HP Server Automation

Software Version: 9.13

Oracle RAC Whitepaper

Document Release Date: May 16, 2012
Software Release Date: May 30, 2012

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Document Changes

Date	Version	Changes
May 15, 2010	9.13	Document Created

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Oracle RAC Support

SA supports Oracle Real Application Clusters (RAC).

Note: Oracle RAC support requires a new installation of both Oracle and SA. Therefore, in order to enable Oracle RAC support in SA, you must first install SA and Oracle RAC 10.2.0.4, 11.1.0.7 or 11.2.0.2, configured as described in the sections in this document.

Prerequisites

This section discusses prerequisites for Oracle RAC.

Database Server Time Requirements

Core servers (either single core or multimaster) and satellite core servers must meet the following requirements. These time requirements do not apply to managed servers.

- All SA core servers must have their time zone set to Coordinated Universal Time (UTC).
- All SA core servers must maintain synchronized system clocks. Typically, you will synchronize the system clocks through an external server that uses NTP (Network Time Protocol) services.

Linux Time Configuration:

To configure the time zone on a Linux server, perform the following tasks:

1. Copy or link `/usr/share/zoneinfo/UTC` to `/etc/localtime`.
2. Ensure that the `/etc/sysconfig/clock` file contains the following lines:

```
ZONE="UTC"
UTC=true
```

Solaris Time Configuration:

To configure the time zone on a Solaris server, verify that the `/etc/TIMEZONE` file contains the following line: `TZ=UTC`

Supported Oracle Versions

SA support for Oracle RAC includes these Oracle Enterprise Edition versions:

- 10.2.0.4
- 11.1.0.7
- 11.2.0.2

Supported Operating Systems

- Red Hat Enterprise Linux AS 4 x86_64
- Red Hat Enterprise Linux AS 5 x86_64

Set up the Oracle RAC Database/Instances

SA supports any valid Oracle RAC configuration, such as any number of nodes, ASM or regular disks, and so on.

However, SA requires that the Oracle database be configured for use with SA. You will require your Oracle DBA's help to configure the Oracle RAC/instances, the required initialization parameters, the required tablespaces, the `opsware_admin database` user, and the `listener.ora` and `tnsnames.ora` files.

Creating the Database

Before installing Oracle, the following scripts must be run and `init.ora` must have certain parameter values edited or added as shown in Required and Suggested Parameters for `init.ora` in the SA 9.10 Simple/Advanced Installation Guide, Appendix A.

1. Create the database.

   Create a database with the UTF8 character set (as required by SA), the data and index files, the default temporary tablespace, the undo tablespace, and the log files.

2. Create the Required Tablespaces.

   Create the following tablespaces that are required by SA:

   ```
   LCREP_DATA
   LCREP_INDX
   TRUTH_DATA
   TRUTH_INDX
   AAA_DATA
   AAA_INDX
   AUDIT_DATA
   AUDIT_INDX
   STRG_DATA
   STRG_INDX
   ```

   See “Tablespace Sizes” in the SA Simple/Advanced Installation Guide for additional tablespace sizing information.

3. Specify the Required and Suggested Parameters for `init.ora`.

   The file `init.ora` must be edited as shown in Required and Suggested Parameters for `init.ora` in the SA 9.10 Simple/Advanced Installation Guide, Appendix A.

4. Create the User `opsware_admin`.

   You can use the script, `CreateUserOpsware_Admin.sql`, to create the `opsware_admin` database user and grant permissions (privileges) to the user (required by SA) or create the user manually.

Manual Creation of the User Opsware_Admin

If you plan to create the `opsware_admin` user manually, follow the procedure in this section.

