Preparing the Oracle External Database

This chapter describes how to configure an external Oracle database for use with Prime Network. Make sure you have the most recent version of the Oracle software documentation (see the Oracle Corporation website).

Using an External Database: General Guidelines

- Installation and sizing:
  - The external Oracle server can be installed on the Prime Network gateway or on any other remote workstation.
  - Preallocate the database storage by creating all required data files to their full sizes in advance. With the exception of *pnuser* and *pnuser_*admin, Prime Network tablespace data files are generated in 1 GB sizes with autoextend set to 256 MB and no size limit. (The data file can grow to 32 GB.)
  - If the Oracle server is installed on the Prime Network gateway, no Oracle services can be installed on port 2100. If an Oracle listener is installed on port 2100, you must disable it or change the port number (see Table 4-2). By default, this port is used by the Oracle XML DB service.
  - The mount directory should be available in both the active and standby nodes. If the mount folder directory does not exists in the standby node, then the installation fails.
  - For deployment information and recommendations, contact your Cisco account representative.
- Starting and stopping processes:
  - Prime Network does not manage the starting and stopping of Oracle processes for an external database. The database administrator is responsible for automatically restarting Oracle processes in the event of a power failure.
  - If your system is configured for gateway high availability, start and stop Prime Network and Oracle using CLI commands. Stopping the applications using the regular application commands (without the awareness of the cluster software) can cause a failover.
  - If you restart Oracle, you must also restart AVM 25 on both the gateway and units.
- Usernames:
  - The Oracle user should be called **oracle**, and it should be part of a group called **dba**.
  - The database username and password that are related to the Prime Network application are created automatically during installation.

- Clocks: In Prime Network, the clocks on the gateway and units must be synchronized. If Oracle is running on a separate workstation, that remote database workstation's clock must be synchronized with the gateway and unit clocks.

Creating an External Oracle Database

The database instance installation can be performed as part of the Oracle installation or separately using the Oracle database configuration assistant (DBCA) utility. This section describes how to create an Oracle database instance using the DBCA utility (in *ORACLEHOME*/bin).

Download the Oracle patches from http://metalink.oracle.com.

Note   After installing an Oracle patch, you must change the permissions for the newly installed files to enable all OS users to use Oracle on the workstation. You can do this by running the script *ORACLEHOME*\install\changePerm.sh.

The Prime Network database size is determined by the usage patterns and the expected load in your deployment. Contact your Cisco account representative for assistance in determining your database load profile and calculating your database memory and storage size requirements.

Prime Network provides sizing estimates for the following usage profiles, which vary according to the maximum expected rate of actionable events per second that your deployment can support:

- Up to 250—Represents a high-scale production environment with a maximum supported rate of database operations, including up to 250 actionable events per second, a maximum amount of services, and the highest rate of configuration archive and provisioning operations.

- Up to 200—Represents a high-scale production environment with a maximum supported rate of database operations, including up to 200 actionable events per second, a maximum amount of services, and the highest rate of configuration archive and provisioning operations.

- Up to 100—Represents a high-scale production environment with a maximum supported rate of database operations, including up to 100 actionable events per second, a maximum amount of services, and the highest rate of configuration archive and provisioning operations.

- Up to 50—Represents a medium- to high-scale production environment with a medium rate of database operations, including up to 50 actionable events per second, a medium amount of services, and a medium rate of configuration archive and provisioning operations.

- Up to 20—Represents a medium- to small-scale production environment with a low rate of database operations, including up to 20 actionable events per second, a small amount of services, and a low rate of configuration archive and provisioning operations.

- Up to 5—Represents a small environment with a low rate of database operations, including up to 5 actionable events per second, a small amount of services, and a low rate of configuration archive and provisioning operations.

- Up to 1—Represents a very small test or proof-of-concept environment with a single machine acting as a gateway, unit, and database (or with a separate unit), with no more than 50 VNEs and a low rate of events.

When installing a database instance, use the values in Table 4-1 for the Oracle initialization parameters. The values are in bytes.

