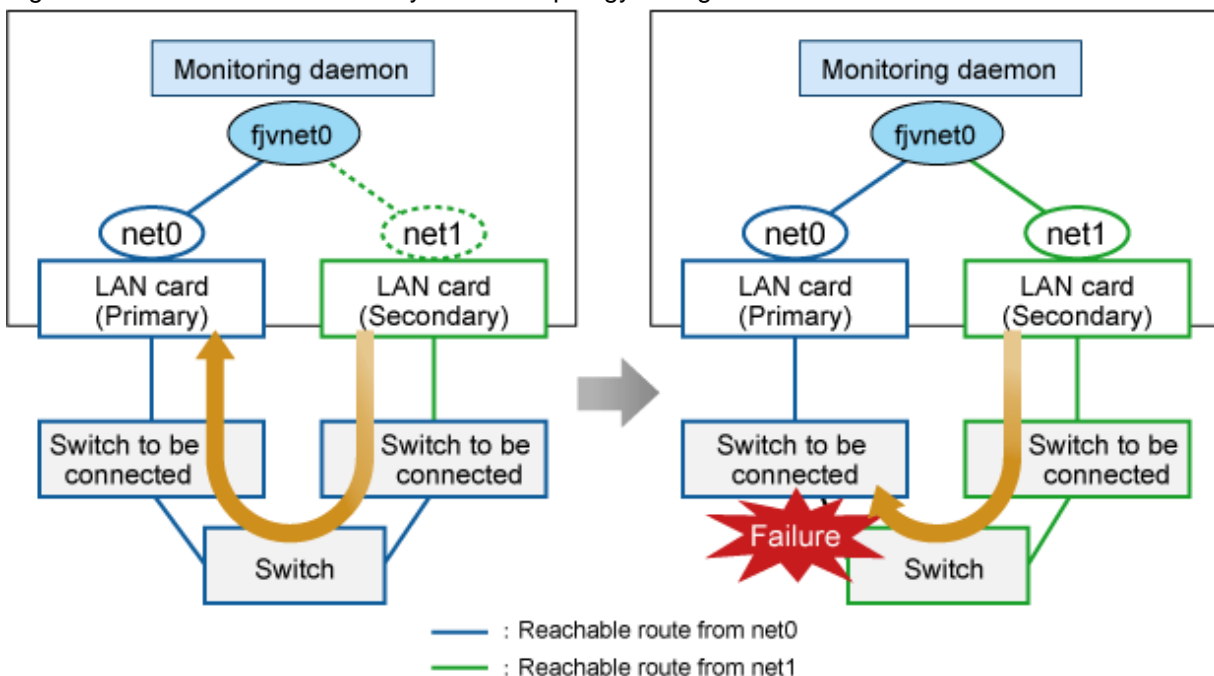
The following shows the link status of the virtual NIC for this case:

Before detecting errors by the network monitoring

```
# /opt/FJSVrvnet/bin/rvnetstat
 VNET               STATE     MODE        ACTIVE-LINK
 +-----------------+---------+-----------+---------------------------------------+
 fjvnet0            active    ACT-STANDBY  net0
```

After detecting errors by the network monitoring

```
# /opt/FJSVrvnet/bin/rvnetstat
 VNET               STATE     MODE        ACTIVE-LINK
 +-----------------+---------+-----------+---------------------------------------+
 fjvnet0            active    MAC-TRACK    net0,net1
```

Also, the following shows the link status of interfaces under the virtual NIC and the monitoring status:

Before detecting errors by the network monitoring

```
# /opt/FJSVrvnet/bin/rvnetstat -s -v

Monitoring Function : enable


[fjvnet0]
 Monitoring Status  : active
 Reachability       : {net0, net1}

 LINK             STATUS     IF-LINK
+----------------+---------+-------+
 net0             active     up
 net1             standby    up
```

After detecting errors by the network monitoring

```
# /opt/FJSVrvnet/bin/rvnetstat -s -v

Monitoring Function : enable


[fjvnet0]
 Monitoring Status  : fail
 Reachability       : {net0},{net1}

 LINK             STATUS     IF-LINK
+----------------+---------+-------+
 net0             active     up
 net1             active     up
```

4.3 Recovery from Failure

When an error occurs, the communication is continued by switching a path automatically. Besides, when the error of the redundant path was recovered, the path is automatically embedded as a switching destination. Therefore, no special operation is required. To return the status to its original operation status, use the rvnetadm set-if command to fail back the operation path.

Note that some applications may need to be restarted.

4.4 Notes on the Operation

Note the following points when operating in the virtual NIC mode.

- In the network monitoring function, failures may be detected when the delay and the lost of the packet occur frequently due to the increase of the communication load, etc.
  If a temporary failure of monitoring occurs frequently, adjust the detection time with the vnetadm set-param command.

- GLS does not support Verified Boot.
  The following warning messages may be output to the system log. However, these messages do not disrupt the system configuration or system operation. No action is required.

```
WARNING: Signature verification of module /usr/kernel/drv/sparcv9/rvnet failed
WARNING: Signature verification of module /usr/kernel/drv/sparcv9/rvnetcf failed
WARNING: Signature verification of module /usr/kernel/drv/sparcv9/sha failed
```

- The following warning messages may be output to the system log during OS startup or while running hotplug(1M) command of Solaris standard, cfgadm(1M) command, and ldm(1M) command. However, these messages do not disrupt the system configuration or system operation. No action is required.
  (fjvnetX: predefined Virtual NIC name)

```
IP: get_link_resource for fjvnetX error(operation failed)
IP: get_link_resource(fjvnetX) failed
```

Chapter 5 Maintenance

This chapter describes how to respond to problems of the virtual NIC mode.

5.1 Collecting information when an error occurred

In the event of a problem in the operation of the virtual NIC mode, see "5.1.1 Collecting information by the rvnet_snap command" or "5.1.2 Collecting information by FJQSS (Information Collection Tool)," and collect information. When collecting only information for investigation of Redundant Line Control Function, use rvnet_snap command. Use FJQSS to collect the information with other middleware products that support FJQSS.

5.1.1 Collecting information by the rvnet_snap command

Collect necessary information with the rvnet_snap command. For details on the command, see "A.3 rvnet_snap command."

When collecting all information under /tmp

```
/opt/FJSVrvnet/bin/rvnet_snap
```

When collecting the minimum information under /tmp

```
/opt/FJSVrvnet/bin/rvnet_snap -s
```

When collecting the minimum information under /export/home/user1

```
/opt/FJSVrvnet/bin/rvnet_snap -s /export/home/user1
```

5.1.2 Collecting information by FJQSS (Information Collection Tool)

[Detail of the function]

By using FJQSS (Information Collection Tool), collect the information required to maintain the Redundant Line Control Function.

The collected information includes all the information in the list of the collected information in "6.1.1 Command to collect information" in "PRIMECLUSTER Global Link Services Configuration and Administration Guide Redundant Line Control Function."

[Using example]

1. Execute the following command.

```
# /opt/FJSVqstl/fjqss_collect
```

2. The product selection menu appears. Put the number of the product of which you want to collect the information ("PRIMECLUSTER GL"), then input "[Enter]".
   For the cluster system, if the number of the cluster product (PRIMECLUSTER HA Server, for example) is specified, the information of PRIMECLUSTER including GLS can be collected at once.

3. Input "Y[Enter]" according to the instruction in the prompt.

4. After the FJQSS has completed the collection, the name of the output directory of the collected information appears. Verify that the information has been collected in the directory whose name is indicated in the console.

5. Send the created file to field engineers.

[Output form]

The following file is created in the output directory of the collected information.

result*YYYYMMDDHHMMSS*.tar.gz

(*YYYYMMDDHHMMSS*: time (year, month, day, hours, minutes and seconds) that the collection started)

📖 Information

· ·

About FJQSS (Information Collection Tool) and its usage

You can collect the information necessary for the trouble investigation with FJQSS (Information Collection Tool). See the FJQSS (Information Collection Tool) User's Guide bundled to the installation medium of the product.

When you see the FJQSS (Information Collection Tool) User's Guide, open the following file in the installation medium of the product by the browser.

documents/fjqss-manual_sollnx/index_en.html

· ·

5.2 Backing up and restoring the environment configuration information

This section describes how to back up and restore the environment definition files used by the virtual NIC mode.

5.2.1 Backing up the environment configuration information

Copy the environment definition files (fjsvrvnet.xml) under /etc/opt/FJSVrvnet/config/ to any directory.

5.2.2 Restoring the environment configuration information

Copy the environment definition files (fjsvrvnet.xml) backed up "5.2.1 Backing up the environment configuration information" to /etc/opt/ FJSVrvnet/config /. After the copying is completed, restart the operating system and allocate IP addresses if necessary.