To create the `opsware_admin` user after a manual Oracle installation, log in to SQL*Plus, and enter the following:

```
# Su - oracle
# Sqlplus "/ as sysdba"
SQL>create user opsware_admin identified by opsware_admin
default tablespace truth_data
temporary tablespace temp
quota unlimited on truth_data;
grant alter session to opsware_admin with admin option;
grant create procedure to opsware_admin with admin option;
grant create public synonym to opsware_admin with admin option;
grant create sequence to opsware_admin with admin option;
grant create session to opsware_admin with admin option;
grant create table to opsware_admin with admin option;
grant create trigger to opsware_admin with admin option;
grant create type to opsware_admin with admin option;
grant create view to opsware_admin with admin option;
grant delete any table to opsware_admin with admin option;
grant drop public synonym to opsware_admin with admin option;
grant select any table to opsware_admin with admin option;
grant select_catalog_role to opsware_admin with admin option;
grant query rewrite to opsware_admin with admin option;
grant restricted session to opsware_admin with admin option;
grant execute on dbms_utility to opsware_admin with grant option;
grant analyze any to opsware_admin;
grant insert, update, delete, select on sys.aux_stats$to opsware_admin;
grant gather_system_statistics to opsware_admin;
grant create job to opsware_admin;
grant create any directory to opsware_admin;
grant drop any directory to opsware_admin;
grant alter system to opsware_admin;
grant create role to opsware_admin;
grant create user to opsware_admin;
grant alter user to opsware_admin;
grant drop user to opsware_admin;
grant create profile to opsware_admin;
grant alter profile to opsware_admin;
grant drop profile to opsware_admin;
```

Working with the Model Repository

Installing the Model Repository

In most production environments with Oracle RAC, the Model Repository installation can be done from any SA server. The database server or RAC nodes in this case are considered to be remote.

The examples used in the following sections assume this configuration.

Note: All the identities have static addresses.

Identity	Host Note	Name	Type	Address	Resolved By
Node 1 Public	rac1pub	rac1pub (rac1pub.dev.opsware.com)	Public	192.168.173.210	DNS
Node 1 virtual	Selected by Oracle clusterware	rac1-vip (rac1-vip.dev.opsware.com)	Virtual	192.168.173.212	DNS, hosts file, or both
Node 1 private	rac1pub	rac1prv (rac1prv.dev.opsware.com)	Private	172.16.1.100	DNS, hosts file, or none
Node 2 Public	rac2pub	rac2pub (rac2pub.dev.opsware.com)	Public	192-168-173-211	DNS
Node 2 virtual	Selected by Oracle clusterware	rac2-vip (rac2-vip.dev.opsware.com)	Virtual	192.168.173.213	DNS or hosts file
Node 2 private	rac2pub	rac2prv (rac2prv.dev.opsware.com)	Private	172.16.1.101	DNS, hosts file, or none
SCAN vip 1	Selected by Oracle clusterware	sa_cluster1-scan (sa_cluster1-scan.dev.opsware.com)	Virtual	192.168.173.216	DNS
SCAN vip 2	Selected by Oracle clusterware	sa_cluster1-scan (sa_cluster1-scan.dev.opsware.com)	Virtual	192.168.173.217	DNS

SCAN vip 3	Selected by Oracle clusterware	sa_cluster1-scan (sa_cluster1-scan.dev.opsware.com)	Vir-tual	192.168.173.218	DNS

Model Repository Installation on a Remote Database (truth) RAC Server

In an Oracle RAC environment, only one of the RAC nodes is used during the SA installation/upgrade process. The SA Installer connects to only one Oracle RAC instance to install/modify the Model Repository. During the regular SA operations, all RAC nodes are used.

Perform the following tasks on the SA server on which you will run the SA Installer, for example `rac1sa.dev.opsware.com`.

