Configuring interconnect redundancy with Oracle RAC 11.2.0.2 or later

Starting with Oracle RAC 11.2.0.2, Oracle has introduced Redundant Interconnect Usage feature based on a multiple-listening-endpoint architecture, in which a highly available virtual IP (the HAIP) is assigned to each private network (up to a total number of 4 interfaces).

Oracle recommends customers to use link aggregation, NIC bonding, or Redundant Interconnect Usage for providing high availability to interconnects.

PrivNIC/MultiPrivNIC no longer supported with Oracle RAC 11.2.0.2 and later versions

In Oracle RAC 11.2.0.2 and later versions, if PrivNIC/MultiPrivNIC is configured to manage the cluster interconnect private IP addresses, and if a private link fails, the PrivNIC/MultiPrivNIC agent fails over the IP addresses configured on the failed link to the next available link. This causes the ora.cluster_interconnect.haip resource to go offline.

The Oracle cluster synchronization services daemon (ocssd) fails and restarts, but does not join the cluster till Oracle Grid Infrastructure is restarted on all the nodes.

Therefore, SF Oracle RAC no longer supports the use of PrivNIC/ MultiPrivNIC to manage high availability of the interconnects.

This document provides summary instructions for:

- Installing Oracle RAC 11.2.0.2 or later on SF Oracle RAC systems
- Upgrading existing Oracle RAC 11.2.0.1 systems

**Note:** This document covers only deviations in the procedure as documented in the Veritas Storage Foundation for Oracle RAC Installation and Configuration Guide. This document should be used in conjunction with the aforementioned installation documentation.

To obtain the list of SF Oracle RAC versions certified with Oracle RAC 11.2.0.2 and later versions, see the Veritas Storage Foundation for Oracle RAC Support Matrix:

A] Installing Oracle RAC 11.2.0.2 and later on Linux and UNIX

Use the following sections in place of similar sections in the installation documentation.

1. Configuring private IP addresses for Oracle RAC

Private IP addresses are required by Oracle RAC to provide communication between the cluster nodes. Depending on your private network configuration, you may need one or more IP addresses.

Oracle recommends customers to use link aggregation, NIC bonding, or Redundant Interconnect Usage to provide redundant, dedicated private communication.

1.1. Using Link Aggregation/NIC Bonding

1) Configure Link Aggregation/NIC Bonding

To configure link aggregation/NIC bonding on various platforms, refer to the following documentation.

**Solaris:**
Refer chapter Administering Link Aggregations in document Oracle Solaris Administration: Network Interfaces and Network Virtualization on Oracle Technology Network (otn.oracle.com).

**AIX:**
Refer chapter Configuring IEEE 802.3ad Link Aggregation in document AIX 6.1/7.1 information center on IBM support portal (www.ibm.com).

**HP-UX:**
Refer document HP Auto Port Aggregation Administrator’s Guide on HP Business Support Center.

**Linux:**
   a) Refer chapter Networking in document Red Hat Enterprise Linux Deployment Guide: Deployment, Configuration and Administration of Red Hat Enterprise Linux
   b) Refer document How To Configure Bonding on Novell Linux products at www.novell.com
   c) Refer http://www.kernel.org/doc/Documentation/networking/bonding.txt

2) Configuring LLT to use link aggregation/NIC bonding

If you are planning to use link aggregation/NIC bonding, make sure that a link configured under an aggregated link or NIC bond is not configured as a separate LLT link. When LLT is configured over a bonded interface, perform one of the following steps to prevent GAB from reporting jeopardy membership:

- Configure an additional NIC under LLT in addition to the bonded NIC, or
- Add the following line in the /etc/llttab file and restart LLT:

```
set dbg -minlinks 2
```

1.2. Using Redundant Interconnect Usage

Starting with Oracle RAC 11.2.0.2, Oracle has introduced Redundant Interconnect Usage feature to support IP failover. Oracle uses its ora.cluster_interconnect.haip resource to provide this functionality. The Highly Available Internet Protocol (HAIP) has the ability to activate a maximum of four private interconnect connections. These
private network adapters can be configured during the initial installation process of Oracle Grid Infrastructure or after the installation process using the oifcfg utility.