Chapter 6 DR (Dynamic Reconfiguration) function/PHP (PCI Hot Plug) function

This section describes the concept and maintenance for building an environment when using the Dynamic Reconfiguration function (hereinafter DR function) or the PCI Hot Plug function (hereinafter PHP function).

In the virtual NIC mode, both DR and PHP functions provided by the following products are available:

- The DR function provided by the eXtended System Control Facility (hereinafter XSCF) of SPARC M12-2S/M10-4S and SPARC Enterprise M4000/M5000/M8000/M9000

- The PHP function provided by the Solaris standard cfgadm(1M) command

See
....

- When using the DR function, be sure to see the following manuals:

    - For SPARC M12-2S/M10-4S

        - "Fujitsu SPARC M12 and Fujitsu M10/SPARC M10 XSCF Reference Manual"

        - "Fujitsu SPARC M12 and Fujitsu M10/SPARC M10 Domain Configuration Guide"

      In this document, these manuals are indicated as "XSCF Reference Manual" or "Domain Configuration Guide," respectively.

    - For SPARC Enterprise M4000/M5000/M8000/M9000

        - "SPARC Enterprise M3000/M4000/M5000/M8000/M9000 Servers XSCF User's Guide"

        - "SPARC Enterprise M4000/M5000/M8000/M9000 Servers Dynamic Reconfiguration (DR) User's Guide"

      In this document, these manuals are indicated as "XSCF User's Guide" or "DR User's Guide," respectively.

- When using the PHP function, be sure to see the following manuals:

    - For SPARC M12/ M10

        - "Fujitsu SPARC M12-1 Service Manual"

        - "Fujitsu SPARC M12-2/2S Service Manual"

        - "PCI Expansion Unit for Fujitsu SPARC M12 and Fujitsu M10/SPARC M10 Service Manual"

        - "Fujitsu M10-1/SPARC M10-1 Service Manual"

        - "Fujitsu M10-4/Fujitsu M10-4S/SPARC M10-4/SPARC M10-4S Service Manual"

        - "PCI Expansion Unit for Fujitsu M10/SPARC M10 Systems Service Manual"

      In this document, these manuals are indicated as "service manual."

    - For SPARC Enterprise M4000/M5000/M8000/M9000

        - "SPARC Enterprise M4000/M5000 Servers Service Manual"

        - "SPARC Enterprise M8000/M9000 Servers Service Manual"

      In this document, these manuals are indicated as "service manual."
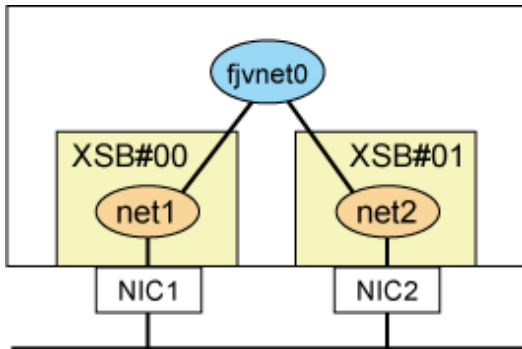..

6.1 When using the DR function

This section describes the recommended configuration and how to replace the system board when using the DR function.

6.1.1 Recommended configuration

The following configuration is recommended when using the DR function of XSCF.

Figure 6.1 The recommended configuration in the available environment for DR function

The DR function is performed per XSB (the system board for DR-compatible machine of XSCF). Make NICs (which are built into each system board) redundant to continue the communication with a virtual NIC even when disconnecting the system board with the DR command.

6.1.2 Replacing the system board

The system board is replaced by using the DR function of XSCF with the rvnetadm disconnect command and the rvnetadm connect command. These commands are used when disconnecting or reconnecting a physical NIC assigned under the virtual NIC.

Procedure when disconnecting a NIC

This section describes the procedure for disconnecting a NIC built into the target system board temporarily from the virtual NIC when replacing a system board due to a failure or other reason.

Figure 6.2 Disconnecting procedure
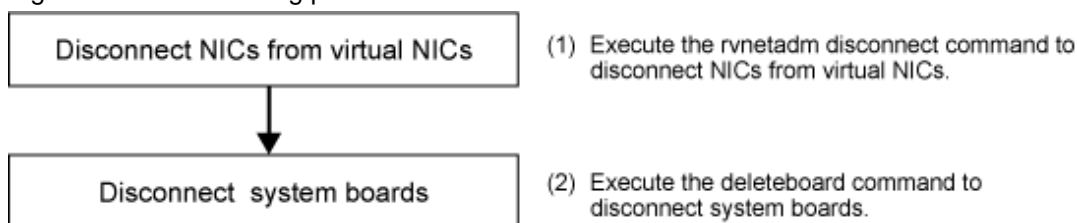
1. Disconnect a NIC from the virtual NIC
   Disconnect all the NICs built into the system board that is to be replaced from the virtual NIC with the rvnetadm disconnect command.

   ```
   # /opt/FJSVrvnet/bin/rvnetadm disconnect -n fjvnet0 -i net1
   # /opt/FJSVrvnet/bin/rvnetadm disconnect -n fjvnet1 -i net3
   ```

   ### 📑 See
   ....
   For details on the rvnetadm command, see "A.1 rvnetadm command."
   ....

2. Disconnect a system board
   Disconnect the system board with the deleteboard command of XSCF.

   ```
   # XSCF> deleteboard -c disconnect 01-0
   ```

See the following manuals in advance to check the board number of the system board to be disconnected:

- For SPARC M12-S/ M10-4S
  "Domain Configuration Guide"

- For SPARC Enterprise M4000/M5000/M8000/M9000
  "DR User's Guide"

For details on the deleteboard command, see the following manuals:

- For SPARC M12-S/ M10-4S
  "XSCF Reference Manual"

- For SPARC Enterprise M4000/M5000/M8000/M9000
  "XSCF User's Guide"

Procedure when connecting a NIC

This section describes the procedure for embedding a NIC built into the target system board to the virtual NIC again when replacing a system board due to a failure or other reason.

Figure 6.3 Connecting procedure

1. Reconstructing a system board
   Connect the system board with the addboard command of XSCF.

   - For SPARC M12-S/ M10-4S

   ```
   # XSCF> addboard -c configure -p 0 01-0
   ```

   - For SPARC Enterprise M4000/M5000/M8000/M9000

   ```
   # XSCF> addboard -c configure -d 0 01-0
   ```

See the following manuals in advance to check the board number of the system board to be connected:

- For SPARC M12-S/ M10-4S
  "Domain Configuration Guide"

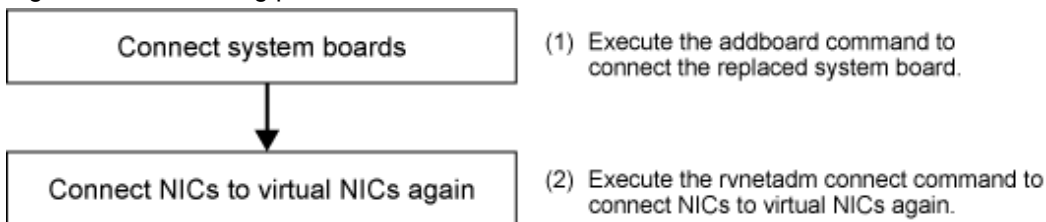- For SPARC Enterprise M4000/M5000/M8000/M9000
  "DR User's Guide"

  - For SPARC M12-S/ M10-4S
    "XSCF Reference Manual"

  - For SPARC Enterprise M4000/M5000/M8000/M9000
    "XSCF User's Guide"
....

2. Reconnecting a NIC to the virtual NIC
   Reconnect all NICs built into the replaced system board to the virtual NIC with the rvnetadm connect command. If changing the active path through the hot swap, fail back the active path as necessary.

```
# /opt/FJSVrvnet/bin/rvnetadm connect -n fjvnet0 -i net1
# /opt/FJSVrvnet/bin/rvnetadm connect -n fjvnet1 -i net3
```

6.2 When using the PHP function

This section describes the recommended configuration and how to replace PCI cards when using the PHP function.

6.2.1 Recommended configuration

The following configuration is recommended in the available environment for the PHP function.

When using a NIC in which contains two or more interfaces built into a PCI card, make interfaces on the respective PCI cards redundant. In this way, if one interface fails, the other one continues the communication.

6.2.2 Replacing the PCI card

The PCI card using the PHP function is replaced with the rvnetadm disconnect command and the rvnetadm connect command. These commands are used when disconnecting or reconnecting a physical NIC assigned under the virtual NIC.