Table 4-1   Database Initialization Parameters

Profile Name	Up to 5 Actionable Events per Second	Up to 20 Actionable Events per Second	Up to 50 Actionable Events per Second	Up to 100 Actionable Events per Second	Up to 200-250 Actionable Events per Second
sga_max_size	4412407808	6509559808	6509559808	10301210624	10301210624
shared_pool_size	1258291200	2147483648	2147483648	2147483648	2147483648
large_pool_size	134217728	134217728	134217728	134217728	134217728
java_pool_size	218103808	335544320	335544320	335544320	335544320
pga_aggregate_target	1048576000	1887436800	1887436800	1887436800	1887436800
sga_target	0	0	0	0	0
memory_target	0	0	0	0	0
memory_max_target	0	0	0	0	0
db_cache_size	1048576000	2684354560	2684354560	2684354560	2684354560
db_keep_cache_size	318767104	872415232	872415232	3690987520	3690987520
db_recycle_cache_size	167772160	167772160	167772160	838860800	838860800
db_file_multiblock_read_count	16	16	16	16	16
open_cursors	2000	2000	2000	2000	2000
optimizer_index_cost_adj	10	10	10	10	10
optimizer_index_caching	50	50	50	50	50

For better performance, make sure you generate statistics for all tables in the database. Prime Network issues alerts if no statistics are generated, or if the current statistics are more than 2 weeks old.

Note   The *pnuser*_admin user is a user with database administrator permissions who can run maintenance tasks—such as gathering statistics—on the other Prime Network database schemas. After the *pnuser*_admin user is created, a cron job runs every 24 hours to gather statistics on the *pnuser* (Fault Database). You no longer have to gather statistics manually.

If you expect a high scale in the first 24 hours, it might be necessary to manually force statistics gathering twice during the first day, 1 and 5 hours after noise start. To force statistics gathering, enter the following command as *pnuser*:

```
cd $NETWORKHOME/Main/scripts; ./call_update_ana_stats.pl >& /dev/null
```

Table 4-2 describes the steps involved in creating an Oracle 12c database using DBCA.
If you are using an Oracle 12c database, please refer to the Cisco Prime Network 4.3.1 Installation Guide.

Table 4-2   *Creating an Oracle database Using DBCA*

	Procedure	Recommended Action
Step 1	In the Operations window, select the operation that you want to perform.	Choose **Create a Database**.
Step 2	Select a creation mode in the Creation Mode window.	Choose **Advanced Mode**.
Step 3	In the Database Template window, select the template.	Choose **Custom Database**.
Step 4	In the Database Identification window, enter the Global Database Name and SID field.	Enter **mcdb**. Do not check the Create As Container Database check box, and do not fill in any of the related data.
Step 5	In the Management Options window, configure the fields in Enterprise Manager as required.	Do not set any of the fields in Enterprise Manager and Automatic Maintenance task, and proceed to the next step.
Step 6	Enter the passwords for the Oracle administrative accounts	Enter passwords for SYS and SYSTEM users.
Step 7	In the Listener Selection window, check the relevant listener check box.	Enter the name and port.
Step 8	In Database File Locations window, specify the storage type and location for the database. Set recovery settings if you intend to configure a database backup policy.	1. Select **Storage Type** as File System. 2. For Storage Location, browse for the common location for all database files (Example: /export/home/oracle/oradata/mcdb). 3. In Recovery Related Files, choose **File System** as the Storage Type. 4. Check the Enable Archiving check box. 5. Click **Edit Archive Mode Parameters** to set the location for archive logs.
Step 9	In the Database Options window, use the default options.	Make sure that the Oracle Label Security and Oracle Database Vault check boxes are not checked. The rest of the check boxes should be checked.

Table 4-2   ***Creating an Oracle database Using DBCA (continued)***

	Procedure	Recommended Action
Step 10	In the Initialization Parameters window, configure the memory settings for the database.	1. Select **Custom**. 2. For the Memory Management field, select the **Manual Shared Memory Management** from the drop down. 3. Configure other initialization parameters. Refer to Table 4-1 for the values of various database initialization parameters based on profiles. 4. In the Sizing tab, change processes to 1000. 5. In the Character Sets tab, choose your preferred character set (AL32UTF8 is recommended). 6. In the Connection Mode tab, choose **Dedicated Server Mode**.
Step 11	In the Creation Options window, select the database creation options.	Choose **Create Database** and click **Customize Storage Locations** to configure redo log settings. Contact your Cisco account representative for assistance in estimating the database size. To support high event rates, redo log files must be six online 2 GB files on raw devices or on a dedicated disk partition mounted with the **directio** option. The redo log files must reside on a physical disk separate from the Oracle data files.