1 Model Repository Hostname Resolution

On the server where you will run the SA Installer, ensure that the Model Repository hostname `truth` resolves to the remote database server, not to the server on which you will be running the SA Installer:

In `/etc/hosts`, enter the public IP address of one of the RAC nodes/instances. For example the `/etc/hosts` file on `rac1sa.dev.opsware.com` would have the following entry:

```
192.168.173.210 truth rac1pub rac1pub.dev.opsware.com
```

If you have set up Oracle Clusterware, you should use the Clusterware scan IP address and DNS name rather than a single database node IP address. For example:

```
192.168.173.216 truth sa_cluster1-scan sa_cluster1-scan.dev.opsware.com
```

2 Install the Oracle 11g Full Client on the SA server

Note: For Oracle RDBMS 11.2.0.2, use the Oracle Full Client version 11.2.0.2

The SA Installer will use the Oracle Full Client to connect to the database server and install the Model Repository. Below are sample commands for installing the Oracle full client.

a Create user oracle for the Oracle Full Client installation:

```
root@rac1sa ~]# mkdir -p /u01/app/oracle
root@rac1sa ~]# mkdir -p /u01/app/oraInventory
root@rac1sa ~]# groupadd oinstall
root@rac1sa ~]# groupadd dba
root@rac1sa ~]# useradd -c "Oracle Client software owner" -g oinstall -G
dba -d /u01/app/oracle -s /bin/bash oracle
root@rac1sa ~]# chown -R oracle:oinstall /u01/app
root@rac1sa ~]# chmod -R 775 /u01/app
root@rac1sa ~]#passwd oracle (change oracle user password)
```

b Create the `.bash_profile` file.

In `/u01/app/oracle` create the `.bash_profile` file.

Temporarily comment out `ORACLE_HOME and ORACLE_PATH`. You will uncomment these entries after the Oracle client installation is complete.

```
Sample .bash_profile file
# .bash_profile
# Get the aliases and functions
if [ -f ~/.bashrc ]; then
. ~/.bashrc
fi
# User specific environment and startup programs
PATH=$PATH:$HOME/bin
export PATH
#SA-OracleRAC parameters begin
#unset USERNAME
export ORACLE_BASE=/u01/app/oracle
#export ORACLE_HOME=$ORACLE_BASE/product/11.2.0/client_1
#PATH=$ORACLE_HOME/bin:$ORACLE_HOME/OPatch:$PATH
export PATH
if [ -t ]; then
stty intr ^C
fi
umask 022
#SA-OracleRAC parameters end
```

c Install the Oracle Full Client.

Install the Oracle Full Client as described in your Oracle documentation. You can create a share to access the Oracle Full Client binaries.

d Set Up Terminals

You will need two X window terminals to install the Oracle Full Client:

```
Terminal 1: log in as root and enter the commands:
Terminal 1> xhost +
Terminal 2: ssh -X oracle@<new_oracle_full_client_host>
```

e Start Oracle Full Client installation

From Terminal 2 run the Oracle Universal Installer (OUI) installer. The Oracle Full Client is installed in:

```
/u01/app/oracle/product/11.2.0/client_1
```

f Run the Oracle Universal Installer to install Oracle Full Client. The directories in this example assume an Oracle 11g Full Client on Linux.

```
a. cd /location_of_oracle_full_client
b. /runInstaller
c. At the Welcome Screen, click Next.
d. Specify the Inventory Directory and Credentials (/u01/app/oraInventory and /
u01/app/oinstall)
e. For Select Installation Type, choose Administrator, click Next.
f. For ORACLE_BASE select: /u01/app/oracle, click Next.
g. The Oracle Universal Installer performs some checks. If the checks are not
successful, fix the issue and re-run this step. If the checks are successful
the click on 'Next'
h. Oracle OUI will list of products that will be installed. Click on 'Install'
i. OUI will show the progress bar when installing
j. On the 'Welcome to Oracle Net Configuration Assistant' window click on
'Next'
k. Click on 'Finish' once the installation is complete.
l. The following two configuration scripts must be executed as "root" upon
installation completion:
- /u01/app/oraInventory/orainstRoot.sh
- /u01/app/oracle/product/11.2.0/client_1/root.sh
```

g Verify that the `.bash_profile` file for user `oracle` is correct.

h Uncomment `$ORACLE_HOME` and `$ORACLE_PATH`.

Making Changes to tnsnames.ora on an SA Server

By default, the `tnsnames.ora` file is located in `/var/opt/oracle`.