Note
....

When using PHP, execute the following command to enable the hotplug service. For details, refer to the service manuals.

```
# svcadm enable hotplug
```
....

Procedure when disconnecting a NIC

This section describes the procedure for disconnecting a PCI card built into the target system board temporarily from the virtual NIC when replacing a system board due to a failure or other reason.

Figure 6.4 Disconnecting procedure

(1) Execute the rvnetadm disconnect command to disconnect NICs from virtual NICs.

(2) Execute the cfgadm command to disconnect PCI cards.
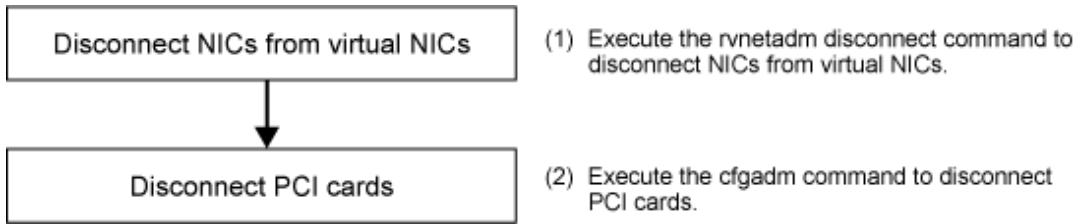
1. Disconnect a NIC from a virtual NIC

   Disconnect a NIC that is to be replaced from the virtual NIC with the rvnetadm disconnect command.

   ```
   # /opt/FJSVrvnet/bin/rvnetadm disconnect -n fjvnet0 -i net1
   ```

   ### 📘 See
   . . . .
   For details on the rvnetadm command, see "A.1 rvnetadm command."
   . . . .

2. Disconnecting the PCI card

   Confirm that the slot status of the PCI slot "slot03" to be disconnected is "connected configured."

   ```
   # cfgadm BB#0-PCI#0
   Ap_Id                        Type       Receptacle   Occupant     Condition
   BB#0-PCI#0                   etherne/hp connected    configured   ok
   ```

   Execute the uncfgadm(1M) command with specifying unconfigure to cancel the configuration of the PCI card at Ap_Id.

   After that, execute the cfgadm(1M) command to check if the slot status is changed to "connected unconfigured".

   ```
   # cfgadm -c unconfigure BB#0-PCI#0 <Return>
   # cfgadm BB#0-PCI#0 <Return>
   Ap_Id                        Type       Receptacle   Occupant     Condition
   BB#0-PCI#0                   unknown    connected    unconfigured unknown
   ```

   Execute the cfgadm(1M) command with specifying disconnect to disconnect the PCI card from Ap_Id.

   After that, execute the cfgadm(1M) command to check if the slot status is changed to "disconnected unconfigured".

   ```
   # cfgadm -c disconnect BB#0-PCI#0 <Return>
   # cfgadm BB#0-PCI#0 <Return>
   Ap_Id                        Type       Receptacle   Occupant     Condition
   BB#0-PCI#0                   unknown    disconnected unconfigured unknown
   ```

   To indicate the slot position for replacement, specify the obtained "Ap_Id" to "cfgadm" command and blink the ATTENTION LED.

   ```
   # cfgadm -x led=attn,mode=blink BB#0-PCI#0 <Return>
   ```

   ### 📘 See
   . . . .
   - For details on the cfgadm(1M) command, see the Solaris manual.

   - For details on disconnecting the PCI card, see the service guide.
   . . . .

Procedure when connecting a NIC

This section describes the procedure for embedding the NIC built into the target system board to the virtual NIC again when replacing a system board due to a failure or other reason.

Figure 6.5 Connecting procedure

Connect PCI cards	(1) Execute the cfgadm command to connect PCI cards.

Connect NICs to virtual NICs again	(2) Execute the rvnetadm connect command to connect NICs to virtual NICs again.

1. Reconnecting the PCI card

   Execute the uncfgadm(1M) command with specifying connect to connect the new PCI card to Ap_Id.

   After that, execute the cfgadm(1M) command to check if the slot status is changed to "connected unconfigured".

```
# cfgadm -c connect BB#0-PCI#0 <Return>
# cfgadm BB#0-PCI#0 <Return>
Ap_Id                          Type         Receptacle   Occupant     Condition
BB#0-PCI#0                     unknown      connected    unconfigured unknown
```

   Specify the target Ap_Id and execute the cfgadm(1M) command with specifying configure to install the new PCI card.

   After that, execute the cfgadm(1M) command to check if the slot status is changed to "connected configure".

```
# cfgadm -c configure BB#0-PCI#0 <Return>
# cfgadm BB#0-PCI#0 <Return>
Ap_Id                          Type         Receptacle   Occupant     Condition
BB#0-PCI#0                     etherne/hp   connected    configured   ok
```

See
....
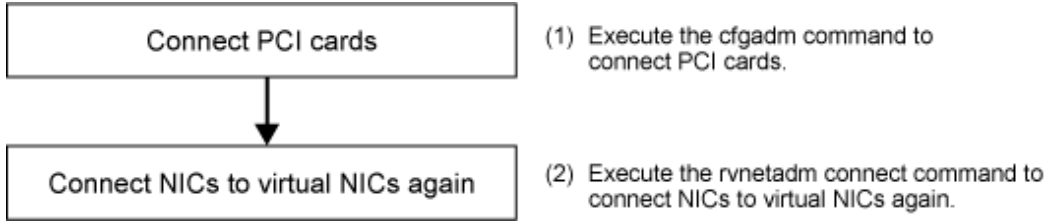
   - For details on the cfgadm(1M) command, see the Solaris manual.

   - For details on reconnecting the PCI card, see the service guide.
....

2. Reconnecting a NIC to the virtual NIC
   Reconnect all NICs built into the replaced system board to the virtual NIC with the rvnetadm connect command. If changing the active path through the hot swap, fail back the active path as necessary.

```
# /opt/FJSVrvnet/bin/rvnetadm connect -n fjvnet0 -i net1
```

See
....
For details on the rvnetadm command, see "A.1 rvnetadm command."
....

Appendix A Command Reference

This appendix describes how to use commands provided by the virtual NIC mode.

A.1   rvnetadm command

[Name]

rvnetadm - Manages virtual NICs

[Synopsis]

/opt/FJSVrvnet/bin/rvnetadm command [args]

[Feature description]

The rvnetadm command creates and deletes virtual NICs used in the virtual NIC mode. This command also adds and deletes links.

command	Process outline	Authority	
		Super user	General user
create	Creates a virtual NIC	Y	-
delete	Deletes a virtual NIC	Y	-
add-if	Adds a NIC that configure a virtual NIC	Y	-
remove-if	Deletes a NIC that configure a virtual NIC	Y	-
set-if	Configures the actual NIC assigned under the virtual NIC for operation	Y	-
print	Displays the configuration definition of the virtual NIC	Y	Y
set-prop	Sets the properties of the virtual NIC	Y	-
show-prop	Displays the properties of the virtual NIC	Y	Y
set-param	Sets common parameters of the virtual NIC	Y	-
show-param	Displays common parameters of the virtual NIC	Y	Y
connect	Reconnects a NIC to configure the virtual NIC	Y	-
disconnect	Temporal disconnection of a NIC to configure the virtual NIC	Y	-
start-observ	Enables the network monitoring function of the virtual NIC	Y	-
stop-observ	Disables the network monitoring function of the virtual NIC	Y	-
version	Displays version information	Y	Y

📒 Note
....

Tagged VLAN interfaces (net2001, net4001002, etc.) cannot be configured under the virtual NIC.
....

📖 Information
....

NICs that are possible to configure under the virtual NIC must correspond to GLDv3. The following shows the applicable types of interface:

- Physical interfaces (net0, net1, etc.)

- Link aggregation (with LACP) interfaces (aggr0, aggr1, etc.)
....

(1) create command

The create command creates a virtual NIC used in the virtual NIC mode. The configuration information is created after creating the virtual NIC. The following is the format of the create command:

```
/opt/FJSVrvnet/bin/rvnetadm create -n fjvnet-link [-i interface1[,interface2]] [-a MAC-address] [-v
yes|no]
```

-n fjvnet-link

Specify the name of a new virtual NIC to be created. Specify the name of a virtual NIC begins with a string of arbitrary characters and is followed by a value (0 to 255) (such as fjvnet0,fjvnet10, etc.).

![Note icon] **Note**

....

- Do not use "sha" for the name of the interfaces.

- Specify a name different from that of the other interfaces.

- Do not change a name with the dladm rename-link command after setting the name.

- Use the rvnetadm delete command for deleting a virtual NIC. Do not use the dladm delete-vnic command.