Configuring the External Database

This section includes details on configuring the database, such as the Oracle initialization parameters, ports, database size, and so forth.

Configuring the cursor_sharing System Parameter

The cursor_sharing system parameter must be set to FORCE. To configure the cursor_sharing system parameter:

Step 1   As the SYS user, enter the following command:

```
ALTER SYSTEM SET cursor_sharing='FORCE' SCOPE=BOTH;
```

Step 2   Enter the following SQL*PLUS command to verify that the parameter is set correctly:

```
SQL> show parameter cursor_sharing
```

In the command output, you should see:

```
NAME                    TYPE        VALUE
-----                   -----       ------
cursor_sharing          string      FORCE
```

Retaining Partitioning Storage Behavior

To ensure that partitioning storage behavior is retained, ensure that the partitions are created with an extent size of 64 KB. To create partitions with extent size of 64 KB, set the hidden parameter (_partition_large_extents) to false.

Enter the following command as the SYS user:

```
ALTER SYSTEM SET "_partition_large_extents" =FALSE SCOPE=BOTH;
```

Note   The partitioning storage behavior is not retained if the partitions are created with the default extent size (8 MB).

Configuring the job_queue_processes System Parameter

The job_queue_processes parameter specifies the maximum number of processes that can be created for the execution of jobs. It must be set to 1000. To configure the job_queue_processes parameter:

Step 1   As the SYS user, enter the following command:

```
alter system set job_queue_processes=1000 scope=both;
```

Step 2   Enter the following SQL*PLUS command to verify that the parameter is set correctly:

```
SQL> show parameter job_queue_processes
```

In the command output, you should see:

```
NAME                    TYPE       VALUE
-----                   -----      ------
job_queue_processes     integer    1000
```

Configuring the audit_trail System Parameter

Disable Oracle auditing by setting the audit_trail system parameter to NONE. To configure the audit_trail system parameter:

Step 1   As the SYS user, enter the following command:

```
ALTER SYSTEM SET audit_trail=NONE SCOPE=spfile;
```

Step 2   As the SYS user, enter the following command to start the database:

```
Startup
```

Step 3   As the SYS user, enter the following SQL*PLUS command to verify that the parameter is set correctly:

```
SQL> show parameter audit_trail
```

In the command output, you should see:

```
NAME            TYPE       VALUE
-----           -----      ------
audit_trail     string     NONE
```

Disabling the Recycle Bin Option

If enabled, the Oracle recycle bin feature retains a version of each dropped object, which can lead to an accumulation of junk information in the Prime Network DB Segments table. To disable the recycle bin option:

Step 1   As the SYS user, enter the following command:

```
ALTER SYSTEM SET recyclebin = OFF DEFERRED scope=both;
```

Step 2   Enter the following SQL*PLUS command to verify that the parameter has been disabled:

```
SQL> show parameter recyclebin
```

In the command output, you should see:

```
NAME            TYPE        VALUE
-----           -----       ------
recyclebin      string      OFF DEFERRED
```

Step 3   (Optional) As *pnuser*, enter the following command to see the objects that are currently saved in the recycle bin:

```
show recyclebin
```

Step 4   (Optional) As *pnuser*, enter the following command to empty the recycle bin:

```
purge recyclebin;
```

Setting the open_cursors Parameter

Open cursors enable the reading and writing of data between the Oracle database and Cisco Prime Network. The open_cursors parameter defines the maximum number of cursors that can be opened concurrently, per session. The recommended maximum number of open cursors for use with Cisco Prime Network is 2000. An error is generated if the number of open cursors in a session exceeds the specified number.