1 Login as root on the SA Server.

2 Enter the command:

```
mkdir -p /var/opt/oracle
```

3 Copy `tnsnames.ora` from the remote database server to the directory you created above.

For the RAC environment, copy `tnsnames.ora` from RAC Node 1 (for example, `rac1pub.dev.opsware.com`).

4 To accommodate the remote Model Repository installation process, two sets of `tnsnames.ora` are required on the SA server:

— `tnsnames.ora-install_upgrade` – this copy of `tnsnames.ora` is used during SA installation/upgrade. The file can be renamed.

— `tnsnames.ora-operational`– this copy of `tnsnames.ora` is used during normal SA operation. The file can be renamed.

You can use softlinks to point `tnsnames.ora` to either `tnsnames.ora-install_upgrade` or `tnsnames.ora-operational`. For example:

```
ln –s tnsnames.ora-install_upgrade tnsnames.ora
```

Testing the Connection from the SA Host to the Database

Before starting the Model Repository installation/upgrade, perform the following tests to verify that your `tnsnames.ora` file is configured correctly and if the SA Installer can connect to the database in restricted mode.

1 Verify that the SA server's `/var/opt/oracle/tnsnames.ora` file is configured correctly as described in Making Changes to tnsnames.ora on an SA Server.

2 On the SA server:

a Login as `oracle` or `root` or `su - twist/spin` – if these users exist.

b Export `ORACLE_HOME=/u01/app/oracle/product/11.2.0/client_1` (or where you installed the Oracle Full Client).

c Export `LD_LIBRARY_PATH=$ORACLE_HOME/lib`.

d Export `TNS_ADMIN=/var/opt/oracle`.

e Set `$PATH $ORACLE_HOME/bin` path.

f `sqlplus sys/password@RAC1SA_TRUTH` as sysdba.

where `RAC1SA_TRUTH` is the `service_name` or entry from the `tnsnames.ora` file.

g Connect `opsware_admin/<password>@RAC1SA_TRUTH`.

If you are able to logon to the database, then all files are configured correctly.

SA Installer Response File

You can now start the installation of the SA Model Repository. Ensure that you have the correct parameter values for the installation interview or that you have a previous response file.

- `%db.sid: truth1` (Oracle SID of the instance where SA installer is going to connect to.)
- `%db.orahome: /u01/app/oracle/product/11.2.0/client_1` (oracle client home)
- `%db.port: 1521` (Oracle listener port)
- `%truth.tnsdir-/var/opt/oracle` (client's `tnsnames.ora` file)
- `%db.host: 192.168.173.210` (server where Oracle RDBMS is installed)
- `%truth.servicename: rac1sa_truth` (value of service name from `tnsnames.ora` file)

You can now install the SA core as described in the *SA Simple/Advanced Installation Guide*.

Post SA Installation Process

After you install the SA core, perform the following tasks in order to use all the nodes in the Oracle RAC environment.

Making changes to tnsnames.ora on the SA server

After SA install is complete, the `tnsnames.ora` file should point/link to the `tnsnames.ora-operational` file.

In an Oracle RAC environment, only one of the RAC nodes or instances is used during the installation/upgrade process. The SA Installer connects to only one Oracle instance to modify the Model Repository. During the normal SA operations, all the RAC nodes are used.

To accommodate the remote truth installation process, two sets of `tnsnames.ora` are required on the SA server.

- `tnsnames.ora-install_upgrade` – this copy of `tnsnames.ora` is used during SA installation/upgrade. You can rename the file.
- `tnsnames.ora-operational` – this copy of `tnsnames.ora` is used during normal SA operation. You can rename the file.