....

-i interface1[,interface2]

Specify the interfaces to be bundled by a virtual NIC. Specify more than one interface, by listing them delimited with a comma (,).

-a MAC-address

Specify a MAC address to be allocated to the virtual NIC. Specify a MAC address used in the virtual NIC to MAC-address directly. Since the MAC addresses of the virtual NIC are automatically generated, normally specifying them to MAC-address is not necessary. However, if necessary, set the address which does not overlap with the assigned MAC address as follows:

- Other virtual NICs

- Physical NICs

- Other nodes on the same segment

Possible format of MAC address is as follows:

```
XX:XX:XX:XX:XX:XX
```

Specify XX in a hexadecimal code and separated by colons (:).

![Note icon] **Note**

....

Multicast and broadcast addresses cannot be specified as a MAC address.

If a MAC address is not specified to a virtual NIC, a MAC address is automatically generated at OS startup. If you want to fix the MAC address, specify it with the -a option.

....

-v yes|no

Specify whether to permit the creation of vnic on a virtual interface. The initial setting value is set to "no" so that the creation is not permitted. To connect a virtual interface to the virtual switch in the Oracle VM environment, set "yes" to permit the creation.

(2) delete command

The delete command deletes a virtual NIC used in the virtual NIC mode. The configuration information is deleted after deleting the virtual NIC.

The following is the format of the delete command:

```
/opt/FJSVrvnet/bin/rvnetadm delete -n fjvnet-link
```

-n fjvnet-link

    Specify the virtual NIC to be deleted.

(3) add-if command

The add-if command adds an interface to the virtual NIC. The configuration information is updated after adding the interface.

The following is the format of the add-if command:

```
/opt/FJSVrvnet/bin/rvnetadm add-if -n fjvnet-link -i interface
```

-n fjvnet-link

    Specify the name of the virtual NIC.

-i interface

    Specify an interface to be added to the virtual NIC.

(4) remove-if command

The remove-if command deletes an interface from the virtual NIC. The configuration information is updated after deleting the interface.

The following is the format of the remove-if command:

```
/opt/FJSVrvnet/bin/rvnetadm remove-if -n fjvnet-link -i interface
```

📄 Note

. . . .

When a network monitoring function is enabled, disable it with the rvnetadm stop-observ command, and then execute this command.

After executing this command, enable the network monitoring function with the rvnetadm start-observ command.

. . . .

-n fjvnet-link

Specify the name of the virtual NIC.

-i interface

Specify an interface to be deleted from the virtual NIC.

(5) set-if command

The set-if command converts the status of a NIC assigned under the virtual NIC, from "Standby" to "Active." This enables the interface for communication. When the communication mode is in "Active-Standby", specifying the "Standby" state interface converts to that of "Active" state. Otherwise, the interface currently in the "Active" state converts to the "Standby" state.

When the communication mode is "MAC Tracking," the setting above cannot be performed.

The following is the format of the set-if command:

```
/opt/FJSVrvnet/bin/rvnetadm set-if -n fjvnet-link -i interface
```

-n fjvnet-link

Specify the name of the virtual NIC.

-i interface

Specify an interface used for communication when the communication mode is in "Active-Standby."

📄 Note

. . . .

Check the status of the NIC assigned under virtual NIC and the virtual NIC by using the rvnetstat command before executing the command. For details, see "A.2 rvnetstat command."

. . . .

(6) print command

The print command displays the current configuration information. The following is the format of the print command:

```
/opt/FJSVrvnet/bin/rvnetadm print [-n fjvnet-link] [-o field[,...] [-p]]
```

-n fjvnet-link

Specify the name of the virtual NIC. If this option is omitted, the print command displays all the virtual NICs.

-o field[,...]

Specify the output field by listing delimited with a comma (,). If this option is omitted, the print command displays all the fields.

-p

Output the field order specified with the -o option for each output line. Use a space () as the delimiter between values.

Field	Description
VNET	The name of the virtual NIC.
MAC-ADDR	MAC address of the virtual NIC When the MAC address is allocated automatically, "auto" is specified.
LINK	The interfaces bundled by a virtual NIC.

The following shows an example of the configuration information.

```
# /opt/FJSVrvnet/bin/rvnetadm print
 VNET            MAC-ADDR           LINK
+---------------+-----------------+--------------------------+
 fjvnet0         auto               net0,net1
 fjvnet1         2:34:56:78:90:12   net2,net3
```

The following shows an example of the virtual NIC name when "fjvnet1" is specified.

```
# /opt/FJSVrvnet/bin/rvnetadm print -n fjvnet1
 VNET            MAC-ADDR           LINK
+---------------+-----------------+--------------------------+
 fjvnet1         2:34:56:78:90:12   net2,net3
```

The following shows an example of the configuration information when the -o option is specified.

```
# /opt/FJSVrvnet/bin/rvnetadm print -o VNET,LINK
 VNET            LINK
+---------------+-----------------------------+
 fjvnet0         net0,net1
 fjvnet1         net2,net3
```

The following shows an example of the configuration information when the -o option and -p option are specified.

```
# /opt/FJSVrvnet/bin/rvnetadm print -o VNET,LINK -p
fjvnet0 net0,net1
fjvnet1 net2,net3
```

(7) set-prop command

The set-prop command changes the properties of the virtual NIC. The configuration information is changed after changing the properties of the virtual NIC.

The following is the format of the set-prop command.

```
/opt/FJSVrvnet/bin/rvnetadm set-prop -n fjvnet-link [-a MAC-address] [-m on|off] [-l yes|no] [-p b|r]
[-u bytes] [-v yes|no]
```

-n fjvnet-link

Specify the virtual NIC name which the properties are to be changed.

-a MAC-address

Specify a MAC address to be allocated to the virtual NIC. Specify a MAC address used in the virtual NIC to MAC-address directly. Since the MAC addresses of the virtual NIC are automatically generated, normally specifying them to MAC-address is not necessary. However, if necessary, set the address which does not overlap with the assigned MAC address as follows:

- Other virtual NICs

- Physical NICs

- Other nodes on the same segment

Possible format of MAC address is as follows:

```
XX:XX:XX:XX:XX:XX
```

Specify XX in a hexadecimal code and separated by colons (:).

Note

. . . .

- Multicast and broadcast addresses cannot be specified as a MAC address.

- Before executing the set-prop command, make sure the virtual NIC is inactive. For the procedure to inactivate the virtual NIC, see "3.4 Notes on setting a configuration."

- When changing to auto configuration (auto) after specifying the MAC address, delete the Virtual NIC once and create it again.

. . . .

-m on | off

Set the operation for "MAC Tracking." Initial value is set to "MAC Tracking" enabled (on).

Note

. . . .

When a network monitoring function is enabled, disable it with the rvnetadm stop-observ command, and then execute this command.

After executing this command, enable the network monitoring function with the rvnetadm start-observ command.

. . . .

on: "MAC Tracking" enabled

This enables the communication that tracks a destination MAC address automatically according to the result of the network monitoring. Normally, the communication is carried out in "Active-Standby". When the network monitoring function detects a failure, the communication is carried out in "MAC Tracking."

off: "MAC Tracking" disabled

"Active-Standby" is used all the time. Network monitoring of the specified virtual NIC is stopped.

-l yes|no

Configure enable/disable Link Status Propagation of the virtual NIC. Initial value is set to Link Status Propagation disabled (no).

yes: Link Status Propagation enabled

The change of the link status for interfaces bundled by a virtual NIC propagates to the link status of the virtual NIC. Enabling this setting will bring the virtual NIC's link status to fail when all the bundled interfaces are linked down.

no: Link Status Propagation disabled

The change of the link status for interfaces bundled by a virtual NIC does not propagate to the link status of the virtual NIC. To maintain the communication between zones in case of a link down occurred in a physical NIC, set Link Status Propagation to "no."

-p b|r

When performing communication via "MAC Tracking," the method for sending packets is according to the following cases: the MAC address that coincides with a destination MAC address has not learned, or the destination MAC address is a broadcast or multicast address. Initial value is set to the round robin system (r).

b: Broadcast mode

Copy the packets and simultaneously send from all the NICs.
In broadcast system, received packets may overlap because the same packet is sent from two or more interfaces. (*) The waiting time to send packet is faster than that of round robin mode. If the application cannot allow any overlapped receiving, use the round robin mode.

```
(*) It occurs when there are two or more servers adopted the virtual NIC mode exist and send UDP-
based packets to the broadcast or multicast destination.
```

r: Round robin mode

Send packets evenly-divided between NICs.
Though round robin mode takes time to send packets, use this mode if the application cannot allow overlapped receiving.