Oracle Grid Infrastructure currently creates an alias IP (known as virtual private IP) on private network interface using the 169.254.*.* subnet for the HAIP. However, if that subnet range is already in use, Oracle Grid Infrastructure will not attempt to use it. The purpose of HAIP is to perform load balancing across all active interconnect interfaces, and failover existing non-responsive interfaces to other available interfaces.

To enable HAIP using the Oracle Grid Infrastructure installer, all the private interfaces should be configured with static private IP addresses before starting the Grid installation. During the installation of Oracle Grid Infrastructure, on the 'Network Interface Usage' screen, select these interfaces as 'private' interfaces. It is recommended to use all the LLT links as cluster interconnects.

1) Configuring static IP address on Linux:

   Edit /etc/sysconfig/network-scripts/ifcfg-<interface_name>
   
   DEVICE=<interface_name>
   ONBOOT=yes
   BOOTPROTO=None
   IPADDR=<ip-address>
   NETMASK=<netmask>

2) Configuring static IP address on Solaris

   Edit /etc/hostname.<interface_name> <ip-address>

3) Configuring static IP address on AIX

   Use command:
   # smit mktcpip

4) Configuring static IP address on HP-UX

   Use command:
   # set_parms ip_address

2. Completing Oracle RAC post-installation tasks

2.1. Configuring the CSSD resource

   Configuration of the CSSD resource under VCS control using the SF Oracle RAC Installer will fail since PrivNIC/MultiPrivNIC resource is not configured. Therefore, configure the cssd resource manually under VCS control. Do not set the dependency of the CSSD resource on PrivNIC or MultiPrivNIC resources. Refer to section Configuring the CSSD resource manually in Veritas Storage Foundation for Oracle RAC Installation and Configuration Guide.

2.2. Configuring LLT links (Private Interconnect links) in the GPnP profile

   If any of the LLT interfaces is not configured as cluster interconnect in GPnP profile, update the GPnP profile to include the remaining LLT links, which were not added to the profile during the Oracle Grid Infrastructure installation.

   1) View the currently configured interfaces:

   # $GRID_HOME/bin/oifcfg getif
   eth0 10.2.156.0 global public
   eth1 192.168.12.0 global cluster_interconnect
The interfaces that are currently stored in the GPnP profile, their subnets, and their role (public or cluster_interconnect) are displayed.

2) Add the remaining LLT links to the GPnP profile:

```bash
# $GRID_HOME/bin/oifcfg setif -global \neth2/192.168.12.0:cluster_interconnect
```

3) Verify that the correct interface subnet is in use:

```bash
# $GRID_HOME/bin/oifcfg getif
eth0 10.2.156.0 global public
eth1 192.168.12.0 global cluster_interconnect
eth2 192.168.2.0 global cluster_interconnect
```
B] Upgrading to Oracle RAC 11.2.0.2 or later on Linux and UNIX

You can upgrade from Oracle RAC 11.2.0.1.

To upgrade:

1) Freeze the cvm service group and delete PrivNIC/MultiPrivNIC. If Oracle database is under VCS control, freeze the database service group.

   # haconf -makerw
   # hagrp -freeze cvm
   # hagrp -freeze <database service group>
   # hares -delete <PrivNIC/MultiPrivNIC resource>
   # haconf -dump -makerw

2) Configure the static private IP addresses for the private interfaces used as cluster interconnect as detailed in the section Configuring private IP addresses for Oracle RAC earlier in the document. Previously, these private IP addresses were managed by PrivNIC/MultiPrivNIC.