You can use softlinks to point `tnsnames.ora` to either `tnsnames.ora-install_upgrade` or `tnsnames.ora-operational`:

```
ln –s tnsnames.ora-operational tnsnames.ora
```

tnsnames.ora-install_upgrade

```
# tnsnames.ora Network Configuration File: /u01/app/oracle/product/11.2.0/
db_2/network/admin/tnsnames.ora
# Generated by Oracle configuration tools.
RAC1SA_TRUTH =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac1pub.dev.opsware.com)(PORT = 1521))
(CONNECT_DATA =
```

```
(UR=A)
(SERVER = DEDICATED)
(SERVICE_NAME = truth)
)
)
RAC2SA_TRUTH=(DESCRIPTION=(ADDRESS=(HOST=192.168.173.214)(PORT=20002)(PROTOCO
L=tcp))(CONNECT_DATA=(SERVICE_NAME=truth)))
```

tnsnames.ora-operational sample file

Note: If you have set up Oracle Clusterware, you should use the Clusterware IP address rather than a single database node IP address.

Make a note of the text that is in BOLD letters. This `tnsnames.ora` file is used during normal SA operation and contains the RAC parameters.

tnsnames.ora-operational sample file - with Clusterware setup

If you have set up Oracle Clusterware, use the following:

```
#This entry is for connecting to RAC virtual machines. This entry is used by
SA during operation of SA.
RAC1SA_TRUTH =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = sa_cluster1-scan)(PORT = 1521))
(LOAD_BALANCE = yes)
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = truth)
(FAILOVER_MODE =
(TYPE = SELECT)
(METHOD = Preconnect)
(RETRIES = 180)
(DELAY = 5))
)
)
#This entry is for connecting to node2 via service_name. This is for DBA
convenience. This is not used by SA.
TRUTH2 =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac2pub.dev.opsware.com)(PORT = 1521))
(CONNECT_DATA =
(UR=A)
(SERVER = DEDICATED)
(SERVICE_NAME = truth)
)
)
#This entry is for connecting to node1 via service_name. This is for DBA
convenience. This is not used by SA.
TRUTH1 =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac1pub.dev.opsware.com)(PORT = 1521))
(CONNECT_DATA =
(UR=A)
```

```
(SERVER = DEDICATED)
(SERVICE_NAME = truth)
)
)
#This entry is added by SA and is used by SA during regular operation.
RAC2SA_TRUTH=(DESCRIPTION=(ADDRESS=(HOST=192.168.173.214)
(PORT=20002)
(PROTOCOL=tcp))
(CONNECT_DATA=(SERVICE_NAME=truth)))
```

tnsnames.ora-operational sample file - without Clusterware setup

If you have not set up Oracle Clusterware, use the following:

```
#This entry is for connecting to RAC virtual machines.
TRUTH =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac1-vip.dev.opsware.com)(PORT = 1521))
(ADDRESS = (PROTOCOL = TCP)(HOST = rac2-vip.dev.opsware.com)(PORT = 1521))
(LOAD_BALANCE = yes)
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = truth)
(FAILOVER_MODE =)
(TYPE = SELECT)
(METHOD = Preconnect)
(RETRIES = 180)
(DELAY = 5))
)
)
LISTENERS_TRUTH =
(ADDRESS_LIST =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac1-vip.dev.opsware.com)(PORT = 1521))
(ADDRESS = (PROTOCOL = TCP)(HOST = rac2-vip.dev.opsware.com)(PORT = 1521))
)

#This entry is for connecting to node2 via service_name. This entry is
optional. This is for DBA convenience. This is not used by SA.

TRUTH2 =
(DESCRIPTION =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac2-vip.dev.opsware.com)(PORT = 1521))
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = truth)
(INSTANCE_NAME = truth2)
)
)
LISTENER_TRUTH2 =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac2-vip.dev.opsware.com)(PORT = 1521))
#This entry is for connecting to node1 using service_name. This entry is
optional. This is for DBA convenience. This is not used by SA.

TRUTH1 =
(DESCRIPTION =
```

```
(ADDRESS = (PROTOCOL = TCP)(HOST = rac1-vip.dev.opsware.com)(PORT = 1521))
(CONNECT_DATA =
(SERVER = DEDICATED)
(SERVICE_NAME = truth)
(INSTANCE_NAME = truth1)
)
)
LISTENER_TRUTH1 =
(ADDRESS = (PROTOCOL = TCP)(HOST = rac1-vip.dev.opsware.com)(PORT = 1521))
#This entry is added by SA and is used by SA during regular operation.
RAC2SA_TRUTH=(DESCRIPTION=(ADDRESS=(HOST=192.168.173.214)
(PORT=20002) (PROTOCOL=tcp))(CONNECT_DATA=(SERVICE_NAME=truth)))
```