-u bytes

Changed the MTU value of a virtual interface. The default of the MTU value is 1500.
The MTU value of a virtual interface should be specified not to exceed the MTU value of the interfaces bundled by the virtual interface.

- When the MTU value is different between the interfaces bundled by the virtual interface.
  The maximum value of the MTU is the minimum value of the MTU among the interfaces bundled by the virtual interface.

- When creating only for the virtual interface instead of specifying the interfaces bundled by the virtual interface.
  The MTU value should be specified in the range of 64 to 65535.

- When the bundled interfaces are shared by multiple virtual interfaces.
  Specify the MTU value for each virtual NIC.

Point

Set the MTU value of the interfaces bundled by a virtual interface with the set-linkprop subcommand of dladm(1M). At the time, the MTU value of the interfaces should not be bundled by a virtual interface.

Note

Do not change the MTU value of the virtual interface with the set-linkprop subcommand of dladm(1M).

The following shows the example of changing the MTU value during the virtual NIC creation:

```
# /usr/sbin/dladm set-linkprop -p mtu=9000 net1
# /usr/sbin/dladm set-linkprop -p mtu=9000 net2
# /opt/FJSVrvnet/bin/rvnetadm create -n fjvnet0 -i net1,net2
# /opt/FJSVrvnet/bin/rvnetadm set-prop -n fjvnet0 -u 9000
```

The following shows the example of changing the MTU value after the virtual NIC creation:

```
# /opt/FJSVrvnet/bin/rvnetadm disconnect -i net1
# /usr/sbin/dladm set-linkprop -p mtu=9000 net1
# /opt/FJSVrvnet/bin/rvnetadm connect -i net1
# /opt/FJSVrvnet/bin/rvnetadm disconnect -i net2
# /usr/sbin/dladm set-linkprop -p mtu=9000 net2
# /opt/FJSVrvnet/bin/rvnetadm connect -i net2
# /opt/FJSVrvnet/bin/rvnetadm set-prop -n fjvnet0 -u 9000
```

-v yes|no

Specify whether to permit the creation of vnic on a virtual interface. The initial setting value is set to "no" so that the creation is not permitted. To connect a virtual interface to the virtual switch in the Oracle VM environment, set "yes" to permit the creation. The setting change will be enabled after the OS is restarted next time.

(8) show-prop

The show-prop command displays the properties of a specified virtual NIC.

The following is the format of the show-prop command.

```
/opt/FJSVrvnet/bin/rvnetadm show-prop -n fjvnet-link
```

-n fjvnet-link

Specify the virtual NIC name which the properties are to be displayed.

Field		Description
VNET		The name of the virtual NIC.
MAC-ADDRESS		MAC address of the virtual NIC. When the MAC address is allocated automatically, "auto" is specified.
PROPAGATE-LINK	yes	Link Status Propagation is enabled.
	no	Link Status Propagation is disabled.
MAC-TRACKING	on	"MAC Tracking" is enabled.
	off	"MAC Tracking" is disabled.
PROBE-MODE	broadcast	Broadcast mode
	round-robin	Round robin mode
MTU		MTU value
ALLOW-UPPER-VNIC	yes	VNIC creation on a virtual interface is permitted.
	no	VNIC creation on a virtual interface is not permitted.

The flowing shows an example of the properties of a virtual NIC.

```
# /opt/FJSVrvnet/bin/rvnetadm show-prop -n fjvnet0
VNET              : fjvnet0
MAC-ADDRESS       : auto
PROPAGATE-LINK    : no
MAC-TRACKING      : on
PROBE-MODE        : round-robin
MTU               : 1500
ALLOW-UPPER-VNIC  : no
```

(9) set-param command

The set-param command sets the common parameter of the virtual NIC.

The following is the format of the set-param command.

```
/opt/FJSVrvnet/bin/rvnetadm set-param [-i sec] [-c times] [-r times] [-d sec]
```

-i sec

Specify the monitoring interval of the network monitoring function in seconds. A value from 1 to 100 can be specified (note that the product of sec and times must be 100 or less). Initially, 3 (seconds) is specified.

-c times

Specify the monitoring count of the network monitoring function. A value from 1 to 100 can be specified (note that the product of sec and times must be 100 or less). Initially, 3 (times) is specified.

-r times

Specify the count for recovery of the network monitoring function to be detected. A value from 1 to 100 can be specified. Initially, 1 (time) is specified.

-d delay

Specify the time for error detection delay time of the network monitoring function. A value from 1 to 100 can be specified. Initially, 45 (seconds) is specified. In addition, if the value of the -d delay is less than the product of -i option and -c option, this option is ignored.

(10) show-param command

The show-param command displays the current common parameter of the virtual NIC.

The following is the format of the show-param command.

```
/opt/FJSVrvnet/bin/rvnetadm show-param
```

Field	Description
INTERVAL(sec)	Monitoring interval of the network monitoring function. Value is in seconds (sec).
FAIL-DETECTION(times)	Frequency of error monitoring in the network monitoring function.
REPAIR-DETECTION(times)	Frequency of recovery monitoring in the network monitoring function.
DELAY-TIME(sec)	Error detection delay time of the network monitoring function. Value is in seconds (sec).

The following shows an example of the common parameter.

```
# /opt/FJSVrvnet/bin/rvnetadm show-param
INTERVAL(sec)             : 3
FAIL-DETECTION(times)     : 3
REPAIR-DETECTION(times)   : 1
DELAY-TIME(sec)           : 45
```

(11) connect command

The connect command reconnects a disconnected interface. This does not reflect the configuration information.

The following is the format of the connect command.

```
/opt/FJSVrvnet/bin/rvnetadm connect [-n fjvnet-link] -i interface
```

-n fjvnet-link

Specify the name of the virtual NIC. If this option is omitted, the entire virtual interfaces will be selected.

-i interface

Specify an interface to be reconnected.

Note
. . . .

By using the rvnetstat command, check that the interface to be dealt with is "disconnect" before executing the connect command. For details, see "A.2 rvnetstat command."
. . . .

(12) disconnect command

The disconnect command disconnects an interface temporarily, and then set its state to unused. This action is not reflected in the configuration information.

The following is the format of the disconnect command.

```
/opt/FJSVrvnet/bin/rvnetadm disconnect [-n fjvnet-link] -i interface
```

-n fjvnet-link

Specify the name of the virtual NIC. If this option is omitted, the entire virtual interfaces will be selected.

-i interface

Specify an interface to be disconnected.

(13) start-observ command

The start-observ command enables the network monitoring function of the virtual NIC.

The following is the format of the start-observ command.

```
/opt/FJSVrvnet/bin/rvnetadm start-observ
```

(14) stop-observ command

The stop-observ command disables the network monitoring function of the virtual NIC.

The following is the format of the stop-observ command.

```
/opt/FJSVrvnet/bin/rvnetadm stop-observ
```

(15) version command

The version command displays the version of this product.

The following is the format of the version command.

```
/opt/FJSVrvnet/bin/rvnetadm version
```

The following shows an example of the version information:

```
# /opt/FJSVrvnet/bin/rvnetadm version
FJSVrvnet version 1.3
```

A.2 rvnetstat command

[Name]

rvnetstat - Displays the state of virtual NICs of the virtual NIC mode

[Synopsis]

```
/opt/FJSVrvnet/bin/rvnetstat [-s] [-n fjvnet-link] [-o field[,...] [-p]] [-v]
```

[Feature description]

The rvnetstat command displays the current status of virtual NICs used in the virtual NIC mode: operation status, interface status, and monitoring status.

[Options]

The following options can be specified.

-s

   The -s option displays the status of the interface bundled by a virtual NIC and its monitoring status.

ℹ️ **Information**

. . . .

   - The monitoring is shared in the virtual interface which bundles the same physical NIC in the same order.

   - The status of the representative virtual interface is displayed when there are multiple virtual interfaces which bundle the same physical NIC in the same order, and also the virtual interfaces are not specified with the -n option.

. . . .

-n fjvnet-link

   Specify a virtual NIC to deal with. If this option is omitted, the entire virtual interfaces will be selected.

-o field[,...]

   Specify the output field by listing delimited with a comma (,). If this option is omitted, the print command displays all the fields. This option cannot be used with the -s option at the same time.

-p

   Output the field order specified with the -o option for each output line. Use a space () as the delimiter between values.

-v

Output the detailed information.

[Without -s option specified (operation status)]

Field		Description
VNET		The name of the virtual NIC.
STATE	active	The virtual NIC is active. (The virtual interface is in use.)
	inactive	The virtual NIC is inactive. (The virtual interface is not in use.)
MODE	MAC-TRACK	Communicating with "MAC Tracking."
	ACT-STANDBY	Communicating with "Active-Standby."
ACTIVE-LINK		The active interfaces bundled by a virtual NIC.
MAC-ADDR (Displays only when the -v option is specified.)		MAC address of a virtual NIC.