To set the open_cursors parameter:

Step 1   To check the value of the open_cursors parameter, enter:

```
SQL> show parameter open_cursors
```

In the command output, you should see:

```
open_cursors integer 2000
```

Step 2   If the integer value is less than 2000, enter:

```
SQL> ALTER SYSTEM SET open_cursors = 2000 SCOPE=BOTH;
```

Step 3   To verify that the value has changed, enter:

```
SQL> show parameter open_cursors
```

> **Note**   If the open_cursors integer value is still less than 2000, contact your local database administrator.

Disabling Automatic Maintenance Jobs

If you deploy Prime Network to handle a high event rate, it is recommended that you disable Oracle's automatic maintenance jobs. Automatic maintenance significantly affects Oracle performance and increases event processing time.

> ⚠ **Caution**   These commands disable *all* scheduler maintenance activities. Complete the following procedure after implementing an alternative method of gathering database statistics. Some of the commands will fail in some versions of Oracle; you can ignore any failures.

Connect to the Oracle database as the SYS user and enter the following commands:

```
execute DBMS_SCHEDULER.disable (name => 'GATHER_STATS_PROG',force => TRUE);
execute DBMS_SCHEDULER.disable (name => 'AUTO_SPACE_ADVISOR_PROG',force => TRUE);
execute dbms_scheduler.disable(name =>'GATHER_STATS_JOB',force => TRUE);
execute dbms_scheduler.disable(name =>'BSLN_MAINTAIN_STATS_JOB',force => TRUE);
execute DBMS_SCHEDULER.disable(name => 'SYS.MAINTENANCE_WINDOW_GROUP', force => TRUE);
execute DBMS_SCHEDULER.disable(name => 'SYS.ORA$AT_WGRP_SA', force => TRUE);
execute DBMS_SCHEDULER.disable(name => 'SYS.ORA$AT_WGRP_SQ', force => TRUE);
execute DBMS_SCHEDULER.disable(name => 'SYS.ORA$AT_WGRP_OS', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.MONDAY_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.TUESDAY_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.WEDNESDAY_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.THURSDAY_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.FRIDAY_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.SATURDAY_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.SUNDAY_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.WEEKNIGHT_WINDOW', force => TRUE);
EXECUTE DBMS_SCHEDULER.disable (name =>'SYS.WEEKEND_WINDOW', force => TRUE);
```

Changing Database Ports

If Oracle is installed on the Prime Network gateway, the Oracle services will be installed on port 2100. If an Oracle listener was installed on port 2100, you must disable it or change the port number. By default, this port is used by the Oracle XML DB service.

> **Note**   You must change the FTP port number if an Oracle listener was installed by default on port 2100.

Use this procedure to change the port numbers of the XML DB listeners, if required. This procedure applies only if you installed the Oracle XML DB service. If you disabled the Oracle XML DB service, skip this section.

Step 1   To log into Oracle SQL, enter:

```
sqlplus user/password
```

Step 2   To change the HTTP port from 8080 to 8083, enter:

```
sql> call dbms_xdb.cfg_update(updateXML(dbms_xdb.cfg_get(),
'/xdbconfig/sysconfig/protocolconfig/httpconfig/http-port/text()', 8083));
```

Step 3   To change the FTP port from 2100 to 2111, enter:

```
sql> call dbms_xdb.cfg_update(updateXML(dbms_xdb.cfg_get(),
'/xdbconfig/sysconfig/protocolconfig/ftpconfig/ftp-port/text()' , 2111));
```

Step 4   To commit the update, enter:

```
sql> COMMIT;
```

Step 5   To refresh the settings, enter:

```
sql> exec dbms_xdb.cfg_refresh
```

Step 6   To exit SQL Command Line, enter:

```
sql> exit
```

Configuring the Database Size and Disk Structure

The size of the stored data is determined mainly by the number of stored events. By default, Prime Network is configured to archive events for up to 14 days. The archive size, the supported event rates, and the average event size dictate the expected database growth on a daily basis. Events that are archived for a long time cause a significant load on the database and require additional disk space. You can change the default archive period using the Administration GUI, if necessary (see the *Cisco Prime Network 4.3.1 Administrator Guide*). Contact your Cisco account representative for assistance with sizing calculations.