3) On Linux, if Oracle patch 8649805 is applied on 11.2.0.1, unlink the Veritas membership library from Oracle Grid Infrastructure:
   a. Stop the database. Run the following command on one of the cluster nodes as the Oracle database user:
      
      $ srvctl stop database -d <database_name>
   b. Stop Oracle Grid Infrastructure on each node in the cluster. As a superuser, enter:
      
      # crsctl stop crs
   c. Unlink the Veritas Membership library. As a Oracle grid user, on each node enter:
      
      $ cd $GRID_HOME/lib
      $ mv libskgx2.so libskgx2.so.veritas.`date '+%m_%d_%y-%H_%M_%S'`
      $ cp libskgxns.so libskgx2.so
   d. Start Oracle Grid Infrastructure on each node in the cluster.
      
      # crsctl start crs
   e. Change to the Oracle Grid Infrastructure home directory and roll back Oracle patch 8649805. Refer to the Oracle patch 8649805 readme for instructions.
   f. Change to the Oracle database home directory and roll back Oracle patch 8649805. Refer to the Oracle patch 8649805 readme for instructions.

4) Install Oracle patches/PSU, if any, before upgrading to 11.2.0.2/11.2.0.3. For more information, see the following Oracle support documents:

   • Things to Consider Before Upgrading to 11.2.0.2 Grid Infrastructure [ID 1312225.1].
   • Things to Consider Before Upgrading to 11.2.0.3 Grid Infrastructure/ASM [ID 1363369.1]

5) To upgrade Oracle Grid Infrastructure, see “How to Upgrade to Oracle Grid Infrastructure 11g Release 2” section in Oracle Grid Infrastructure Installation Guide 11g Release 2 (11.2) for more details.

6) Log in as the Oracle grid user. On the first node, set the DISPLAY variable.

   • For Bourne Shell (bash), type:
      
      $ DISPLAY=10.20.12.150:0.0; export DISPLAY
      where 10.20.12.150 is the IP address of X client where you want to export the display for the installer.
   • For C Shell (csh or tcsh), type:
      
      $ setenv DISPLAY 10.20.12.150:0.0
      where 10.20.12.150 is the IP address of X client where you want to export the display for the installer.

7) Start the Oracle Universal Installer for installing Oracle Grid Infrastructure, and select the option to upgrade an existing Oracle Clusterware and Oracle ASM installation.
8) After completing Oracle Grid Infrastructure installation, run the rootupgrade.sh script when prompted. The Veritas Membership library is automatically linked with Oracle Grid Infrastructure during installation. For upgrading the Oracle database, see the Oracle Database Upgrade Guide for complete details.

9) Log in as the Oracle database user. On the first node, set the DISPLAY variable.
   - For Bourne Shell (bash), type:
     ```
     $ DISPLAY=10.20.12.150:0.0; export DISPLAY
     ```
     where 10.20.12.150 is the IP address of X client where you want to export the display for the installer.
   - For C Shell (csh or tcsh), type:
     ```
     $ setenv DISPLAY 10.20.12.150:0.0
     ```
     where 10.20.12.150 is the IP address of X client where you want to export the display for the installer.

10) Start the Oracle Universal Installer for installing database software on the first node.
    ```
    $ <11.2.0.x installer directory>/runInstaller
    ```

11) After upgrading the Oracle database, relink Veritas ODM library. Refer to the procedure provided in the section Relinking the SF Oracle RAC libraries with Oracle RAC in the Veritas Storage Foundation for Oracle RAC Installation and Configuration Guide. When prompted for Oracle home, provide the database home directory path for 11.2.0.2 and later versions.

12) Use the database upgrade assistant to upgrade the existing databases. As a Oracle database user, enter:
    ```
    $ORACLE_HOME/bin/dbua
    ```

13) If the database is managed by VCS, configure the Oracle RAC database for manual startup. See the section Preventing automatic database startup in the Veritas Storage Foundation for Oracle RAC Installation and Configuration Guide.

14) Unfreeze the cvm service group; If database is managed by VCS, unfreeze the database service group.
    ```
    # haconf -makerw
    # hagrp ~unfreeze cvm
    # hagrp ~unfreeze <database service group>
    # haconf ~dump ~makero
    ```