[With -s option specified (interface status)]

Field		Description
Monitoring Function	enable	The network monitoring function is enabled.
	disable	The network monitoring function is disabled.
Monitoring Status	active	The network monitoring function operates normally.
	fail	The network monitoring function detects a failure.
	inactive	The network monitoring function is inactive.
Reachability	{LINK1,LINK2,...}	Displays the reachability of a heartbeat message between interfaces. Displays the reachable interface groups of heartbeat messages. Interfaces with link down are not displayed.
	----	Displays interfaces when the network monitoring function is disabled.
LINK		The interfaces bundled by a virtual NIC.
STATUS	active	Activated state Displays the status if the interface is in operation mode.
	standby	Standby state Displays the status if the interface is in standby mode.
	disconnect	Disconnected state Displays the status if the interface is disconnected temporarily by the rvnetadm disconnect command.
	fail	Failure detection state Displays the status if a failure is detected in the interface by the link down monitoring function.
	unknown	Unknown state Displays the status if the interface is unable to obtain its link status or there is no IP interface on the virtual NIC right after starting the operating system.

Field		Description
IF-LINK (Displays only when the -v option is specified)	up	Link up state Displays the status if the link state of the interface is in the up state.
	down	Link down state Displays the status if the link state of the interface is in the down state.
	unknown	Link state is unknown Displays the status if the link state of the interface is in the unknown state.

The following shows the display format used when no option is specified.

```
# /opt/FJSVrvnet/bin/rvnetstat
 VNET              STATE     MODE        ACTIVE-LINK
+-----------------+---------+-----------+---------------------------------------+
 fjvnet0           active    ACT-STANDBY net0
 fjvnet1           active    MAC-TRACK   net0,net1
```

The following shows the display format when the -v option and fjvnet0 are specified.

```
# /opt/FJSVrvnet/bin/rvnetstat -n fjvnet0 -v
 VNET              STATE     MODE        MAC-ADDR           ACTIVE-LINK
+-----------------+---------+-----------+------------------+----------------------+
 fjvnet0           active    ACT-STANDBY 2:11:22:33:44:55   net0
```

The following shows an example of the configuration status of the virtual interface.

Example) Configuration status of the virtual interface

Virtual NIC	Physical NIC	Network monitoring status	Link status
fjvnet0	net0, net1	Normal	Link up state
fjvnet1	net1, net2	Failure	Link down state
fjvnet2	net1, net2	Failure	Link down state
fjvnet3	net3, net4	Failure	Link up state
fjvnet4	net5, net6	Stop	A disconnected NIC exists.
fjvnet5	net6	Stop	Link up state

[Example when the -s option is specified]

```
# /opt/FJSVrvnet/bin/rvnetstat -s

Monitoring Function : enable


[fjvnet0]
 Monitoring Status  : active
 Reachability       : {net0, net1}

 LINK              STATUS
+-----------------+----------+
 net0              active
 net1              standby

[fjvnet1, fjvnet2]
 Monitoring Status  : fail
```

```
 Reachability        : {net1}

  LINK               STATUS
 +-----------------+----------+
  net1               active
  net2               fail

 [fjvnet3]
  Monitoring Status  : fail
  Reachability       : {net3},{net4}

  LINK               STATUS
 +-----------------+----------+
  net3               active
  net4               active

 [fjvnet4]
  Monitoring Status  : inactive
  Reachability       : ----

  LINK               STATUS
 +-----------------+----------+
  net5               disconnect
  net6               active

 [fjvnet5]
  Monitoring Status  : inactive
  Reachability       : ----

  LINK               STATUS
 +-----------------+----------+
  net6               active
```

[Example when the -s option and -v option are specified]

```
 # /opt/FJSVrvnet/bin/rvnetstat -s -v

 Monitoring Function : enable


 [fjvnet0]
  Monitoring Status  : active
  Reachability       : {net0, net1}

  LINK               STATUS     IF-LINK
 +-----------------+----------+-------+
  net0               active     up
  net1               standby    up

 [fjvnet1, fjvnet2]
  Monitoring Status  : fail
  Reachability       : {net1}

  LINK               STATUS     IF-LINK
 +-----------------+----------+-------+
  net1               active     up
  net2               fail       down

 [fjvnet3]
  Monitoring Status  : fail
  Reachability       : {net3},{net4}

  LINK               STATUS     IF-LINK
```

```
+-----------------+----------+-------+
 net3             active     up
 net4             active     up

[fjvnet4]
 Monitoring Status  : inactive
 Reachability       : ----

 LINK             STATUS     IF-LINK
+-----------------+----------+-------+
 net5             disconnect unknown
 net6             active     up

[fjvnet5]
 Monitoring Status  : inactive
 Reachability       : ----

 LINK             STATUS     IF-LINK
+-----------------+----------+-------+
 net6             active     up
```

A.3 rvnet_snap command

[Name]

rvnet_snap - Collect troubleshooting information for maintaining the virtual NIC mode

[Synopsis]

```
/opt/FJSVrvnet/bin/rvnet_snap [-s] [save-directory]
```

[Feature description]

Collect troubleshooting information for maintaining the virtual NIC mode. This command is available only in the case of super-user authority.

[Options]

The following options can be specified.

-s

Specify the -s option when collecting troubleshooting information to the minimum necessary. If this option is omitted, the entire troubleshooting information will be collected.

save-directory

The save-directory specifies the storage destination that stores troubleshooting information. If this option is omitted, the information is stored in "/tmp."

A list of collected information is as follows:

[Meaning of the symbols] Y: Collect -: Not collect

Type	File name when collected	Collected information	Minimum information
System information: OSInfo/	etc/	/etc/hosts	Y
		/etc/netmasks	Y
		/etc/nsswitch.conf	Y
		/etc/gateways	Y
		/etc/defaultrouter	Y
	etc/inet	/etc/inet/*	Y
	etc/ipf/	/etc/ipf/*	Y
	adm/	/var/adm/messages*	-
	var/svc/log/	/var/svc/log/network-loopback:default.log	-
		/var/svc/log/network-physical:default.log	-
		/var/svc/log/network-initial:default.log	-
		/var/svc/log/network-service:default.log	-
		/var/svc/log/system-zones:default.log	-
		/var/svc/log/network-inetd:default.log	-
		/var/svc/log/network-fjsrvnet:default.log	-
		/var/svc/log/system-filesystem-minimal:default.log	-
	uname_a	uname -a	Y
	ifconfig_a	ifconfig -a	Y
	dladm_info	dladm show-link dladm show-linkprop dladm show-phys dladm show-bridge dladm show-vlan dladm show-ether dladm show-secobj dladm show-vnic dladm show-iptun dladm show-part dladm show-ib dladm show-link -P dladm show-phys -P	Y
	ipadm_info	ipadm show-if ipadm show-ifprop ipadm show-addr ipadm show-addrprop ipadm show-prop	Y
	netstat	netstat -na netstat -ni netstat -np netstat -nr netstat -ng	Y
	ip_forward	/usr/sbin/ndd -get /dev/ip ip_forwarding	Y
	ipcs_a	ipcs -a	Y

Type	File name when collected	Collected information	Minimum information
	ipaddrsel	ipaddrsel	Y
	ipfstat	ipfstat -io	Y
	ps_ef	ps -ef	-
	pstack	pstack pid	-
	svcs	/bin/svcs -apv	Y
	uam	/var/opt/FJSVfupdate/log/*	-
	timezone	date +'%Z'	Y
	virtinfo_info	virtinfo virtinfo -a	Y
	ldm_list-domain_e	ldm list-domain -e	Y
	prtconf_vb	prtconf -vb	Y
	pfctl_sa	pfctl -sa	Y
Information of the virtual NIC mode: rvnetinfo/	config/	/etc/opt/FJSVrvnet/config/*	Y
	log/	/var/opt/FJSVrvnet/log/*	Y
	version	rvnetadm version	Y
	filelist_tmp	ls -la /var/opt/FJSVrvnet/tmp/	Y
	rvnetadm_print	rvnetadm print	Y
	rvnetadm_show-prop	rvnetadm show-prop	Y
	rvnetadm_show-param	rvnetadm show-param	Y
	rvnetstat_v	rvnetstat -v	Y
	rvnetstat_s_v	rvnetstat -s -v	Y
	rvnetstat_f	rvnetstat -f	Y

[Output file name]

The collected information are compressed and stored by the tar and compress commands. A stored file name is "rvnet_" + "machine name" + "Date collected (YYMMDDhhmmss)".tar.Z.