Recommended Disk Structure

Following is the recommended disk structure for an Oracle server based on the number of disks that the server holds:

- Oracle data files—The optimal location is an external disk array (preferably RAID 10).
- Online redo log files—The optimal location is an internal disk partition. The redo log files should not reside on the same disk as the data files.
- Archive files—Should not reside on the same disk as the data files.
- Backup files—Should not reside on the same disk as the data files.

Configuring Oracle to Start Automatically When Prime Network Restarts

By default, the Oracle application does not start automatically when Prime Network is rebooted. This is because the best practice is for the system database administrator to manually start the database in a controlled environment. However, if you want Oracle to start when the system is rebooted, there are multiple ways to accomplish this task. The following is one example; see the Oracle documentation for other implementations.

As the Oracle UNIX root user, create a file in the /etc/rc2.d directory named S99OracleDB, with the following contents:

```
ORA_OWNER=oracle
DBLOG=$INSTALL_DIR/log/dbop.log
TZ=GMT
if [ -f /var/opt/oracle/oratab ]; then
    orahome=`grep -v "^#" /var/opt/oracle/oratab | grep . | sed -ne '1p' | awk -F: '{print
$2}'`
else
     echo "/var/opt/oracle/oratab file doesn't exist. Please check if Oracle is installed "
>> $DBLOG
     echo "dbora $1 aborted...." >> $DBLOG
     exit
fi
ORA_HOME=$orahome
TNS_ADMIN=$ORA_HOME/network/admin
if [ ! -f $ORA_HOME/bin/dbstart -o ! -d $ORA_HOME ]
then
echo "Oracle startup cannot start"
exit
fi

if [ ! -d $INSTALL_DIR/log ]; then
    mkdir $INSTALL_DIR/log
    chmod 777 $INSTALL_DIR/log
fi
if [ ! -f $DBLOG ]; then
    touch $DBLOG
fi

#start the Oracle databases
echo "Invoking dbstart at `date` " >> $DBLOG
echo >> $DBLOG
su - $ORA_OWNER -c $ORA_HOME/bin/dbstart
echo "Invoking Listener start at `date`" >> $DBLOG
echo >> $DBLOG
su - $ORA_OWNER -c "lsnrctl start"
echo "Listener started." >> $DBLOG
echo >> $DBLOG
```

Preventing Passwords in the Default Profile from Expiring

When you create a database, passwords of users that belong to the default profile expire after 180 days. Because Prime Network database users receive the default profile, their database password will expire after 180 days. To prevent this from occurring, complete the following steps:

Step 1   Log into the Oracle SQL as the sysdba.

Step 2   Enter:

alter profile default limit PASSWORD_LIFE_TIME unlimited;

Maintaining the External Database

After installation, maintaining the database can involve:

- Maintaining Archive Log File Disk Space—Ensure that there is sufficient space on a disk to store a large volume of archive logs caused by the large number of Cisco Prime Network updates to the database.

- Adding Data Files to the Tablespace—Add data files to enable the storage of event history logs for a longer period of time.

> **Note** Refer to your Oracle documentation for instructions on how to back up the Oracle database.

Maintaining Archive Log File Disk Space

The large number of Prime Network updates to the database causes the size of the archive log to expand rapidly and consume a large amount of space on the disk partition. To maintain space on the disk partition, an Oracle database administrator should delete the archive log files periodically.

Adding Data Files to the Tablespace

After you install Prime Network and its database, you might need to add more data files, depending on the event rate per second. Here is an example showing how to add a data file to the existing tablespace:

```
alter tablespace tablespace-name add datafile 'new-data-file-full-path' size 32G
autoextend off;
```

where *tablespace-name* is *pnuser*_TABLESPACE, dwe_TABLESPACE.

The size can be changed and is subject to actual needs and availability.

> **Note** With the exception of *pnuser* and *pnuser*_admin, Prime Network tablespace data files are generated in 1 GB sizes with autoextend set to 256 MB and no size limit. (The data file can grow to 32 GB.) It is recommended that you preallocate the database storage by creating all required data files to their full sizes in advance.