Use softlinks to link the file to `tnsnames.ora` file after SA installation is complete and you are ready to start SA in operational mode.

```
ln –s tnsnames.ora- operational tnsnames.ora
```

During installation, the SA Installer adds an SA Gateway entry into `tnsnames.ora` (linked to `tnsnames.ora.install-upgrade`) file on the First SA core. When installation is complete, copy that entry into `tnsname.ora.operational`. If this entry is not present in the `tnsname.ora.operational`, Multimaster Mesh transactions will not flow. The following is a sample gateway entry from `tnsnames.ora`:

```
Rac2sa_truth=(DESCRIPTION=(ADDRESS=(HOST=192.168.173.214)(PORT=20002)(PROTOCO
L=tcp))(CONNECT_DATA=(SERVICE_NAME=truth)))
```

vault.conf File Changes

Note: If you have set up Oracle Clusterware, you should use the Clusterware IP address rather than a single database node IP address.

In an Oracle RAC environment, the `vault.conf` file must be modified after SA installation is complete. Modify `/etc/opt/opsware/vault/vault.conf` to specify the complete `tnsname` definition instead of the SID. For example:

If you have set up Oracle Clusterware, use the following:

Before:

```
truth.sid: truth1
```

After:

```
#truth.sid: truth1
truth.sid: (DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST =
sa_cluster1-scan)(PORT = 1521))
(LOAD_BALANCE = yes)
(CONNECT_DATA =(SERVER = DEDICATED)
(SERVICE_NAME = truth)
(FAILOVER_MODE = (TYPE = SELECT)
(METHOD = Preconnect)(RETRIES = 180)(DELAY = 5))))
```

If Oracle Clusterware is not setup, use the following:

```
truth.sid:(DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST =
rac1-vip.dev.opsware.com)(PORT = 1521)) (ADDRESS = (PROTOCOL = TCP)
(HOST = rac2-vip.dev.opsware.com)(PORT = 1521)) (LOAD_BALANCE = yes)
```

```
(CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = truth)
(FAILOVER_MODE = (TYPE = SELECT) (METHOD = Preconnect) (RETRIES = 180)
(DELAY = 5))))

truth.port: 1521
```

Also, ensure that these values are correct:

```
truth.port: 1521
truth.host: 192.168.173.210 (database server IP)
truth.servicename: rac1sa_truth (tnsnames.ora enter)
```

Restart the `vaultdaemon`:

```
/etc/init.d/opsware-sas restart vaultdaemon
```

Changing the da.conf Configuration File

In SA 9.10, the Application Deployment Manager reads database connection information from the `tnsnames.ora` file.

In SA 9.10 and 9.1x, the default was `SID =Truth` unless changed by the user, for example, in `/etc/opt/opsware/da/da.conf`:

`truth.sid=truth1` (this is the Oracle SID of the instance on RAC node)

Changes to /opt/opsware/oi_util/startup/opsware_start.config

Note: If you have set up Oracle Clusterware, you should use the Clusterware IP address rather than a single database node IP address.

- **`TRUTH_HOST="192.168.173.210"`** - If Clusterware is not set up, then set the `TRUTH_HOST` value to one of the node's hostnames or public IPs.
- **`TRUTH_HOST="sa_cluster1-scan.dev.opsware.com"`** - If Clusterware is set up, then set the `TRUTH_HOST` value to the Clusterware scan name.

Upgrading the Model Repository

To upgrade the Model Repository in an Oracle RAC environment, follow the same procedure as in Installing the Model Repository on page 7. If you are doing a remote database installation, ensure that you modify your tnsnames.ora on the server where the SA Installer is run. It is recommended that you test the connection as suggested in section Testing the Connection from the SA Host to the Database on page 10.