Example: rvnet_hostname031030084916.tar.Z

[Examples]

- When collecting all information under /tmp.

```
/opt/FJSVrvnet/bin/rvnet_snap
```

- When collecting the minimum information under /tmp.

```
/opt/FJSVrvnet/bin/rvnet_snap -s
```

- When collecting the minimum information under /export/home/user1.

```
/opt/FJSVrvnet/bin/rvnet_snap -s /export/home/user1
```

Appendix B Messages and corrective actions

This appendix describes messages output by the virtual NIC mode.

B.1 Message format

This section describes message formats of the virtual NIC mode.

[Output message]

1. A format for information messages and error output messages:

```
rvnet: AAAAA: BBBCC:   DDDDD EEEEE
 (1)    (2)    (3)     (4)   (5)
```

2. A format for console output messages:

```
rvnet: BBBCC AAAAA: DDDDD EEEEE
 (1)   (3)   (2)    (4)   (5)
```

(1) Component name

Always begins with "rvnet."

(2) Error type

AAAAA provides the following information:

ERROR:

   Error message

WARNING:

   Warning message

INFO:

   Information message

(3) Message number (Displayed in total five digits.)

Outputs an output message with a unique number. The message number is not displayed when an internal message is output.

The first three digits (BBB) indicate the message number.
The last two digits (CC) indicate the internal code.

(4) Error details

DDDDD indicates the details of the error.

(5) Others

The complementary information (EEEEE) is occasionally output if necessary.

B.2 Output message

The meaning of and response to each message output by the virtual NIC mode is listed below.

The following table shows facilities and priorities for the message numbers output to the system log file.

Facility	Priority	Message number
user	error	121, 501, 503, 505, 800s
kern	notice	502, 900s

Table B.1 Error output message

Message number	Message	Meaning	Action
101	command can be executed only with super-user.	Only a super-user can execute this command.	Execute with a super user authority.
102	invalid parameter.	An invalid parameter is specified.	Read the appropriate command reference, and execute the command again.
103	virtual interface is inactive.	Specified virtual interface is inactivated.	Check the status of the specified virtual interface with the rvnetstat command.
104	virtual interface is active.	Specified virtual interface is activated.	- Check the status of the specified virtual interface with the rvnetstat command. - Check whether the specified virtual interface is not used in the virtual switch and the non-global zone.
105	invalid interface name.	An invalid interface name is specified.	Specify a correct interface name, and execute the command again.
106	invalid virtual interface name.	An invalid virtual interface name is specified.	Specify a valid virtual interface name, and execute the command again.
107	invalid MAC address.	An invalid MAC address is specified.	Specify a correct MAC address, and execute the command again. Note that a multicast address or broadcast address cannot be specified as a MAC address.
108	MAC address is duplicated.(interface)	Duplicated MAC addresses are used. interface: Interface name in which the same MAC address is used	Specify a different MAC address, and execute the command again.
109	interface name is already defined.	The specified interface name has already been selected.	Specify a different interface name, and execute the command again.
110	virtual interface name is already defined.	The specified virtual interface name has already been selected.	Specify a different virtual interface name, and execute the command again.
111	virtual interface name is not defined.	The specified virtual interface name is not set in the configuration information.	Review the setting of the Redundant Line Control function.
112	specified interface is not bundled by a virtual interface.	The specified interface is not defined as one that configures a virtual interface.	Check the interface that configures a virtual interface with the rvnetadm print command.
113	failed to create a directory.	The specified directory cannot be created.	Check the specified directory.
114	number of interface is already maximum.	Unable to add an interface because the number of interfaces that configures the	Review the number of interfaces that configures a virtual interface, and

Message number	Message	Meaning	Action
		specified virtual interface has reached a maximum bundle number.	change the definition with the rvnetadm command if necessary.
115	number of virtual interface is already maximum.	The number of virtual interfaces exceeded the maximum number. The maximum number is 256.	Delete unnecessary definitions, and execute the command again.
116	interface is inactive.	The specified interface has been inactivated.	Check the status of the specified interface with the rvnetstat command.
117	specified interface is already connected.	The specified interface has already been connected.	Check the status of the specified interface with the rvnetstat command.
118	specified interface is already disconnected.	The specified interface has already been disconnected.	Check the status of the specified interface with the rvnetstat command.
119	directory not found.	The specified directory was not found.	Specify a directory name that already exists, and execute the command again.
120	virtual interface is not Active-Standby mode.	The specified virtual interface is not Active-Standby status.	Check the status of the specified interface with the rvnetstat command.
121	network monitoring could not start. (virtual-interface)(detail)	It is not possible to execute the network monitoring. virtual-interface: Virtual interface name detail: Detail	Check that the MAC address of the physical interface bundled by the virtual interface is not overlapping and the system has already recognized, and then execute again.
122	network monitoring is already started. (virtual-interface)	The network monitoring has already been started. virtual-interface: Virtual interface name	Check the monitoring status with the rvnetstat -s command. When the network is stopped, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
123	network monitoring is already stopped. (virtual-interface)	The network monitoring has already been stopped. virtual-interface: Virtual interface name	Check the monitoring status with the rvnetstat -s command. When the network is stopped, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
124	network monitoring is running.	The network monitoring is running.	Check the monitoring status with the rvnetstat -s command. When the monitoring is running, stop the monitoring once because the configuration cannot be changed.
125	specified MTU is out of range. (min-max)	The value specified as the MTU value of a virtual interface exceeded the range which can be specified. min: the minimum value of MTU which can be specified	Specify the MTU value of a virtual interface not to exceed the MTU value of the interfaces bundled by the virtual interface, and execute the command again.

Message number	Message	Meaning	Action
		max: the maximum value of MTU which can be specified	
126	MTU of the virtual interface and bundled interface is inconsistent.	The MTU value of the interfaces bundled by a virtual interface is smaller than the MTU value of the virtual interface which bundles the interfaces.	The MTU value of the bundled interfaces must be the same as or larger than the MTU value of the virtual interface which bundles the interfaces. Specify the correct MTU value to a virtual interface and the interfaces bundled by the virtual interface, and execute the command again.
127	failed to add specified interface. (code)	An error was found when adding the specified interface. code: Detail code	Execute the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
128	failed to connect specified interface. (code)	An error was found when connecting the specified interface again. code: Detail code	Execute the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
301	could not open configuration file. (errno=XXX)	Failed to open the configuration information file.	Check whether the creation of configuration information has been completed.
302	could not write configuration file. (errno=XXX)	Failed to write to the configuration information.	Collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
303	invalid interface name. (interface)	An invalid interface name is specified in the configuration information. interface: Interface name that a virtual NIC bundles	Check the status of the interface.
501	system call fail. (func=YYY, errno=XXX)	An error was found in the internal system call.	Check that there is no problem in the setting of the Redundant Line Control function. After verifying that everything is correct, execute the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
502	unexpected error.(code)	An unexpected error occurred. code: Detail code	Check that there is no problem in the setting of the Redundant Line Control function. After verifying that everything is correct, execute

Message number	Message	Meaning	Action
			the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
503	ioctl() fail. (cmd=ZZZ, errno=XXX)	An error was found in the internal system call.	Check that there is no problem in the setting of the Redundant Line Control function. After verifying that everything is correct, execute the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
504	failed to delete virtual interface. (errno=XXX)	Failed to delete a virtual interface.	Execute the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
505	failed to allocate memory.(code)	Memory allocation failed. code: Detail code	Execute the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
506	daemon process does not exist.	There is no daemon process.	Collect information for examination of a Redundant Line Control function, and contact field engineers.
507	failed to restart daemon.	Stop of the daemon was detected and restart was tried, but failed.	Collect information for examination of a Redundant Line Control function, and contact field engineers.
508	semaphore is broken. (errno).	Creates a semaphore again because it is deleted.	No action is required.
509	shared memory is broken. (errno)	Creates a shared memory again because it is deleted.	No action is required.
510	failed to get OS version.	Failed to get the OS version.	Execute the command again. If the same symptom still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
801	network monitoring is established. (virtual-interface)	The network monitoring started normally. virtual-interface: Virtual interface name	No action is required.

Message number	Message	Meaning	Action
802	monitoring detected a recovery. (virtual-interface)	The network monitoring detected a recovery. virtual-interface: Virtual interface name	No action is required.
803	monitoring detects a failure. (virtual-interface)	The network monitoring detects a failure. virtual-interface: Virtual interface name	Check that the connection between switches is correct. When a higher load is imposed on the network, occasionally a recovery message is output immediately after this message is output. In this case, a transfer route of the standby side is normal. Therefore, not necessary to deal with.
901	link up detected: the interface link is up. (virtual-interface: interface)	An interface is linked up. virtual-interface: Virtual interface name interface: Interface name that a virtual NIC bundles	No action is required.
902	link down detected: the interface link is down. (virtual-interface: interface)	An interface is linked down. virtual-interface: Virtual interface name interface: Interface name that a virtual NIC bundles	Check the link status of the interface from the result of executing the dladm show-link command (displayed in STATE). When the interface link down is detected, check whether a failure has occurred in the adjacent switch. Also, check that the correct speed for the switch and server has been selected (such as Auto-negotiation and full-duplex).
903	link up detected: the virtual interface link is up. (virtual-interface)	A virtual interface is linked up. virtual-interface: Virtual interface name	No action is required.
904	link down detected: the virtual interface link is down. (virtual-interface)	A virtual interface is linked down. virtual-interface: Virtual interface name	Check the link status of the interface that a virtual NIC bundles.
905	the interface of the virtual interface was switched. (virtual-interface: from=interface1 to=interface2)	The virtual interface switched the interface used for communication. virtual-interface: Virtual interface name interface1:Interface before switching interface2: Interface after switching	Check the link status of the interface that a virtual NIC bundles. When executing the rvnetadm set-if command, no action is required.
906	failed to allocate memory for kernel. (code)	Kernel memory allocation failed. code: Detail code	No action is required. If this message is output at frequent intervals, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.
907	changed to MAC tracking mode. (virtual-interface)	Changed the mode to MAC tracking.	No action is required.

Message number	Message	Meaning	Action
		virtual-interface: Virtual interface name	
908	changed to Active-Standby mode. (virtual-interface)	Changed the mode to Active-Standby. virtual-interface: Virtual interface name	No action is required.
909	failed to set multicast address. (virtual-interface:interface)(code)	Failed to register the multicast address. virtual-interface: Virtual interface name interface: Interface name that a virtual NIC bundles code: Detail code	The cause may be one of the following. Review the system environment. - The multicast address, which can be registered in a physical interface, exceeds its upper limit. - There is a temporary shortage of memory resource. If a problem still remains, collect troubleshooting information of the Redundant Line Control function, and then contact field engineers to report the error message.

Appendix C Changes from previous versions

This appendix describes changes to the GLS specification. It also suggests some operational guidelines for Redundant Line Control Function for Virtual NIC Mode

C.1 Changes from Redundant Line Control function 4.3A20 to version 4.3A40

The following table shows a list of changes.

Table C.1 List of changes from Redundant Line Control Function for Virtual NIC Mode 4.3A20 to 4.3A40

Category	Item	Version
New command	None	-
Incompatible command	rvnetadm command	PRIMECLUSTER GLS 4.3A40 or later
Incompatible functions	Kernel Zones are supported	PRIMECLUSTER GLS 4.3A40 or later
	Oracle VM is supported	PRIMECLUSTER GLS 4.3A40 or later

C.1.1 A list of new commands

There is no new command for Redundant Line Control function for Virtual NIC Mode 4.3A40.

C.1.2 A list of incompatible commands

The following is the incompatible command of Redundant Line Control function for Virtual NIC Mode 4.3A40 from the previous version.

For details on the following command, please refer to "Appendix A Command Reference."

C.1.2.1 rvnetadm command

[Contents]

Specify whether to permit the creation of vnic on a virtual interface by using the -v option of the create command.
Specify whether to permit the creation of vnic on a virtual interface by using the -v option of the set-prop command.
Display the setting value (ALLOW-UPPER-VNIC) of the -v option with the show-prop command.

[Changes]

Before modification

There is no -v option for the create command.
There is no -v option for the set-prop command.
The setting value (ALLOW-UPPER-VNIC) of the -v option is not displayed with the show-prop command.

```
# /opt/FJSVrvnet/bin/rvnetadm show-prop -n fjvnet0
VNET              : fjvnet0
MAC-ADDRESS       : auto
PROPAGATE-LINK    : no
MAC-TRACKING      : on
PROBE-MODE        : round-robin
MTU               : 1500
```

After modification

If you set "yes" to the -v option of the create command, vnic can be created on a virtual interface.
If you set "yes" to the -v option of the set-prop command, vnic can be created on a virtual interface.
The setting value (ALLOW-UPPER-VNIC) of the -v option is displayed with the show-prop command.

```
# /opt/FJSVrvnet/bin/rvnetadm show-prop -n fjvnet0
VNET             : fjvnet0
MAC-ADDRESS      : auto
PROPAGATE-LINK   : no
MAC-TRACKING     : on
PROBE-MODE       : round-robin
MTU              : 1500
ALLOW-UPPER-VNIC : yes
```

C.1.3 Other incompatibilities

C.1.3.1 Kernel Zones

[Contents]

A virtual interface of the virtual NIC mode created on a global zone is available from Kernel Zones.

[Changes]

Before modification

Kernel Zones are not supported.

After modification

Kernel Zones are supported.

C.1.3.2 Oracle VM

[Contents]

Communication on a guest domain is available in the environment where the virtual NIC mode is connected to the Oracle VM virtual switch in Solaris 11.2.
The setting or communication is enabled by setting "yes" to the create command for the rvnetadm command or the -v option of the set-prop command.

[Changes]

Before modification

Communication on a guest domain is not available in the environment where the virtual NIC mode is connected to the Oracle VM virtual switch in Solaris 11.2.

After modification

Communication on a guest domain is available in the environment where the virtual NIC mode is connected to the Oracle VM virtual switch in Solaris 11.2.

C.2 Changes from Redundant Line Control function 4.3A40 to version 4.5A00

The following table shows a list of changes.

Table C.2 List of changes from Redundant Line Control Function for Virtual NIC Mode 4.3A40 to 4.5A00

Category	Item	Version
New command	None	-
Incompatible command	None	-
Incompatible function	Modification of the directory of installation	PRIMECLUSTER GL 4.5A00 or later

C.2.1　New command

There are no new commands for Redundant Line Control function for Virtual NIC Mode 4.5A00.

C.2.2　Incompatible commands

No commands in the Redundant Line Control function for Virtual NIC Mode 4.5A00 are incompatible from the previous versions.

C.2.3　Other incompatibilities

C.2.3.1 Modification of the directory of installation

[Contents]

Changed the directory of installation of the package from "/opt" to "/etc/opt."

[Changes]

Before modification

The directory of installation of the package is "/opt."

After modification

The directory of installation of the package is "/etc/opt."
Also the compatibility of the existing command path is maintained by creating a symbolic link in the unmodified directory of installation.

C.3　Changes from Redundant Line Control function 4.5A00 to version 4.5A10

There is no change.

Glossary

DR

Dynamic Reconfiguration

Fast switching mode

Fast switching mode keeps the communication alive during transfer route failure and increases the total throughput by multiplexing transfer routes between servers on the same network.

Global zone

A global zone is the global view of the Solaris operating environment. There is always one global zone per Solaris instance. Each software partition that is created within the Solaris instance can be managed and controlled in the global zone.

[Related article] Solaris Zones, Non-global zone (Zone)

GS/SURE linkage mode

GS/SURE linkage mode multiplexes transfer routes between global server/SURE SYSTEM and ExINCA lies on the same network. This mode provides functionality of transfer route failover during transfer route failure in which implements high availability.

LAN card

The same meaning as that of NIC.

NIC

Stands for Network Interface Card. Also called a LAN card.

NIC switching mode

A mode to realize high reliability by exclusively using a redundant NIC and switching when an error occurred. It is necessary to connect a redundant NIC in the same network in this mode.

Non-global zone (Zone)

Each non-global zone has a security boundary around it. The security boundary is maintained by allowing zones to only communicate between themselves using networking APIs.

[Related article] Solaris Zones, Global zone

PHP

PCI Hot Plug

Physical interface

An interface created for the NIC equipped with in a system.

Redundant Line Control function

A function to realize high reliability of communication by making a network line redundant.

Solaris Zones

Solaris Zones isolates software applications and services using flexible, software-defined boundaries. This software partitioning enables administrators to easily create many private execution environments in a single instance of the Solaris Operating System. It also enables dynamic control of applications and resource priorities. For details, see the "Solaris manual."

Virtual interface

An interface created for a Redundant Line Control Function to deal with a redundant NIC as one virtual NIC. The virtual interface name is described as fjvnetX (X is 0, 1, 2...).

Virtual NIC mode

This mode enables the highly reliable communication by exclusively using a pair of the physical NICs which were grouped on the same network as a single virtual interface.

XSCF

eXtended System Control Facility